COLLÈGE D'ÉTUDES OSTÉOPATHIQUES
DE MONTREAL

THE OSTEOPATHIC TREATMENT OF ADULTS WHO EXPERIENCED WAR AS CHILDREN

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THESIS SUBMISSION TO
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ROBERT TAYLOR, DO (MP),

DPodM, MChS, Srch

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HYPOTHESES

Hypothesis # 1: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective counting Stroop (cStroop) reaction times in adult subjects who experienced war related trauma in childhood.

Hypothesis #2: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective emotional counting Stroop (ecStroop) reaction times in adult subjects who experienced war related trauma in childhood.

Hypothesis #3: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective World Health Organization Quality of Life bref (WHOQOL-bref) scores in adult subjects who experienced war related trauma in childhood.

Hypothesis #4: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood.

ABSTRACT

The primary objective of this research was to discover if Global Osteopathic treatment combined with treatment using the Endocranial Concept developed by Philippe Druelle DO, following the methodology of College d'Etudes Osteopathiques (CEO) of Montreal, would improve quality of life and cerebral processing in adults who experienced war related trauma in childhood. It was hypothesized that Endocranial treatment would have a positive effect on the anterior cingulate cortex and cortico-limbic structures most often affected by trauma exposure. Outcome measures were derived from the SF-36 Health survey, the World Health Organization Quality of Life bref (WHOQOL-bref), the Counting Stroop test (cStroop), the Emotional Counting Stroop test (ecStroop), and Osteopathic endocranial assessment results.

This research was done in Croatia in order to seek a homogeneous trauma exposed subject group. The target population consisted of young adults who lived in Croatia at some point during the Croatian War of Independence from 1991 to 1995 and who were 3 to 14 years of age during that four-year time period. Those admitted to the subject group met the Inclusion/Exclusion and Exposure to War criteria and agreed to abstain from other forms of physical treatment for one month prior to and during the study.

This was a chronological experimental study with one subject group. The results of two pre-treatment control trials spaced three weeks apart were compared with two post treatment experimental trials also placed three weeks apart. A nine-week treatment phase began directly after the second trial. Subjects were given 6 to 8 treatments as needed to honor Osteopathic methodology. The treatment phase had two components, global and endocranial treatment was given once a week for the first three weeks. Endocranial treatment was given every other week for three weeks to allow time for integration. Subjects (N=25) were a mixed gender group between 21 and 34 years old.

An independent assessor conducted the objective testing in four trials. Participants completed all tests in Croatian. The SF-36 was administered in trials 2 and 4. The WHOQOL-bref was given in each of the four trials. The cStroop, ecStroop, and edcStroop tests were administered using validated SuperLab software on a computer designated solely for Stroop test data collection. A Cedrus external response box/input data device was used in order to accurately record reaction times.

Upon completion of research treatment notes were examined, and based on a seven point Endocranial treatment criteria two subgroups were selected. Subjects who achieve treatment goals that justified and

enabled endocranial treatment were placed in the Global Osteopathic and Endocranial Subgroup (N=14). Subjects who were treated but did not achieve milestones for justifying endocranial treatment were placed in the Global Osteopathic sub-group (N=11). Test results for the Global Osteopathic and Endocranial treatment group were examined to support or deny the hypothesis. Test results for the two sub-groups were used as a basis for comparison in so far as they informed the hypothesis.

An analysis of variance was conducted by a research analyst to see if the cStroop, ecStroop, edcStroop test reaction times improved. The SF-36 and WHOQOL-bref scores were also statistically analyzed using Wilcoxon, Friedman, ANOVA on SPSS 15.0 program. The Global Osteopathic and Endocranial treatment group showed statistically significant improvement in SF-36 measures in 4 out of 8 domains with one marginal outcome. The SF-36 domain, General Health Perception, showed a statistically significant Group Effect. ($p=.04$) Trends in all objective measures revealed that endocranial vitality and mobility, as the primary criteria for inclusion in the Endocranial subgroup, were predicators for better objective test results.

The Wilcoxon Signed Ranks Test for the WHOQOL for physical and psychological domains for the Global Osteopathic and Endocranial group, showed no significant improvement between control trials 1 and 2 ($p = .937$, $p = .958$ respectively) but did reveal significance after Osteopathic treatment between trials 2 and 3. ($p = .003$, $p = .036$ respectively) and between trial 1 and 4 ($p = .009$, $p = .032$) . Over all Friedman across multiple trials for physical and psychological were significant. (Physical $p = .001$, Psychological $p = .010$)

No significance was found between subgroup reaction times in Stroop test analysis. Both groups improved. Further analysis demonstrated that significantly more subjects who receive Global Osteopathic and Endocranial treatment improved their reaction times faster in Emotional Stroop Interference ($p=.04$) and Counting Stroop Neutral ($p=.03$), than subjects who receive Global Osteopathic treatment.

Although significant effects were found in quality of life testing it could be said the positive experience contributed to improved scores. However when comparing subgroups, comprised of members who all received treatment, it can be said that groups had different experiences, sub-groups behaved differently. Osteopathic palpation based on Endocranial methodology selected the subgroup that performed best in terms of significance and trends in each test used.

RESUMÉ

L'objectif principal de cette recherche était de savoir si le traitement ostéopathique global, associé à un traitement se servant de l'*Endocranial Concept* développé par Philippe Druelle DO, suivant la méthodologie du Collège d'études ostéopathiques (CEO) de Montréal, améliorerait la qualité de vie et le processus cérébral chez les adultes qui ont vécu, dans leur enfance, des traumatismes liés à la guerre. L'hypothèse qui a été émise est que le traitement endocrânien aurait un effet positif sur le cortex cingulaire antérieur et sur les structures cortico-limbiques qui sont le plus souvent affectées en cas d'exposition au traumatisme. La mesure d'impact provenait du questionnaire SF-36, du questionnaire de l'Organisation Mondiale de la Santé relatif à la qualité de vie (WHOQOL-bref), du test *Counting Stroop* (cStroop), du test *Emotional Counting Stroop* (ec Stroop) et des résultats de l'évaluation endocrânienne ostéopathique.

Cette recherche a été faite en Croatie afin de trouver un groupe sujet qui a été exposé de façon homogène au traumatisme. Une méthode d''enquête'a été utilisée pour sélectionner les enfants « à risque » appartenant à la frange de la population qui a vécu les affres de la guerre. Cette méthode a été préférée à la sélection des sujets particuliers dont on connaît déjà les symptômes de stress post-traumatique. La population cible était constituée de jeunes adultes qui ont vécu à un moment ou à un autre en Croatie pendant la guerre d'indépendance croate de 1991 à 1995 et qui avaient entre 3 et 14 ans pendant cette période de quatre ans. Ceux qui ont été admis dans le groupe sujet remplissaient les critères d'Inclusion/Exclusion, ainsi que ceux de l'exposition à la guerre. Ils avaient aussi accepté de s'abstenir d'autres formes de traitement physique pour un mois avant et pendant l'étude.

C'était une étude expérimentale chronologique avec un groupe sujet. Les résultats de deux essais de contrôle de prétraitements espacés de trois semaines l'un de l'autre ont été comparés à deux essais de posttraitement expérimental, eux aussi espacés de trois semaines l'un de l'autre. Une période de neuf semaines de traitement a commencé immédiatement après le deuxième essai. Les sujets ont reçu entre 6 et 8 traitements, selon les besoins, pour respecter la méthodologie ostéopathique. La phase de traitement comportait deux volets, un traitement global et endocrânien a été donnée une fois par semaine pour les trois premières semaines. Le traitement endocrânienne a été donné toutes les deux semaines pendant trois semaines pour laisser du temps à l'intégration. Les sujets (N=25) étaient un groupe d'hommes et de femmes âgés de 21 à 34 ans.

Un évaluateur indépendant a effectué le test objectif en quatre essais. Les participants ont passé tous les tests en croate. Le SF-36 a été administré dans les essais 2 et 4. Le WHOQOL-bref a été donné dans chacun des quatre essais. Les tests cStroop, ecStroop, et edcStroop ont été administrés en se servant d'un logiciel SuperLab validé sur un ordinateur destiné uniquement à la collecte de données pour le test Stroop. Une boîte de réponse externe Cedrus/un dispositif d'entrée des données a été utilisé afin d'enregistrer avec précision les temps de réaction.

À la fin du traitement de la recherche, les notes ont été examinées, et à partir des critères de traitement endocrânien en sept points (appendice?), deux sous-groupes ont été formés. Les sujets qui ont atteint les objectifs du traitement qui justifiaient et permettaient le traitement endocrânien étaient placés dans le sous-groupe ostéopathique global et endocrânien (N=14). Les sujets qui étaient traités, mais n'ont pas atteint l'étape importante pour justifier un traitement endocrânien étaient placés dans le sous-groupe ostéopathique global (N=11). Les résultats du test pour le traitement ostéopathique global et endocrânien ont été examinés pour voir s'ils confirmaient ou infirmaient l'hypothèse. Les résultats des tests pour les deux sous-groupes ont été utilisés comme base de comparaison dans la mesure où ils influençaient d'une manière ou d'une autre l'hypothèse.

Une analyse de variance a été effectuée par un analyste de recherche pour voir si le temps de réaction des tests cStroop, ecStroop, et edcStroop s'était amélioré. Les scores du SF-36 et WHOQOL-bref étaient également analysés statistiquement à l'aide de Wilcoxon, Friedman, ANOVA sur le programme SPSS 15.0. Le groupe expérimental ostéopathique global et endocrânien a montré une amélioration statistiquement significative en termes de mesures du **SF-36** dans 4 sur 8 domaines avec un résultat marginal. Le domaine SF-36, la perception de la santé générale, a montré un effet de groupe statistiquement significatif. (p=.04) Les tendances dans toutes les mesures objectives révèlent que la vitalité et la mobilité endocrânienne, comme les principaux critères d'inclusion dans le sous-groupe endocrânien, étaient des facteurs pouvant favorablement influencer l'objectivité des résultats de tests.

Le test *Wilcoxon Signed Ranks* pour le WHOQOL pour les domaines physique et psychologique pour le groupe ostéopathique global et endocrânien, n'a montré aucune amélioration significative entre les essais de contrôle 1 et 2 (p-.937, p=.958 respectivement), mais ont bel et bien révélé de l'importance après le traitement ostéopathique entre les essais 2 et 3. (p=.003, p-.036 respectivement) et entre les essais 1 et 4

(p=.009, p-.032). L'ensemble des essais multiples Friedman pour l'examen médical et psychologique étaient significatifs. (Examen médical p=.001, Examen psychologique p=.010).

Aucune importance n'a été trouvée entre les temps de réaction des sous-groupes dans l'analyse du test Stroop. Les deux groupes se sont améliorés. Une analyse plus approfondie a montré que plus de sujets qui ont reçu le traitement ostéopathique global et endocrânien ont considérablement amélioré leurs temps de réaction plus rapidement lors de l'*Emotional Stroop Interference* (p=.04) et du *Counting Stroop Neutral* (p=.03) que les sujets qui ont reçu le traitement ostéopathique global.

Bien que des effets significatifs aient été trouvés dans les tests sur la qualité de vie, on pourrait dire que l'expérience positive a contribué à l'amélioration des scores. Cependant, en comparant les sous-groupes composés de membres qui ont tous reçu un traitement, on peut dire que les groupes ont eu des expériences différentes, les sous-groupes se sont comportés différemment. La palpation ostéopathique fondée sur une méthodologie endocrânienne a permis de sélectionner le sous-groupe qui a effectué la meilleure performance en termes d'importance et de tendances dans chacun des tests utilisés.

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PREFACE

The objectives for this thesis grew out of this researcher's early professional life working with a multi-disciplinary team at a Family Mental Health Centre as an early childhood Outreach Prevention Worker providing support programs for families and children living with the stress of poverty. This researcher, her colleagues and mentors, Elizabeth Berry, and Jane Le Clair worked to build neighbourhood networks and to integrate communities stressed by condensed living situations. The task at hand was to provide an enriched space for children to 'be' in, to facilitate their potential and to attempt to crack open doorways to 'the many possibilities' that were otherwise not easily available to them.

It was not difficult to see that what lay at the root of their need was choice, in particular the need to have 'choice' rather than 'no choice.' The simplicity of this right holds within it opportunities to address the multi-faceted layers of fundamental change within the life of the individual – that create lasting changes within and that extend into the world she or he walks in.

Through Osteopathy now, 'the work' is the same: 'choice' is made available. The spectrum of choice is the same one – after all, 'choice' needs only a 'beginning' – but the foundation and the source of 'where' their choice may arise is, within this terrain, qualitatively different. What may open now… is the self, found at each one's centre… within a source that gives.

Chapter 1: Introduction

CHAPTER 1. INTRODUCTION

It was the intention of this research, to become familiar with the somatic terrain of adults who have experienced childhood trauma, in this case the trauma of war. The primary objective of this quantitative chronological study was to discover if global osteopathic and endocranial treatment, following the methodology of the College d'Etudes Osteopathiques (CEO), would improve quality of life in adult subjects who experienced war-related trauma in childhood.

Presuming a link between past events and present somatic cognitive states, at least in quantitative research, is fundamentally a challenge. In terms of cause and effect the greater the time gap between an event and its presumed impact the harder it is to prove a quantifiable connection. In the field of law human rights issues are classically affected by this dilemma. In fact we can't 'empirically' prove that the behavior of one group is the cause of a poor quality of life in another. However we can use our knowledge of events to ask questions, build a body of evidence and observe trends in order to guide value choices that have the physical integrity of others at heart. It is the intention of this research to explore the question, "Do traumas from the past leave impact in the present?" Without the expectation of an empirical answer, nonetheless, this is the framework that created this research.

Joseph LeDoux author of *The Emotional Brain* wrote, "Emotions are forever." (Van der Kolk, 2006) If emotions are forever then they are living in the psycho-soma of the individual who lived them, and thus are intimately part of the terrain of the Osteopath. As Osteopathic professionals we are fortunate enough to work in a discipline that has the potential to improve the quality of life of 'most' who might seek out treatment. Is it appropriate to view our discipline as capable of treating neuronally based adaptive reactions to trauma and stress? Are we validly capable of offering therapeutic relief and front line intervention to 'at-risk' populations experiencing the psychological symptoms that go hand in hand with high rates of exposure to stress? There is an historical precedent and current trend within the field of Osteopathy for affirming the answer is 'yes.' These fundamental questions have been explored with the intention of investigating the relevance of possible answers to the needs of children.

This thesis hopes to draw upon Osteopathic insights of the past and to build upon the small body of documented work that has examined and utilized Phillipe Druelle DO's endocranial concepts of treatment. This researchers goal was to apply endocranial concepts of treatment, as extensions of cranial and global osteopathic treatment. The research was designed to attempt to demonstrate the extent to which an approach which takes in all realms of anatomy, including neuroanatomy, is a useful spectrum of treatment to employ in the service of individuals whose need for wholeness extends to the realm of anatomy that participates in their view of the world – their brain. In her book *The Physiology of Consciousness* Louisa Burns D.O. writes,

> In all the domain of human thought, the study of conscious phenomena alone has been kept subject to the necessity for an idealistic method of treatment. This method, which long retarded the development of other sciences, should be set aside also in the study of conscious phenomena. A rational psychology must depend upon the use of these methods which have been successful in the study of other sciences. (Burns, 2005)

As professor of Physiology at the Pacific College of Osteopathy writing in 1911 Dr. Burns, as Osteopath and teacher, wrote walking forward upon a strong but membranous-like fine line balancing rigorous science on one hand with an Osteopathic view of the diagnosis and treatment of the physiology of consciousness on the other. Just as enzymes, glucagons, and insulin are the products of the pancreas, thought, emotion, personal perception, and human action are the products of the parenchyma of the brain.

The human brain co-ordinates stimuli from the senses, responds to, and in kind produces, hormonal and electrochemical cocktails that support the function of the body as a whole. Through the motility of the brain and the action of the ventricles cerebral spinal fluid (CSF) carries nutrition to the central nervous system (CNS) and vitality is transmitted throughout the body. The brain also, in its parallel role as 'thinker,' balances memory with imagination, curiosity with anticipation, introspection with invention – creating a myriad of expressions mired and inspired. Visual artist, Ray Robinson states, "Change the way you think and everything changes." (R. Robinson, personal communication, January 8, 2012) An Osteopath might add, 'Change how you feel, that changes the way you think and everything changes.' Raimund Engel wrote about the same phenomenon. In his thesis *Cranial State*

of Mind he studied the connection between Osteopathic treatment and commonly heard patient reports of a shift in consciousness particularly when addressing the movement of CSF in Cranial treatment. (Engel, 2006)

Louisa Burns detailed examination of the physiology of the brain almost 20 years before Sutherland presented the cranial concept exemplifies a compassionate and intelligent bridge between the practical and the ideal in an area of Osteopathic practice that continues to beg further study. In the same spirit, and along the same trajectory and evolutionary path this need for further study has found expression in the work and teachings of Philippe Druelle D.O. founder and director of the College d'Etudes Osteopathiques de Montreal, (CEO) Quebec. Druelle writes in his article 'Was the Inner Physician an Osteopath? According to Tradition and Research in Osteopathy'; "A therapeutic discipline becomes a medicine when it fulfils certain criteria's. This discipline must have a philosophy, an original understanding of the Human Being, treatment and assessment methodology specific to that practice, and an active research field." (Druelle, 2005)

Philippe Druelle D.O. has taken great care to develop and impart a methodology of Osteopathic practice for students at College d'Etudes Osteopathiques de Montreal (CEO) that embodies scientific and creative principles. Having made space for the presence of both principles within the CEO's curriculum Druelle has demonstrated and highlighted a compassionate respect for the fine balance and rhythmic interchange that exists between learning and becoming. He has provided a terrain in which to learn what it is to be an Osteopath in living partnership with the Inner Physician. He has inspired each of his students to share their skills to the best of their abilities in order to facilitate a living partnership of simple stillness and wholeness within their patients.

It is toward this end that this researcher became interested in exploring the Endocranial Concept put forth by Philippe Druelle D.O. and taught by Genevieve Forget D.O.. In following the path of need when considering what appeared to be the functional limitations and internalized states impose upon many patient's quality of life and self-expression, this researcher welcomed the windows of insight Philippe Druelle's endocranial concept provided. This approach provides us with a unique opportunity to actively facilitate a movement toward health in our patients and to be advocates of the individual's right to inner ease and self-expression. Toward this end I hope this research will further define Osteopathy's contribution to the society of children and to their future.

Velda Lulić DO, an Osteopathy professor at the CEO, and founder of the The Akademija Osteopatije, Velika Gorića, Croatia along with one of her valued academic co-ordinators, Zvonka Tomasović, who became this researcher's highly valued Co-ordinator, Research Assistant, and Independent Assessor, both facilitated elements

needed to make this research idea a reality. Tomasović and the Osteopathy students of Velika Gorića gathered 27 adult children of war. The so-called "children" for this work came in the form 20-to 33-year-old young adults living in and around Zagreb, Croatia. As a subject group this particular population was very open and willing to explore Osteopathic Treatment. They are the generation that has reached adulthood right at the point when their country is almost ready to tip the balance from recovery to a fledgling economic stability. The Croatian is a culture in 'recovery' with a deep awareness of what they have overcome and a dubious optimism about what challenges they have yet to face. (Đurđa Sučević, personal communication, Zagreb 2011) It appeared however, to this researcher, that these young people were very ready to throw off the cloak of 'recovery' and to be well and happy in their own 'recovered' present. The participants who chose to come, did so because they either expressed awareness that they felt an influence from the war in their lives, or they held curiosity that an effect from the war may or may not be present, but nonetheless they were 'curious.' They each maintained their engagement, or at least their curiosity, long enough to stay the course of treatment. Twenty-seven remained during treatment phase: however, two did not finish the testing, and so we ended with data for twenty-five.

The tools of measurement were two health surveys and one cognitive activation test. The cognitive activation test, the Stroop test, was chosen for the following reason. Research in the field of neuropsychology looks to the Central Nervous System for answers to questions concerning trauma treatment. Magnetic Resonance Imaging (MRI) studies have shown diminished brain function particularly in the anterior cingulated cortex (ACC) in subjects with post-traumatic stress disorder (PTSD). The hypothalamic-pituitary-adrenal axis is another neurologically centered system which when stressed becomes compromised in its neuroendocrine adaptive abilities. Science and clinical experience tell us to look, in the physical at least, to the CNS if we are to treat the effects of past experience. Bruce Perry and his colleagues in a paper titled "How 'States' become 'Traits,'" refer to the neurobiological imprint of a repeated need for adaptation to stress as 'use-dependent internalization.' "In the developing brain, these states organize neural systems, resulting in traits." (Perry, p. 275, 1995) This field is referred to as Developmental Traumatology. It is a field of research that takes into consideration the neural adaptations that may have occurred with trauma exposure in childhood. This may, in part, account for the long lasting effects of trauma exposure in some cases.

It is the belief of this researcher that our unique ability to assist patients in walking the path toward their own centre, and by doing so, resolving the experiences of their past in the present is in itself a 'life-gift,' for the patient

and for the practitioner. But in addition to what it means to the individual who receives Osteopathy and to the Osteopath who facilitates 'it,' Osteopathic practice also contributes to the collective knowledge of what we know about each other and this in turn 'changes everything.'

Chapter 2: Literature Review

CHAPTER 2. LITERATURE REVIEW

The field of trauma exposure takes in a wide range of research and an even wider range of human experiencing. This literature review attempts to look at the child within the adult. A new sensitivity to the residual presence of past experience and its involvement in present neurocognitive and biochemical responses is changing the way researchers view the impact of experience. Hand in hand with these new views there is a growing understanding of role of the body in itself, as an avenue for change. Neuroscience is helping this view to evolve by understanding the mechanisms of automatic response and behaviour. By understanding the natural functions of mutual response between the sensitive soma and the sensing mind the field of trauma research is beginning to keep pace with the actualities of lived emotion.

2.1 Trauma Definition

The broad definition of trauma is "an injury, physical or mental." (Stedmans, 2001, p. 1008) But trauma is rarely as simple as that. Trauma is fundamentally how one consciously and unconsciously 'receives' the impact of an externally induced experience that changes one's response to life metabolically, emotionally and socially. There is the event and there is the individual. There is a 'before' and an 'after' which are different from one another. Without question experiences that can be classified as traumatic induce change and place those who experience these at higher risk of suffering its potential short-term and long term effects. The nature of the event defines the imprint of the shock and the nature of the individual and their circumstances defines the response.

Exposure to trauma doesn't necessarily result in symptoms of Posttraumatic Stress Disorder (PTSD). There are wide ranges of response to trauma exposure, on a variety of timelines that are dependent upon developmental stages and health needs. In the case of war response to trauma can also become generalized as pressure embedded within society as a whole. What occurs then is an accepted presence of stress and hyper-vigilance as an invisible norm within the general population. A Posttraumatic Stress Disorder (PSTD) diagnosis is only the most visible expression of a general stress disorder that exists within an at risk population.

Prevention of decompensated physical states resulting in chronic illness is part of Osteopathy's legacy. Therefore rather than seeking subjects who had been given a PTSD diagnosis this research, in the spirit of prevention, targets a subject group who is at-risk. Their risk factors: exposure to trauma, exposure during childhood, and continued exposure to chronic environmental stress in the form of post-war recovery are all contributing factors

to a higher likelihood of present and future health and vitality concerns. This researcher will give an overview of the current trends of thought on the long-term effects of childhood trauma, stress, and PTSD.

2.1.1 Trauma And PTSD Symptoms

The words trauma and stress are often used interchangeably; on the scale of stressors, trauma is an extreme stressor that often carries an element of shock. There is an immediate perception of threat and vulnerability. Such threats can be categorized as acute stressors or chronic stressors. The long-term nature of war can be categorized as a 'human generated chronic stressor.' War as an externally imposed event, is also classified as an intentional stressor which means harm is the objective versus unintentional human made disasters (Shaw, 2007). "Children exposed to chronic stressors may experience a gradual loss of resiliency and adaptive coping skills. Cumulative stress is associated with both immediate and long-term neurobiological changes." (Shaw, 2007)

PTSD has a broad range of chronic symptoms that are common to adults and children, which include hyper-vigilance, attention disorders, insomnia, avoidance, and the re-living of past experience. (NCTSN, 2009). The view of symptomology that applies to the experience of children in conflict settings requires a dynamic approached. Erwin Randolph Parsons Ph.D. and his colleagues use the term war zone stress responses to more accurately describe the experience of children. Their response to stress includes a complex relation to their caregivers, the society they are in, traditional practices and their own developmental needs and needs for expression on cognitive, emotional and physical levels. Parsons and his team found it important to be aware of and treat the 'network' around the child as well as the individual.

> The therapist finds creative ways to engage the child in direct verbal recounting of traumatic events. Rituals produce indirect mental and somatic processing that impacts painful emotions and cognitions through the use of art, dance, music, woodworking, drawing, myths, cultural or tribal games and rituals, as well as the use of specific toys and play materials. (Parsons p.336, 2000)

An overview of the possible experiences of adults who experienced war as children are as follows:

Table 1: War-Zone Stress Responses in Children (includes PTSD as sub-section)

Cognitive	• Significant levels of mental intrusion, inability to focus and sit still • limited use and expression of language, problem-solving, and adaptive behavior • PTSD: symptoms of intrusive thoughts, avoidance, and arousal
Emotional	• numbing stress symptomatology • incomplete emotional processing • depressive reactions • some children show hardened intra-psychic defenses • emotionally anesthetized • grief reactions
Physical	• somatic symptoms • limited use of physical skills • limited auditory and visual reception • sympathetic overload: nightmares, sleep disturbance, intrusive memories of violent episodes, anger, anxiety, fears

(**Parsons** p. 329, 2000)

2.1.2 Developmental Traumatology - Structural Findings

PTSD is unique in that, although its onset is externally imposed it may last years after the initial trauma. Its on-going presence is the result of a 'decompensated' neurobiological response to stress. The multiple components that contribute to the presence of this disorder in some and not in others have yet to be understood. Factors such as age of exposure, duration, genetic background, and bio-chemical resilience are elements that define various initiatives in PTSD research.

The important factor that marks the experience of trauma that begins in childhood versus adulthood is the effect trauma may have on the vital developmental processes of early and middle childhood. The brain and its biological stress systems are genetically programmed to be influenced by early experience. "Traumatic stress may have negative effects on the development of biological stress systems." (DeBellis, 1999)

Michael D. DeBellis is part of a new area of study called, "developmental traumatology research." He is looking at the effects of trauma exposure on the body's stress response systems and on brain maturation. Brain imaging scans were done on 44 children and adolescents with diagnosed PTSD. Eight percent of subjects had smaller intercranial and cerebral volumes. Cerebral midsagittal area, middle and posterior aspects of the corpus callosum were smaller. Right and left lateral ventricles were relatively larger in proportion to intracranial volumes. DeBellis positively correlated early onset of trauma exposure with smaller brain size. (DeBellis, p.2, 1999)

A paper by Christine Heim and Charles B. Nemeroff, *The Role of Childhood Trauma in the Neurobiology of Mood and Anxiety disorders: Preclinical and Clinical* Studies, also concur that adaptive responses, initiated by the central nervous system's response to stressful events particularly in childhood, have the potential to create neurobiological change. (Heim, 2001) Kathryn M. Connor, M.D. in her comprehensive overview of PSTD, *Posttraumatic Stress Disorder,* outlined the most consistent MRI findings on alterations of brain structure and function. Her review is illustrated in the chart below. (Connor, 2003)

Table 2 Structural and Functional Alterations found in PTSD subjects through MRI

Brain Structure	System	Location	Function
Hippocampus reduced volumes decreased functions	Limbic system	Floor of lateral ventricle	Relates to memory and emotional aspects of behaviour
Amygdala implicated in PTSD	Limbic system	Medial-inferior temporal pole	Makes conscious the sense of smell, is emotional amplifier.
Anterior Cingulate Gyrus (ACG) structural/functional alterations	Limbic system	Medial cerebral hemisphere, wraps around anterior corpus callosum	Error detection, attention, emotion, memory, ACG receives from amygdala, implicated in depression
Thalamus structural/functional alterations	Diencephalon	Small egg shape, forms lateral walls of third ventricle	Relays sensory information, assists motor function, regulates brain arousal.
Medial Frontal Cortex structural/functional alterations	Frontal lobe, neo-cortex	Medial, inferior frontal lobe, surrounds region of ACG	Long term memory, emotional processing, social brain

(Connor, p. 252, 2003, Crossman 2000, Clark, Boutros, Mendez 2010, Thieme 2007)

2.2 Neurophysiology

2.2.1 The Stress Response

The coordinated response of the endocrine system and HPA axis when experiencing stress in general or the fight or flight response in times of duress was first understood by and represented as a model for homeostasis by Hans Selye in the first half of the last century. This three-stage model became known as General Adaptation Syndrome. The first alarm stage refers to the sudden and automatic response of the sympathetic nervous system to stress on a physiological level which next results in mobilized action – fight or flight: "Metabolism speeds up

dramatically, heart rate increases, and blood is diverted from the skin and extremities to the brain and internal organs (Selye, 1976)." (Lefton p. 540, 2008) The second phase of the stress response is 'resistance.' The metabolism remains moderately charged but on alert. This state may continue for hours months or even years. Last, natural exhaustion occurs as the final phase however if the resistance phase has been a prolonged one the physiological and physical ability to compensate fails and adaptation deteriorates to de-compensation.

2.2.2 Allostatic Load

Within the last twenty years an extended version of the stress model was developed by Professor of neuroendocrinology; Bruce McEwan. His model concerning the allostatic load was conceived as a way to describe the damaging effects of chronic stress in a manner that includes the sequelae of hormonal-chemical, immune, and neural responses. Allostatic load refers to, "The cumulative negative effects, or the price the body pays for being forced to adapt to various psychosocial challenges and adverse environments." (McEwan, 1999) If allostasis, which means homeostasis through change, solicits the stress response for a prolonged period of time the ability to respond to stress can become compromised. Early childhood development, genes, life style and socioeconomic factors positively or negatively influence the resilience of physiological stress mediators. (McEwan, 1999)

2.2.3 HPA – Cortisol – Biological Mediators

There have been several studies done on trauma exposure that use cortisol measures to investigate the long-term effects of stress. Cortisol (steroid hormone) is produced by the adrenal gland. When under stress the pituitary signals the release of cortisol as a protective mechanism to maintain homeostasis. Glucocorticoids are a type of cortisol that mediate blood sugar levels, allocation of energy sources and direct lymphocytes toward peripheral pathogens.

This process begins in the hypothalamus when it receives signals from the cerebral cortex, limbic system and visceral organs. The regulating action of the hypothalamic pituitary adrenal axis occurs in a daily rhythm. When chronic stress unrelentingly demands the activation of the HPA biochemical pathway system fatigue occurs and the HPA responds differently. Glucocorticoids that once acted to control inflammation now stimulate it and cortisol levels become chronically low. (Vanltallie, 2002).

Rohleder and team conducted a study with Bosnian subjects 10 years after the Bosnian war. They measured cortisol levels in Bosnian subjects with PTSD and compared them with a non-trauma exposed German subgroup.

They found low morning cortisol levels that remained low in PTSD subjects: "typical increase 30 min after awakening was not present in PTSD patients." (Rohleder, p. 747, 2004)

Researchers also found an increase in cytokines, proteins that work with glucocorticoids, indicating the presence of chronic inflammatory processes which are linked to poor immune response and depression. Rohleder concludes his findings with the statement, "Whether this pattern reflects an adaptive mechanism and whether this is sufficient to protect from detrimental effects of low cortisol remains to be investigated." (Rohleder p 746, 2004) In psychometric measures the PTSD group scored significantly higher in anxiety, paranoia, interpersonal sensitivity, somatization, and depression. Rohleder et al used the SCL-90 (the German version of Symptom Checklist). (Rohleder p. 746 2004)

Muhtz and Godemann in their work titled *Effects of Chronic Posttraumatic Stress Disorder on Metabolic Risk, Quality of Life, and Stress Hormones in Aging Former Refugee Children* studied 25 subjects with chronic PTSD and 25 trauma controlled subjects who were children in WWII Germany. (Muhtz, 2011) They also gathered measures on two fronts: physiological (metabolic, endocrine) and psychometric (SF-36 Health Survey). Their subject group time line was much longer than the Bosnian study in that the trauma exposure happened 60 years earlier and subjects now lived under far more culturally stable circumstances.

In comparing these two studies it is interesting to note that in the Bosnian study, 10 years after trauma exposure, within a culture in transition, physiological and psychometric scores indicate ongoing symptoms of stress. Sixty years later, in a stable political environment, within the parametrics of this study, physiological measures (cortisol, blood pressure, insulin, HPA axis function) are stable or at least match the norm. The realm of influence that has maintained a long lasting presence in the lives of elderly PTSD subjects involved low quality of life scores and depression. "We demonstrated that chronic PTSD is not associated with endocrine or metabolic parameters but with (diminished) quality of life and depression in aging former refugee children." (Muhtz, p. 650 2011) This finding indicates that Osteopathic treatment of trauma-exposed subjects may provide valuable assistance in preventing long term symptoms of depression through fundamental methods of treatment which improve mobility and vitality.

2.2.4 Serotonin – Neurological Mediator

Serotonin is a neurotransmitter that plays a large role in mediating and regulating many of the body's functions from digestion to mood to memory. (Moore, 2006)) There are two components in serotonin's role in

balancing behaviour and function: its production is proportionately balanced with its ability to be used, or in other words its reuptake potential and its binding potential. This balance has been found disrupted in patients with PTSD, mood disorders and environmental hypersensitivity: "It may help to facilitate meaningful sensory stimuli and to inhibit non-meaningful sensory stimuli. Serotonin in this way aids in maintaining behaviour within specific limits." (Clark, p. 169, 2010)

James W. Murrough MD studied the role of serotonin and early trauma exposure in his paper, *The effect of Early Trauma exposure on Serotonin type 1B receptor expression revealed by Reduced Selective Radioligand Binding* (Murrough, 2011). He found a high correlation between reductions in binding potential as a measure of serotonin type 1B receptor expression in PTSD with symptoms and trauma exposed subjects without symptoms. He found a correlation between earlier and more prolonged exposure and more severe PTSD symptoms. Murrough also made an important discovery concerning the link between trauma exposure and trauma symptom response. He observed that alterations in serotonin receptor expression were present as an indicator of trauma exposure but did not necessarily result in the expression of trauma symptoms. This indicates that a mix of numerous possible factors is involved in PTSD expression and also that trauma exposure is an indicator for future 'at risk' susceptibility. (Murrough, 2011)

2.3 Neurobiology

2.3.1 Limbic System

Neuroscientist Paul MacLean was among the first, in the 1970's, to attribute emotion to the limbic system. (Black, 1970) Since then writers like Candace Pert, Ph.D. has expanded this model by suggesting in her book 'Molecules of Emotion' that neuropeptides are the chemical foundation of emotion. She writes, "Core limbic brain structures, such as the amygdala, hippocampus, and limbic cortex, believed by neuroscientists to be involved in emotional behavior contained a whopping eighty-five to ninety-five percent of the various neuropeptide receptors we had studied!" (Pert, p. 133, 1997) Though the 'seat of emotion' within human beings is still under question, Pert led the way in liberating emotion from the confines of the brain and made a case for the biochemical presence of 'emotion' within the body as a whole. It can be said that within the limits of the cortex the 'language' of emotion is best received by the limbic system. The limbic system plays a primary role in integrating, translating, and

facilitating the communication of emotion as a whole body experience. Hence many neuro-scientists have focused their lens upon the limbic system to detect the effects of significant life stress and trauma.

"The limbic system is where the muscular and visceral meets the emotional or where emotion meets the soma." (Lederman, p. 184, 1997) The limbic is an interpreter and mediator, translating experience and neurochemistry into action. Deep subcortical structures inform us we are hungry, in danger, or happily aroused, the limbic system feels that message and the neo-cortex acts on it. The limbic system organizes our survival and our procreation. The imposition of trauma upon this messaging system overpowers homeostasis and upsets the balance of the mediator. "Trauma is a state bound consciousness encoded into the limbic-hypothalamic and related systems and has the body set up in a state of somatic arousal most of the time." (McClure, 2012)

Table 3 Triune Brain

Neocortex (Neo-mammalian) Analyses and interacts with external world	**Limbic system** (Paleo-mammalian) Maintains balance between internal and external realities	**Brain Stem & Hypothalamus** (Reptilian/Archaic) Regulates internal homeostasis
• Creativity and imagination • Problem solving • Reasoning and reflection • Self awareness • Kindness, empathy, and concern	• Rage • Fear • Separation distress • Caring and nurturing • Social bonding • Playfulness • Explorative urge • Lust in adults	• Hunger • Digestion/elimination • Breathing • Circulation • Temperature • Movement, posture, and balance • Territorial instincts • Fight or flight

(Sunderland, p. 18, 19, 2006, Panksepp, p. 324, 2004)

2.3.2 Amygdala

When our personal sensory system 'reads' its environment fear judgments are primarily registered in the amygdala - the brain's early warning system. "There are two paths through which the amygdala's fear response can be triggered, a fast "low road," that passes from the thalamus to the amygdala, and a slower "high road" that passes from the thalamus to the neocortex and then to the amygdala." (Christopher, p. 80, 2003) This can be considered the 'snakes and ladders' model of fear response. Sub-cortical regions respond immediately and autonomously, without consulting the neocortex, to perceived threats to life such as seeing a snake. Moderate threats that involve judging one's ability to achieve security within a social structure, which might include anything from getting a job promotion to securing basic needs like food and shelter, are perceived first through the longer thalamus / neocortex / amygdala pathway.

Internal stress conflicts have their foundations in a neurobiological survival mechanism. What we currently understand about our selves through present views in neuroscience is based upon a description of 'survival' which relies on physical and mental reaction processes. Past experience, recorded as a 'feeling state' in the amygdala,

informs this reaction process. Trauma creates a 'past experience feeling state' that remains 'neurologically embedded' in such a way that future responses are selectively and even randomly measured against it.

Joseph Le Doux states the amygdala becomes physiologically encoded in early childhood with its basic template for judging 'threat' throughout life. This experientially encoded fear response becomes an unconscious pattern. Conscious awareness of an alarming stimulus does not have to occur for the amygdala to trigger a cascade of heightened sympathetic responses. "Conditioned stimuli activate the amygdala unconsciously, but at the same time reach the temporal lobe memory system and can lead to the recall of the initial trauma or to the recall of recent episodes in which the initial trauma is relived. This gives rise to conscious anxiety and worry." (Le Doux p. 257) When this physical / mental reaction cycle between subcortical and neocortical structures dominates, then, panic attacks, posttraumatic stress symptoms and contextually irrational reactions can occur. The ability for the neocotex to rationalize and make functional decisions cannot compete with the overriding excitation of neural messages, and sympathetic neurochemical reactions coming from subcortical structures.

2.3.3 Cingulate Cortex

The cingulate gyrus originally called the *grande lobe limbique* by Broca has "emerged relatively recently as (a) major contributor(s) to the human psychological system." (Clark, p.197, 2010) As an extension of the limbic system the cingulate gyrus communicates with the limbic structures (hippocampus, amygdala, anterior thalamic neuclei, septum, and fornix) in a feedback loop called the Papez circuit. (Crossman, p. 172, 2000) The Papez circuit, the circuit of memory and emotion, connects the cingulate gyrus with the entorhinal cortex, hippocampus, mammillary body, anterior thalamic nucleus and back to the cingulate gyrus. (Clark, p. 219, 2010) for the purpose of this research it is important to also know that the cingulate cortex is now thought to become less active in subjects with PTSD because it is 'actively' inhibiting a hyper-responsive amygdala that is chronically reacting to fear stimuli (Vanltallie, 2002)

2.3.4 Anterior Cingulate Cortex (ACC)

The **anterior cingulated cortex** defines the border between old and new within the central nervous system. It acts as an information mediator between the neo-cortex and the sub-cortex. The anterior cingulate cortex "is remarkable in comparison with the remainder of the cingulate gyrus for massive input from the amygdala." (Clark, P. 197, 2010) The ACC acts as a stress filter that allows attention and decision making to focus specifically on

survival in the present moment. In less dire circumstances it simply gives us the ability to attend to a stressful task. Traumatized individuals are no longer able to engage attention skills facilitated by the ACC in its role as an effective filter:

> The ACC plays a role in the experiential aspects of emotion, as well as in the integration of emotion and cognition. It has extensive connections with multiple brain structures, including the hypothalamus, amygdala, and brain stem autonomic nuclei. Thus the ACC is part of a system that orchestrates the autonomic, neuroendocrine, and behavioural expression of emotion and may play a key role in the visceral aspects of emotion. (Van der Kolk, 2006)

Table 4 Global ACC Tasks (in health)

- Activated during normal processing of emotional stimuli, monitors action, adapts behaviour
- Activated during error detection paired with emotional response
- Central to all models of attention
- Regions process and retain safety signal information
- Interconnections with medial and lateral pre-frontal cortex. (b and b. p. 197)
- Role in memory acquisition, of words, faces, of a series of events

Shin (2007), Whalen (2006), Bush (1998), Thieme p. 374, (2007), Clark, p. 197, 198, (2010)

2.3.5 ACC Research

In neurocognitive testing the ACC can be stimulated in tests by the presentation of incongruent mental challenges. PSTD subjects have been shown to have longer cognitive activation test reaction times (Stroop test) when faced with emotionally challenging stimuli.

> The ACC plays central role in interference and attentional tasks by mediating response selection and/or by allocating resources when confronted with competing information-processing streams, consistent with the theories of Vogt (1992), Paus (1993), Posner and Dehaene (1994) and Devinsky (1995) (Bush, 1998)

In the research of Dr. Lisa Shin and her colleagues, they were able to demonstrate altered structure and function in patients with PTSD in the amygdala, medial prefrontal cortex (or anterior cingulate cortex) and the hippocampus: "One of the most consistent functional neuro-imaging findings in Post Traumatic Stress Disorder has been that of relatively diminished activation in the medial prefrontal cortex, including the anterior cingulate cortex (ACC) and the medial frontal gyrus." (Shin, Bush, p. 702, 2007) The ACC and hippocampus were both shown to have diminished volume and function in the above research. Using cognitive activation tests along with fMRI they observed healthy subjects engage the ACC to dampen or filter emotionally stressful interference.

Table 5 PTSD and fMRI ACC findings

- Diminished activation in medial prefrontal cortex, ACC and medial frontal gyrus upon presentation of traumatic stimuli or verbally recounting trauma.
- Diminished activation specific to pregenual and subgenual ACC.
- The greater the PTSD symptom severity the lower the ACC activation.
- Lesions of medial prefrontal cortex retard extinction of fear conditioning.
- Neuroanatomic model of PTSD posits a failure of medial prefrontal cortex to inhibit a hyperresponsive amygdala.

(Shin, 2007, Whalen 2001)

2.3.6 Prefrontal Cortex

> "Another important structure involved in the regulation of emotion is the prefrontal cortex, which is believed to control behavioral and pituitary-adrenal responses to stress through inhibitory GABA-ergic projections to the amygdala and the hypothalamus (see Davidson et al 2000)." (Heim, 2001)

The prefrontal cortex lies anterior to the central sulcus and communicates with the parietal, temporal and occipital lobes through long association fibres. The prefrontal's cognitive functions "include intellectual, judgemental and predictive faculties and the planning of behaviour." (Crossman, p. 143, 2000) The prefrontal plays an important role in how we learn to navigate efficiently in social contexts. Emotion and long-term memory facilitate the ability to judge the environment and learn from past mistakes: "Children only develop autonomy when they start developing a **prefrontal cortex.** This allows them to appraise their internal states and to execute the actions necessary to restore disturbances in homeostasis." (Van der Kolk, p. 3, 2006)

2.3.7 Medial Prefrontal Cortex

The medial prefrontal cortex is often shown functionally altered in patients with PTSD. "It is closely linked with the anterior insula, temporal pole, medial temporal lobe and hippocampus, inferior parietal lobe and amygdala. These connections relate it to long-term memory as well as to emotions processed through the limbic system." (Clark, p. 98, 2010) As the 'social brain' it is linked to the amygdala in judging facial expression. It is linked to the subgenual cingulate gyrus with regard to 'mentalizing' and predicting the social intentions of others: "All of this is used to judge risk and reward of alternative behaviours we might select to be successful in a social situation." (Clark, p. 98, 2010)

As an adaptive mechanism the medial prefrontal cortex in combination with the rostral anterior cingulate will suppress messages from the amygdala even though this compromises other functions such as memory and

emotional responsiveness. The "medial prefrontal cortex appears to be volumetrically smaller and is hypo-responsive during symptomatic states and the performance of emotional cognitive tasks in PTSD." (Shin, 2006)

Dr. Rebecca Elliot writes about the need for different approaches to treatment in re-coding messages to the prefrontal cortex:

> Psychological constructs such as cognitive reserve, cognitive flexibility and coping strategies may depend on top-down control of amygdala function by prefrontal cortical regions. It may, therefore, be possible to strengthen resilience through pharmacological and non-pharmacological means, including cognitive behavioral or other psychological therapies and education. (Elliott, 2008)

2.4 Perspectives On Trauma

2.4.1 Effects Of Childhood Trauma Exposure

A study which will contribute immensely to our understanding of the long term effects of war on children has been conducted by Philipp Kuwert and his colleagues called, *Sixty years later: post-traumatic stress symptoms and current psychopathology in former German children of World War II* (Kuwert, 2006). Their investigations grew in response to the current needs of the children of WWII who are now approaching retirement age. They are being confronted with the need to integrate the unspoken issues that surrounded them as children in families recovering from the experiences of war. Kuwert found, through a method of self-reporting, that 50% of participants born between 1933 and 1945 were directly traumatized. Researchers reported, "The main finding of our study is that 10.8% of participants were suffering post-traumatic symptoms six decades after the end of World War II." (2006, p.5) Researchers felt this statistic could in reality be much higher based on the fact that "highly traumatized subjects find it difficult to participate in such research." (2006, p.6)

The long-term effects of war have been corroborated in other research but on shorter timelines. Bosnia, Palestine, and Rwanda have lower measures on health surveys and higher rates of diagnosed PTSD. National care programs are beginning to recognize the systemic nature of these health concerns. Poor cognitive skills, anxiety leading to depression, and emotional/social challenges are on-going. The daily effect of living in a society in recovery creates states of chronic stress from unemployment and general burnout. (Munyandamutsa 2012, Samir Qouta 2005, Rohleder 2004)

2.4.2 Transmission Factors

When inquiring into the effect of war trauma on an individual and their physiology, it needs be understood that as a condition it is unique in that the mechanism of injury is culturally imposed. Exposure doesn't happen in isolation and the context of that exposure is a pervasive one. The entire family, extended family and community at-large are often also affected. Patterns of reaction and adaptation, positive and negative, not only become personal patterns and familial patterns but cultural patterns.

Among the first to recognize this and to constructively address it were Nicolas Abraham and Maria Torok. Abraham and Torok were two Hungarian psychoanalysts whose major works were written after WWII: hence, they were strongly influenced by the needs of those who suffered the experiences of war. They observed a great need among post war individuals to recover unity for the lost 'self.' They originated the concept of the Transgenerational Phantom to describe the unspoken wounds one generation unwittingly inherits from another. (Abraham, Torok, 1994) By developing linguistic structures, in therapeutic psychoanalysis, to describe the very personal mechanisms that connect us with ourselves and our 'extended self' - our family and community – they gave voice to incomprehensible struggles. They were able to describe what had been experienced by so many but had not yet been understood 'in thought' in a way that would begin processes of resolution.

2.4.3 Transgenerational Factors

"Trans-generational transmission of stress response characteristics" (Yehuda, 2007) is a phenomenon that has been observed most intently in Holocaust survivors and their children. Rachel Yehuda has been leading research in this field. "She posits cortisol as a candidate mechanism for such a cascade (of PTSD symptoms) that can account for both the development of trauma and its transmission across generations." (Weingarten, 2004) Yehuda and her colleagues have done numerous studies looking at the levels of cortisol in adult children of Holocaust survivors with PTSD. They've found low cortisol levels even in adult children without their own accompanying symptoms of depression. Their findings have led them to consider the possibility that changes in utero have caused glucocorticoid receptor sensitivity, that "genes regulating HPA activity can be programmed by pre- and postnatal early life events and even by differences in maternal care." (Yehuda, p. 165, 2007) She acknowledges the presence of stress in the home environment may be a contributing factor to offspring expression of low cortisol and suppressed HPA axis function but points to the stability of their findings over time and among subjects. This is an

indicator that these patterns may be evidence of "changes in patterns of DNA methylation, that may reflect earlier life events rather than cumulative effects of stress." (Yehuda, p. 165, 2007)

Garbarino and Kostelny (1996) provided evidence that Palestinian children from dysfunctional families were more vulnerable to the negative consequences of chronic military violence, when compared to children whose parents used positive styles. An additional study on Palestinians revealed that children who had loving and non-rejecting parents were more creative and efficient in problem solving than those from problematic families. The creativity and efficiency in turn could protect children's mental health despite exposure to military violence (Qouta, 2001). Exposure to war trauma however, places a great burden on parents and may compromise their parenting quality. "Notably, research has revealed that the child's access to supportive, attentive, and sensitive adult care plays a salient role in buffering the activity of the HPA system and protecting the developing brain from potentially harmful effects of stressors." (Gunnar, 2009) Children's success in coping was directly linked to the coping skills of their parent. In terms of prevention conditions that support parents support children's future health. Osteopathically, it is important we are aware of the 'network' of influences we are relating to when treating in one individual.

2.4.4 Genetic Factors

Commonly cited research on the genetic transmission of PTSD is in a twin study titled *Genetic and Environmental Influences on Trauma Exposure and Posttraumatic Stress disorder Symptoms: A Twin Study.* They studied monozygotic and dizygotic twins who had both experienced 'assault trauma' and found a higher correlation of symptoms and common influences in the monozygotic pairs. They concluded, "PTSD symptoms were moderately heritable… correlation between genetic effects on assaultive trauma exposure and on PTSD symptoms were high." (Stein, 2002) The 'seat' of the genetic correlation remains unknown but Stein and Jang hypothesize factors ranging from personality traits that influence choices to genetic pre-disposition to anxiety disorders. Their study primarily included women so gender differences have yet to be considered.

2.4.5 Contemporary Views On Trauma Treatment

Views on trauma treatment have changed in recent decades. The drive for the treatment of trauma's ongoing development has been coming from the other side of the war equation: the needs of soldiers. The Mayo Clinic, for example, is combining cognitive therapies, exposure therapies (desensitization techniques) and EMDR (eye movement desensitization and reprocessing) with drug therapy. Drug therapies use anti-depressants, anti-psychotics and brain blockers (Mayo clinic, 2012)

In the last decade the spectrum of trauma treatment research, which has more often focused on neurobiology, has broadened to include more and more models from behavioural psychology and neuropsychology. Authors like Candace Pert, (Molecules of Emotion, 1997), Babette Rothschild (The Body Remembers 2000), Peter Levine (Waking the Tiger: Healing Trauma), Joseph LeDoux (The emotional Brain, 1996), Antono Damasio (Descartes' Error: Emotion, Reason, And the Human Brain, 1994) are all adding their voice to a new paradigm that includes a recognition of emotion as it reflects the integration of body, mind, and spirit. A growing interest in 'somatic therapies' has been part of this paradigm shift.

Changes in treatment approach have been accompanied by a greater understanding of the way individuals experience their own sensory systems and physical integrity. There is a recognition that trauma creates a dissociation between what the body experiences what the mind 'thinks.' Therapies seek to help the patient reclaim their integrity of function and harmonic integration. Neuroscientist Bessel A. Van der Kolk writes, "Neither behavioural nor psychodynamic therapeutic techniques pay sufficient attention to the experience and interpretation of disturbed physical sensations and pre-programmed physical action patterns." (Van der Kolk, p. 6. 2006) Van der Kolk observes that traumatized individuals are exposed to a bombardment of irrelevant "subcortically initiated responses" (Van der Kolk, p. 1, 2006). Cognitive therapies alone are not sufficient enough to re-train the imprint of these deep automatic survival responses. Van der Kolk advises conscious re-training of deep brain centres through non-mainstream practices that employ sensory awareness and mindful movement. "Neurobiologically speaking: they need to activate their medial prefrontal cortex, insula, and anterior cingulated by learning to tolerate orienting and focusing their attention on their internal experience, while interweaving and conjoining, emotional, and sensorimotor elements of their traumatic experience." (Van der Kolk, p. 12, 2006)

2.4.6 The Dual Brain

There is a trend among the authors listed above to create treatment paradigms that take into account a fundamental understanding of the 'oppositional nature' of competing dichotomies existing within a body/mind that evolved to serve its prime mandate: to simply 'stay alive.' This is a common theme among today's neuroscience based behavioural psychologists as expressed by Michael Christopher MD: "Evolutionary psychology argues that many, if not most, psychological pathologies result from a discontinuity, or dissonance, between the actual environment (our current socio-cultural system) and the environment our hunter gather ancestors spent millions of years biologically adapting to." (Christopher p. 78, 2003) This evolutionary bio-social 'lack of fit' is "manifested as internal biological conflicts between older and newer biological systems of the brain." (Christopher p. 78, 2003) Hence adaptation, in this view, is measured by how well one is able to interact with his or her environment and balance the competing neural complexities within themselves and by extension within their own environmental context. In treatment this translates to the general belief that cognitive therapy appeals to the neocortex whereas somatic and desensitizing therapies (EMDR) reach the limbic and archaic regions. (Van der Kolk, 2006)

2.5 Trauma Treatment Approaches

2.5.1 Introception

New neuro-scientific views about the nature of the brain and its response pathways as outlined above, have contributed to a paradigm shift in strategies of treatment. Holistic approaches are being accepted as ways to modulate sensory input prior to provoking automatic stress responses. Programs that teach mindfulness, that improve introception, that is, the ability to consciously identify internal feelings and body sensations that teach sensory awareness through movement and breathing exercises are all gaining acceptance. (Van der Kolk, p.6, 2006)

Changing one's relationship to sensory input by broadening the spectrum of positive experience and thereby gaining mastery over stress triggers is also a doorway to creating 'meaning.' Current therapies are also recognizing that a search for meaning and a unifying sense of purpose creates balance. The words balance, resilience, dynamic equilibrium, moderation, coping mechanisms, adaptation skills all infer the need to co-ordinate opposite extremes by finding a middle ground or still centre. Practices and treatment methods that facilitate a window of experience for the patient to 'view' things not from within their own narrative but through an

understanding that stands 'outside' what happened to them shift their sense of calm, self-control and feelings of personal safety. (Van der Kolk, p. 13, 2006)

Christopher further emphasizes the interdependent link between perception of experience, sensory input and body chemistry. It is necessary to break the cycle of neural facilitation repeatedly so that lasting change can happen on all levels. He writes:

> The focus should be on assisting the patient to develop the metacognitive reconfiguration of schema needed to turn anxiety into meaning. Because a person is always biologically changed by trauma, and because pharmacological treatment does not restore pre-trauma biology, if the person lacks the cognitive schema to turn traumatic stress into meaningful lessons, the endocrine changes in the HPA axis will likely continue to transform environmental novelty into maladaptive or pathological responses. (Christopher, p. 92, 2003)

2.5.2 Cognitive Behavioural Therapy

Cognitive behavioural therapy and pharmacology have focused on treating the external unwanted behaviours that are an expression a lack of neurological integration. Dampening of PTSD symptoms such as hyper-arousal, avoidance, depression, re-living of the experience etc. has been the single-minded goal of most treatment strategies. This is a top down approach combining learning theory with information processing theories, which look at the thoughts that drive behaviour and reinforces the link between action and natural consequences. This approach has been shown to be effective with young refugees also. (Ehntholt, p. 1203, 2006). A program of trauma desensitization and reaction normalizing methods using creative writing, drawing, narrative and relaxation exercises was implemented with refugee children by "Smith et al 2000." However gains were not maintained. Researchers found that when programs were provided over the long-term in community settings such as schools results were more long-term. (Ehntholt, 2006)

2.5.3 Testimonial Based Psychotherapy

Ermann et al have responded to the needs of a growing numbers of senior citizens in Germany who are children of the WWII by surveying their experience using psychoanalytically oriented research interviews. The personal healing becomes part of the cultural healing. Ermann expresses this by saying,

> It is my thesis that remembering the traumata of the Germans is a necessary step on the way to a memory culture which does more and more accept the complexity and unfolding of the different facets of the NS catastrophe. (Erlich, Ermann, Project Children in War)

On a personal level the narrative engages the individual in a process of remembering while in safe circumstances and then again joins the subject with society through the sharing of their story. "What distinguishes

this approach is its social aspect. One of its explicit aims is to reframe the individual survivor's story within the social and historical context in which the state sponsored violence took place." (Ehntholt, 2006) This is a means of interacting with and expressing oneself to the larger context, or 'mechanism of injury' – the perpetrating body within the culture.

Talk therapies are also relevant to the neuroanatomical needs of PTSD subjects. Biological psychiatrists point out that fMRI studies show a decrease in the activation and function of the verbalizing centres of the right hemisphere. The brain's default mechanism, which includes the pre-frontal cortex, when stimulated, is left to re-live the trauma in an unfiltered experience. Cognitive training therapy in combination with other treatment methods may help re-train the right neo-cortex to regain its balancing narrative. (Panksepp, p. 336, 2004)

2.5.4 Eye Movement Desensitisation And Reprocessing (EMDR)

EMDR is a cognitive re-training technique that has been very successful in helping people eliminate symptoms of anxiety and post-traumatic stress. It is a method of bilaterally repeated eye movements that is combined with other information that distracts or exposes the subject creating a focusing task that requires 'dual attention.' (Ehntholt, 2006) Bessel Van der Kolk stated the fundamental reason it works to calm and integrate brain function in PTSD subjects is unknown. He speculates EMDR may relax the functions of the thalamus. (Van der Kolk, 2011)

Isabel Fernandez who has written extensively on EMDR says the following, "One of the most plausible reasons [EMDR works] may regard the fact that there seems to be an innate information processing system that is physiologically configured to facilitate mental health in much the same way the rest of the body is designed to heal itself when injured. (Shapiro, 1995)" (Fernandez, Isabel, 2007)

Van der Kolk and colleagues conducted a study using three approaches (psychotherapy, pharmacotherapy and EMDR) to treatment with PSTD adult onset and PSTD childhood onset patients.

"At 6-month follow-up, 75.0% of adult-onset versus 33.3% of child-onset trauma subjects receiving EMDR achieved asymptomatic end-state functioning compared with none in the fluoxetine group. For most childhood-onset trauma patients, neither treatment produced complete symptom remission." (Van der Kolk, Spinazzola, 2007)

From an Osteopathic point of view this may indicate that the original lesion state is still present and EMDR allowed them to temporarily adapt to their lesion.

2.6 Contributing Factors

2.6.1 Individual Resilience

Resilience is a concept that has often been applied to the inner life of the child as if it is an attribute protecting them from the influence of adverse circumstances. Dante Cicchetti writes in the forward of the book *Resilience and Vulnerability: Adaptation in the Context of Childhood Adversities*, that it is "the more optimistic component of the psychopathology-risk equation." (Martin, Njoroge, 2003) He points out that resilience is not the final cure. It is still an adaptation to trauma that leaves the child 'one step removed' from living within a true experience of his or her own personal sense of ease.

The patient's general life circumstances, the age at which they experience trauma may bolster or diminish resilience. Some risk factors against resilience are duration of the stressor, the absence of a support system, poverty, the inability to meet fundamental survival needs, and the absence of a safe zone to give temporary relief. Childhood traumas are psychophysical and psychosocial phenomena. Resilience and social context are interdependent.

It has also been shown that many war children acquire positive survival skills and develop ways of coping that are of a lifelong advantage to them. Samir Qouta attributes this to the self-esteem that comes from successful coping and creative problem solving. "It has also been noted that living in chronic life-endangering conditions forces children to balance between distress and resilience and to solve conflicts between fear and courage." (Qouta, 2007) Adaptive trauma responses such as this according to Michael Christopher can lead to a "more integrated sense of self, more awareness of relationships with others, and more integrated philosophy of life." (Christopher, p. 83, 2003)

2.6.2 Social Resilience

Community and family support systems can greatly ameliorate stress and assist the individual's ability to adapt to and assimilate physical and mental states of healing. Support systems are a vital part of what enables one's ability to move forward. This kind of network changes toxic stress into 'tolerable stress,' which is a normal part of physical and social development. Jack Shonkoff in his article *Preventing Toxic Stress in Children* writes,

> Neuroscience and the biology of stress help us to begin to understand how poverty and other adversities are literally built into our bodies. Prolonged activation of the body's stress system during early development can damage the formation of the neural connections that comprise our brain architecture and set our stress-response system at a hair-trigger level. (Shonkoff, 2009)

Much research has been done to evaluate attitudes that support recovery from war trauma. For example, when the political environment is viewed as playing a positive role in creating change attitudes of acceptance and trust are fostered that assist recovery in war-affected communities. In 2000 Gordana Kuterovac Jagodi surveyed 230 Croatian children between the ages 11-14 years to ask the question, "Is war a good thing or a bad thing?" "The results indicate that Croatian children generally have a negative attitude toward war, but strongly support the fight for the freedom of their nation." (Jagodi, p. 241, 2000) Researchers further explain that the view of war as necessary plays a role in promoting an acceptance that allows the community as a whole to move forward. The individual's personal perspective is strongly influenced by their fundamental agreement with the culture they live in.

In his paper "Understanding Children with War-zone Traumatic Stress Exposed to World's Violent Environments" Erwin Randolph Parsons, Ph.D. wrote about the importance of identifying meaningful "healing symbols for trauma-transformation, integration, and healing. These are expressed in song, chants, ritual, dance, and in play that build inner strength and reaffirm individual identity and a sense of connectedness and continuity with the community." (Parson p. 336, 2000) Parsons work describes a process by which they support individuals to begin the long walk back to their own personal and emotional centre.

2.7 Developmental Reasoning For Subject Age

"By the time a child is three years old their brain has formed about 1,000 trillion connections - about twice as many as adults have. The brain will stay this way throughout the first decade of life. Beginning about the age of 11, a child's brain gets rid of extra connections in a process called pruning." Pruning continues to shape synaptic density until approximately 15 years of age. (Brotherson, 2005) The neural connections that are most well used between three to fifteen years old are the pathways that become hardwired in the brain. Change and learning can occur throughout life however when the demand for learning new skills is necessary after 15 years of age the process is slower and may involve 'unlearning' as well.

The lower brain centres growth and development are complete at birth as witnessed by the uninhibited presence of the primitive reflexes: sucking, Moro reflex, Babinski. etc. The development and arborization of the upper cortex, that eventually supresses the primitive reflexes, continues until puberty and is dependent upon experience. For this reason the wartime ages 3 to 14 were chosen as the limit for the inclusion criteria due to critical periods of neural plasticity based on milestones of neural development.

Chapter 3: Osteopathic Justification

CHAPTER 3. 0STEOPATHIC JUSTIFICATION

Osteopathic perspectives on the treatment of trauma, stress, and mental health extend into a wide variety of avenues and paradigms of practice. This is a reflection of the legacy left to us by A.T. Still that acts as a challenge and a gift. The gift given through this discipline is the fact that the holistic principles and natural laws inherent in Osteopathy, without reserve, support the intention of this field of trauma and quality of life research. The challenge, and this is a positive challenge, is that the 'entry point' in investigating these paradigms of practice may be at any one of numerous openings. Is it the heart, the adrenals, the thoracic spine, the sympathetic nervous system, is it the vagal path, the cervical baroreceptors, is Sutherland's fulcrum key or simply the third ventricle? Where is it best to begin?

Ultimately, when linking treatment that is focused on body's effect on mind and mind on body the 'story' is told in all of its parts. With Osteopathic principles as the 'entry point' this research has chosen to look to the endocranium to understand its version of the 'tale.' This Osteopathic justification will look at Global Osteopathic treatment and how it is utilized in the treatment of stress, also at stress factors and their influence on the primary respiratory mechanism (PRM). The possibilities Endocranial treatment presents will be reviewed before looking at treatment methodologies and the necessary anatomy for the treatment of trauma exposure.

3.1 PTSD Research – The American School

Although Osteopathic perspectives on stress and trauma are numerous, Osteopathic research on the treatment of traumatic stress is sparse and appears to be in its early stages of development. According to Roy R. Reeves DO in his article, *Diagnosis and Management of Posttraumatic Stress Disorder (PTSD) in Returning Veterans,* "To date, there have been no studies investigating the effectiveness of osteopathic manipulative treatment (OMT) in patients with PTSD." (Reeves, p. 188, 2007) Although this appears to remain true in the journals of American Osteopathic research there has been growing focus on reviewing what an Osteopathic approach to PTSD would contribute.

There is agreement among Osteopathic practitioners on this continent and abroad that Osteopathic principles with a focus on the integration of body, mind, and spirit can become an integral part in recovery from traumatic stress. Daryl Callahan DO, author of *Combat-Related Mental Health Disorders: The Case for Resiliency in The Long War* states, "An opportunity exists for osteopathic physicians to improve the rates of recovery from, and

prevention of, mental health disorders such as PTSD in the great number of US military service members deployed during The Long War." (Callahan, 2010)

Though Callahan acknowledges that American Osteopaths have not researched the effectiveness of Osteopathic treatment on PSTD he does a review of non-manipulative approaches such as stress inoculation training to support resilience. This method uses incremental exposure to stressful stimuli presented over time to retrain the stress response. Osteopaths in the U.S. are also advocating drug therapies in addition to cognitive re-training. (Callahan, p. 525, 2010) Reeves hypothesizes that somatic dysfunctions related to increase sympathetic nervous system activity would respond well to Osteopathic Manipulative Treatment. (OMT) Kozminski reports that OMT has been successfully used with soldiers suffering head injuries who also have PTSD. "In at least one small case series, OMT was shown to be a helpful adjunct therapy to traditional pharmacologic therapies for US soldiers suffering from posttraumatic headache attributed to mild head injury." (Kozminski, 2010) The above mentioned American Osteopaths collectively agree that doing global Osteopathic treatment of the osseous-membranous system as it relates to reduced tension, vasoconstriction, nerve facilitation, nociception, and reduced sympathetic nervous system activity are all valid ways to help patients recover from PTSD. Clearly PTSD research is only just beginning in the field of Osteopathy.

In turning the focus to research and articles gathered from JAOA on mental health, depression, anxiety, and trauma exposure written by American Osteopaths it is clear that at present rather than employ Osteopathic manual techniques, mainstream American Osteopaths equate mental health concerns with the need for a multidisciplinary approach. In addition to pharmacology, use of psychoanalaysis to promote access to community resources such as crisis centers and community education programs rank high on their action plan in the treatment of post-traumatic stress related symptoms. (Dolnak DO, Douglas 2006, Shelton DO, Charles, 2004, Boone, Anthony, 2003) Although these are all suitable measures there is clearly a need for research on alternative trauma treatment concepts, which are most certainly available in the Osteopathic field.

3.2 Trauma and the Soma

Franklyn Sills in *Craniosacral Biodynamics (Volume One)* makes an important distinction between trauma and traumatization. (Sills, p. 356, 2001) We have the ability use the stress response for survival and then the ability to resolve, express and shake off traumatic experiences physically, mentally and emotionally. Involuntary shaking and a good cry are natural and healthy ways to deal with and release the effects of a minor car accident for example.

However when we are unable to cognitively process, physically and emotionally release a traumatic experience we risk burying the impact within. If an impact or shock overwhelms the system and cannot be released traumatization occurs. For the sake of survival the individual must adapt to a new personal paradigm which includes the presence of residual impact. Sills refers to traumatization as an impact that has imploded itself within and has resulted in "trauma bound energy and shock affects" (Sills, p. 356, 2001)

> This charge is held within the central nervous system and within the fluids and tissues of the body. These fright or flight and shock energies, in the form of neuroendocrine-immune processes continue to cycle until they are resolved in some way. Psychological, emotional, and pathological processes will become coupled with these energies.
>
> (Sills, p. 356, 2001)

When describing the need of the CNS, liquids and body's tissues to find resolution Robert C. Fulford D.O. employed the term "dynamic equilibrium" which he referred to as an ongoing living ballet animated by the Breath of Life in physical form. "When this dynamic equilibrium becomes upset, the organism feels a need or a hunger. The hunger arouses the organism to modify the existing pattern, so a re-establishing of the equilibrium can take place." (Fulford, p. 86, 2003) Although stress challenges our dynamic human mechanism it also stimulates it to grow. This is part of our inherent survival mechanism and success as human beings. When studying a population exposed to war, it is important to remember Fulford's principle of dynamic equilibrium. There is an equal potential to find positively modified life patterns, great adaptation skills, and resilient 'dynamic equilibrium.' The human dance has many possibilities.

3.3 Trauma and the PRM

CEO Osteopath Karen Hain conducted a phenomenological survey asking Osteopaths how they view trauma treatment, what symptoms do they see, how do they perceive it and how do they palpate it? She reported that there was much common ground in how Osteopaths palpate the presence of trauma but the most common response was the presence of a lack of Primary Respiratory Mechanism (PRM). She concluded, "Osteopathy recognized the existence of the primary respiratory mechanism, which as revealed in this study, can be altered as a result of emotional trauma, hindering the traumatized individual's ability to self-regulate." (Hain, p.157, 2011) She further goes on to say, "Osteopathy therefore can offer the traumatized individual relief from burdens of the past by releasing emotional trauma from the body so ultimately he/she may live life to its fullest potential." (Hain, p.157, 2011) In research conducted by Plotkin, the manual Osteopathic treatment of women experiencing depression not

only improved perception and quality of life but a change in the cranial rhythmic impulse was noticed. "Of interest was the fact that after OMT treatment four of the six treatment subjects registered an increase in the rate of their cranial rhythmic impulse." (Plotkin, p. 521, 2001)

Becker describes in detail the sequelae of stress that most certainly impedes the PRM. Becker tells us in his book *Life in Motion* the following;

> The greatest and most direct conditioners of stress reactions are membranous-articular strains in the craniosacral mechanism that lead to a disturbance of mobility of the cranial articular mechanism, abnormal patters of mobility of the reciprocal tension membrane, venous retardation, loss of mobility and motility of the pituitary gland within the sella turcica, disturbances of the hypothalamic areas, hyper and hypo irritability of the central innervation of the sympathetic and parasympathetic nervous systems, and hormonal changes that accompany all of this reaction to strain and stress. (Becker, p. 211, 1997)

Rollin E. Becker, DO also stated that stress has a limiting effect on the PRM and the inherent motility of the CNS. Clearly trauma is an experience that reaches our very core coherence and has the potential to displace it. The effects spread in every direction and have the potential to penetrate each aspect of the physical, mental, and spiritual human being, leaving the individual without a clear centre to live from. One's individual experience of an event that 'holds' a potential 'impact' is highly contextual and personal thus resolution can be complex. In the case of childhood trauma the exposure may have happened when they were pre-verbal making the experience unconscious in terms of thought processing yet possibly conscious in terms of 'feeling state' alone. Depending on the age of impact, the nature of the event and the nature of the support structures impact from trauma is widely different. (Parsons, 2000) It is well worth pursuing a growing understanding of trauma, one that is able to keep pace with what we know in Osteopathy partnered with what we know in mainstream science. As new discoveries are made, and for that matter, as new understanding of old discoveries are re-discovered again, new information will stimulate change – there to meet ever present and waiting need.

3.4 Osteopathic Treatment Genres

The following is a survey of research designed to address neurochemical and neurobiological sources of stress as well as confirm a link between Osteopathic treatment as an effective approach to support cognitive processing and general changes in perception will follow. Many Osteopathic researchers are beginning to investigate how quality of life may be improved through Osteopathic treatment.

3.4.1 Global Osteopathy: Stress, Anxiety, Depression

Chantale Bastien DO of the CEO completed a thesis on generalized anxiety disorders in 2008. In her thesis titled "Etude Experimentale Mesurant L'Effet du Traitement Osteopathique General Chez L'Adulte Souffrant de Trouble D'Anxiete," Chantale Bastien successfully demonstrated that global osteopathic treatment relieves the degree of anxiety experienced by a mixed population of subjects between 20-to 50-years old. Bastien used the Hamilton Rating Scale for Anxiety (HAMA). (Bastien, 2008) Her global Osteopathy approach paid specific attention to the cranial and thoracic area to decrease sympathetic nervous system tone. Kuchera D.O. writes, "The highly significant presence of hyper-sympathetic tone in dysfunctional and disease states of patients prompts the clinician to consider specific and effective ways of returning sympathetic tone to normal homeostatic levels." (Kuchera, p. 76, 1993) Bastein D.O. was also able to conclude that the age of onset of anxiety symptoms whether in childhood or adulthood did not compromise their response to treatment.

Joelle Robin Williams D.O. conducted research on stress in her work titled, "*The effect of osteopathic treatment aiming for the hypothalamus-pituitary-adrenal axis (HPA axis) on self-perceived stress."* (Williams 2010) She was able to demonstrate, "Highly statistically significant decreases of stress scores were observed after two osteopathic treatments in both PSS 10 and PSM-9." (Williams, p.101, 2010) Williams DO's treatment focus was to restore "nervous innervations as well as proper blood supply and drainage to these structures" (Williams, p. 35, 2010) She also specifically treated the hypothalamus, pituitary and adrenal glands. Her work established a positive link between osteopathic treatment and the promotion of psychological health.

Another study that also exemplifies the spectrum of what is possible to address through Osteopathy, titled *Adjunctive Osteopathic manipulative treatment in women with depression: a pilot study* was conducted by Plotkin Phd, Rodos DO and associates to "assess the impact of osteopathic manipulative treatment (OMT) as an adjunct to standard psychiatric treatment of women with depression." (Plotkin, 2001) They established a link between OMT and successful recovery to normative measures on depression scales for women in their treatment group. Both control and treatment groups received conventional drug therapy and psychotherapy during the 8 week research timeline. Both groups showed improved outcome scores however, all participants of the OMT group versus 33% of the control group achieved normative psychometric evaluation scores. Plotkin concludes saying, "Because there is a direct connection between behaviour and ther nervous and immune systems, it is reasonable to expect that OMT, which affects neural transmission, would have an impact on behavioural states." (Plotkin p. 518, 2001)

3.4.2 Osteopathy and Perception

Austrian osteopath Raimund A. Engel in his thesis titled, *Cranial States*, explored changes in states of consciousness in patients after receiving cranial osteopathic treatment. He compared subjects who received cranial osteopathy with one group who received sham treatment and a third who laid with their eyes closed for fifteen minutes: "The results indicate that the applied cranial technique induced an altered state of consciousness (ASC) associated with positive affect in the subjects." (Engel, 2006) Using the Phenomenology of consciousness Inventory (PCI) Engle found the cranial treatment group demonstrated a greater shift in consciousness than the other two. The positive effects included mental, physical and emotional relaxation, improved interoception, and presence within a state that allowed them to view their worries and problems differently. This shift of awareness was accompanied by a calmer body state as measured by heart rate variability. (Engel, 2006)

3.4.3 Osteopathy, Biochemistry and Perception

Explanations for Osteopathy's effect on states of mind often begin with a description of the global health that comes from mobilizing the cranial sacral axis: the release of cranial nerves, vasoconstriction, decrease sympathetic tone and balanced parasysmpathetic responses through sacral manipulation that restores pelvic, splanchnic innervation to the organs. (Kuchera, p. 77, 1993) However a new perspective can now be added that looks at the biochemistry and how it responds to the re-alignment of the global and cranial sacral mechanism. John McPartland DO in his JOAO review titled *The Endocannabinoid System: An Osteopathic Perspective* draws comparisons between Osteopathy's view on the global nature of the body's self-healing mechanism and the systemic role of endocannabinoid function as a primary facilitator of health. He links Osteopathic practices with the ability to enhance endocannabinoidal receptor site function (cannabinoid receptors, CB 1 and CB 2). (McPartland 2008)

Activation of cannabinoid receptors supports immune function and suppresses inflammatory processes. McPartland observes that manual osteopathy's role in relieving inflammation may be explained by Irvin Korr's work demonstrating the negative effect of mechanical compression on axoplasmic flow. (McPartland p. 594, 2008) If the cytoplasm in the space between neurons and axon fibers is not free to flow, then degeneration occurs. (Moore, Dalley p. 48, 2006) As Korr states, "Deformations of nerves and roots, such as compression, stretching, angulation, and torsion, that are known to occur all too commonly in the human being [...] are subject to manipulative amelioration and correction." (Kabara, Korr, 1975)

Endocannabinoid receptors (CB 1) are also found in abundance in the CNS. McPartland states, "Activation of CB1 may explain many CV-4 effects, such as relaxation and drowsiness, decreased sleep latency, and

decreased sympathetic nerve activity." (McPartland, p. 595, 2008) What McPartland proposes in linking Osteopathic manual practice with having an effect on the endocannabinoid system may support us in understanding why it appears Osteopathic treatment may contribute to enhanced feelings of well-being, improvement of quality of life and support changes in cognitive perception.

Rollin Becker builds upon the search for biochemical correlates by saying, "There are biomechanical answers in the Osteopathic concept that explain questions in the general adaptation syndrome." (Becker, Life in Motion, 2006) He is referring to Dr. Hans Selye's model of stress reaction and adaptation. Briefly, Hans Selye defined stress as, "a non-specific response to real or imagined challenges or threats." (Lefton, p. 540, 2008) This paper also hopes to explore some the biomechanical answers Osteopathy has to offer in answer to the questions of impact and adaptability to stress.

Jean-Pierre Barral DO also made mention of the effects of trauma upon biochemistry. "In addition to the complex mechanical factors involved, biological, chemical, hormonal, and psychological reactions also come into play following lesions" (Barral, p. 89, 1997). Barral writes that post-traumatic syndromes are not purely psychogenic but have a clear and strong link to "hormonal-chemical reactions." (Barral, p. 91, 1997). The traumatic impact in this case was not received through forces in gravity but rather through forces of perception, cognitive/sensory experience impacting biochemical processes and physiology.

'Life' is a physical experience whether the experience of an event is recorded in the body through forces of gravity in the bones, viscera or liquids or is 'written' within, through perceptual experience, upon our chemical physiology. The chemical and hormonal messaging mechanisms within our gravity-bound physical structure, work in concert with one another and thus just as connective tissues and joint articulations show the wear of use, overused neural and endocrine stress mediators also become inefficient. The body physiology may also become 'mechanically loaded.'

3.5 Endocranial Approach

A growing number of osteopaths endorse the belief that Osteopathic methods of practice have the ability to positively affect not only the osseous membranous container of the cranium but also its contents – the central nervous system. Mental health, cognitive function, and an improved sense of wholeness and well-being are aspects

of personal experience that are uniquely within Osteopathy's realm of possible treatment according to Louisa Burns. She went on to say:

> "The over-stimulation or over-inhibition of the cortical centers is as efficient a cause of malfunction as is the over-stimulation or over-inhibition of the spinal centers. The efficient osteopath is the one who recognizes the cause of malfunction, corrects it if possible, and advises the best care." (Burns, p. 4, 2005)

Along with Philippe Druelle D.O. there are others, though few, in the Osteopathic field who acknowledge the ability to effect change within neural tissue using endocranial concepts are James Jealous D.O. (Jealous, 1997), Bruno Chikly D.O. (Chikly, 2011), and Paul Lee D.O. (Lee, 2005).

Within the research archives of the College d'Etudes Osteopathiques can be found several thesis works that has been inspired by Philippe Druelle DO's Endocranial concept which have focused on its effect on cerebral processing. The work of Genevieve Forget also sets a precedent for the content and direction of this work through her research titled "Traitement Osteopathique des Spasmes Endocraniens: Influence sur L'Equilibre de l'etre au Niveau Physique, Mental, Emotionnel et Spirituel" (Forget, 2001) which explores the link between body, mind and spirit. She assessed and treated the encephalon and endocranial spasms "on the tissue, fluidic and energetic levels, according to the concepts and methods developed by Philippe Druelle, DO" in healthy individuals. (Forget, 2001) Her experimental group demonstrated significantly positive results and improvement in overall well-being. The above examples demonstrate that Osteopathic treatment using the endocranial concept has the potential to support patients in improving quality of life. Osteopathy as a therapeutic modality can contribute to an understanding of the physical, mental, emotional, and spiritual needs of the patient.

David Bergstein D.O.'s research titled *Osteopathic Treatment of the Encephalon: A quantitative EEG study* was a landmark study that positively demonstrated, "Osteopathic treatment of the encephalon affects electrocortical activity as measured by QEEG." (Bergstein, p. 191, 2009) Changes in brainwave activity resulted from direct osteopathic treatment of the encephalon. A consistent pattern of non-random, centralized, and orderly brain wave activity was found in most of the pre/post results for the treatment group. Bergstein treated healthy subjects to demonstrate his findings however he writes in conclusion, "The ability to affect the structure, and therefore function of the brain, is a significant concept. The human suffering relegated to conditions of the central nervous system, whether physical or psychological in nature, is enormous and growing. As osteopathic practitioners, we must continually seek to add to our arsenal" (Bergstein, p. 193, 2009)

In 2007 Caroline Desilets and Katia Isaac-Villette completed a thesis entitled *Influence du Traitement Osteopathique sur le Trouble de Stress Post-Traumatique chez l'Adulte (2007).* Desilets and Isaac-Villette observed that Osteopathic research on the topic of mental health "has not been the object of many studies so far." (Desilets, Isaac-Villette, p. XXVII, p. 2007) These researchers divided a group of twenty-eight subjects each with a post trautmatic stress disorder diagnosis and treated 17 subjects Osteopathically using the endocranial concept and 11 with placebo treatment. All subjects demonstrated improvement over the time of the study with no significant difference between the two groups. They faced research challenges in terms of homogeneity age (26 to 65) and stress experience. Although each subject had a PTSD diagnosis their experiences varied widely. Isaac Villete also noted a need for many patients to verbalize their past experience which in fact inhibited treatment. The subject stayed within the hyper-responsiveness of their sympathetic nervous system. (personal communication December 21, 2010)

In 2010 another Osteopath with the CEO, Merrill Lalonde DO, used global and osteopathic and endocranial treatment to study its effect on patients who scored low on self-esteem screening tests. Her goal was to establish coherence and integration within the layers of the osseosmembranous container with a focus on the central chain and endocranium. When compared to an untreated control group Lalonde's treatment group scored significantly higher on the Rosenberg Self Esteem Scale (SES) and the Self-Liking Self-Competency (SLSC) scales. Lalonde used Heart Math Heart Rate Variability as an objective measure for investigating the physiology of Heart Rate Coherence in response to treatment: "Through their research, they (the Institute of Heartmath) found that heart rate variability (HRV) and heart rhythms seemed to be the physiological measures that most reflected one's inner emotional state and stress. In addition, they found that negative emotions resulted in increased disorder in the rhythms of the heart and in the autonomic nervous system (ANS), while positive emotions increased coherence of heart rhythms and improved harmonization of the ANS." (Lalonde, p. 90, 2010) Although this test did not reveal significant changes it nonetheless reflects a valued perspective among Osteopaths that self-esteem and the heart are partners in the integration of wholeness.

3.5.1 The Endocranial Concept

Philippe Druelle DO began to develop the endocranial concept and methodology of treatment in the 1980s after he noticed various densities and inertias in the brain tissue surrounding the cerebral ventricles, which were the initial focus of his intention. He came to realize and then teach that the vascular tree and fascias have contractile

properties which when 'shortened' within and around brain tissue can be considered a spasm. Druelle noticed these qualities within the endocranium during his exploration of the ventricles, specifically the third ventricle. His work was further developed when he came to classify these densities according to their texture, resonance, expanded or imploded qualities, to name a few. He identified four basic styles of regional spasm in brain tissue two of which (traumatic and emotional) will be used in this research: traumatic, emotional, transgenerational and civilizational. (Forget, 2009a)

Philippe Druelle DO's endocranial concept treatment methods have created a vital bridge that enables us to begin to cross the gap that exists between our understanding of psychophysical trauma and our ability to treat it. Philippe Druelle's endocranial concept provides Osteopathic practitioners with gentle tools to facilitate the positive harmonics of the encephalon as a whole. Genevieve Forget DO wrote in her article, '*Endocranial Spasms*,' that brain tissue densities and textures that are not homogeneous (and should be) create relative regions of inertia. A balanced reciprocal network of neural connections that allow free resonance of consciousness is the goal of endocranial treatment. This requires a very specific work honoring Osteopathy's core treatment principles and especially honoring the true nature of the patient as they live within the readiness of their needs. These inertias, in the long run, affect the quality and free movement of energy within tissue, the liquid, and electromagnetic domains. (Forget, 2002)

The decision to use Global Osteopathic skills up to and including Endocranial emotional spasm treatment came upon the recommendation of Genevieve Forget DO. It was recommended that treatments be given with a goal to address the limbic system and the limbic cortex – the anterior cingulate cortex. Prior to addressing possible endocranial spasms the goal of all preparation work was to restore global encephalon motility by establishing its fulcrum at the thalamus. Restoration of global encephalon motility would improve the cognitive processing abilities of the association fibers leading to the anterior cingulate cortex.

Just as the sacrum between the ilia may be off its axis due to a fall or injury, the encephalon also has the potential to lose its pure axis of motion. Jean-Pierre Barral has written extensively about the presence of somatic trauma through the mechanics of physical force. (Barral, 1999) He describes the effects of force vectors generated by high velocity impacts as they pass through bone, viscera and liquid. Physical impacts have a distorting effect on structural position and motility, intra-cavity volumetric pressures and lines of gravity. Each tissue in the body has a different suspension system, density and set of relations to the whole physical structure. A traumatic force is

received in anatomically different structures by a series of different reactions creating a disorganized composite of multiple lesions. Genevieve Forget DO has suggested that the same force/density principles apply to the components of the encephalon. The cortex, brain stem, cerebellum, the limbic structures, and ventricles within all have different densities and each move at different velocities during a car accident, for example. This creates sheering and torsion patterns between different structures in the CNS that in health have an independent but synchronized motility. (Forget DO, 2009a)

3.6 Osteopathic Treatment Methods

The goals of this research would never have been able to be conceptualized if not for the universally applicable framework that Osteopathy provides. Andrew Taylor Still's osteopathic philosophy, created in 1874, is based on four basic principles:

1. The body is a functional unit.
2. The role of the artery is absolute
3. Structure and function are reciprocally interrelated.
4. The body has its own self-protecting system of auto-regulation

(Druelle,1992, Kuchera, 1991)

By knowing, practicing, and honoring these four basic Osteopathic principles the osteopath is allowed the privilege of participating with the living health within each patient: "Osteopathy is a natural medicine and science with precise palpatory acts." (Druelle, p. 1, 1992) These are used as principles to treat by, to create new understanding with, but also they are tenets to guide us in our relationship as co-practitioners with each patient's inherent mechanism, the 'Inner Physician.' The auto-regulatory system is utilized by the body to sustain a natural state of health. Trained thinking and feeling fingers participate with the auto-regulatory system to assist the structures of the body to right themselves and thus allow correct function. "The body, properly nourished, has a natural store of substances to fight disease, repair and maintain normal health. The osteopath's role is to restore mobility between systems such that the patients inherent ability to heal themselves is maximized." (Druelle, p. 5. 1992)

The structure and function of the cranial sphere was first revealed to the American Osteopathic Association in 1929 by its founder William Garner Sutherland. His discoveries were a natural and necessary extension of Doctor

Still's Osteopathic science and contributed vital changes to the way we assess and treat the mechanism as a whole. In his book *The Cranial Bowl* Sutherland writes, "Our subject concerns the primary respiratory mechanism wherein the diaphragmatic respiratory mechanism is secondary." (Sutherland, p. 2, 2000)

Primary Respiratory Mechanism involves the body as a unit of physiological function and expresses the following six phenomena (Magoun, p. 23, 1976):

1. The inherent motility of the brain and spinal cord.
2. The fluctuation of the cerebrospinal fluid.
3. The mobility of the intracranial and intra-spinal membranes.
4. The articular mobility of the cranial bones.
5. The involuntary mobility of the sacrum between the ilia.
6. The effect of all these phenomena throughout the entire body by way of all possible channels.

According to Viola Fryman DO Sutherland stated:

> "The brain involuntarily and rhythmically moves within the skull. This involuntary rhythmical movement involves dilation and contraction of the ventricles during respiratory periods. The ventricle dilation and contraction in turn effects cerebrospinal fluid circulatory activity and the circulatory activity effects movement of the arachnoid and dural membranes and through the special reciprocal tension membrane effects mobility of the basilar articulations."
>
> (Fryman, p. 121, 1998)

The above principles concern two basic realms, 'mobility between systems' and 'the liquid flow.' The PRM transmits itself by means of reciprocal tension throughout all connective tissues: bone, muscle, membrane, and fascia. It also transmits itself through liquid: blood, lymph, cerebral spinal fluid and extra-cellular fluid. The PRM can be likened to 'the unified field theory of Osteopathy' in that it is a palpable demonstration of the unity of this mobile mechanism. It may be felt anywhere in the body. Its regional presence tells us there is health in that region and that the potential for global integration is present.

What generates the motion of the PRM has yet to be agreed upon. However it is believed its over all transmission through the body begins with the flow of the CSF.

> "It should be emphasized that the significance of cerebrospinal fluid fluctuation upon metabolism is by no means limited to the brain. Because of the physical continuity with lymphatic circulation, tissue juices and the interchange in every cell, there can be much influence upon the biochemical and bioelectrical balance all over the body."
>
> (Magoun p. 36, 1976)

Furthermore Still also wrote, before Sutherland's discoveries, "The lymphatics are closely and universally connected with the spinal cord and all other nerves, long or short, universal or separate, and all drink from the waters of the brain." (Still, p. 105, 2004)

3.7 The Anatomy of the Endocranium

It is the belief of this researcher that respect for this most sensitive of terrains, the central nervous system, requires a 'traveling knowledge' of its contours, shape, volume, and rhythms along with its functional attributes.

3.7.1 Cerebral Spinal Fluid

Neurobiology in Still's early Osteopathy noted the importance of cerebral spinal fluid. When Still writes about cerebrospinal fluid he writes not about the fluid itself in its local functions but about its quality as a philosopher and seeker of truth. He attributes the core essence of the CSF with the quality of truth. Still writes that a wise seeker is able to recognize the half-truths from the whole. He continues, "We will take man when formed. When we use the word formed, we mean the whole building being complete. The brain with all organs, nerves, vessels, and every minutia in form with all materials found or used in life." (Still, p. 38, 2004) To live in the CSF is to live in the whole of one's truth and not the parts.

Doris Tanner D.O. a Canadian Osteopath who treated patients into her 90's wrote simply:

> "The CSF is everything." (Tanner DO, 1988)

Tanner DO also linked uniquely Osteopathic palpation skills to the presence of the CSF by saying,

> "CSF is present throughout the spinal cord and because every nerve in the body comes off the brain or the spinal cord CSF is in the covering of every nerve. That's why it can be felt in every place in the body and it can be activated by light pressure in any two points on the body." (Tanner, 1988)

Therefore the spaces and reservoirs where CSF is produces are vital to our palpation of it and to our ability to assist evolving personal truth.

3.7.2 The Ventricles

The ventricles are four interconnected reservoirs (two lateral and two midline) that filter blood to produce clear cerebral spinal fluid within the encephalon. In a sense they create an anatomical border between the old brain and the new in that the lateral ventricles outline the outer ring of the limbic system within and the internal capsule

leading to the neocortex beyond. The hydraulic forces within the lateral ventricles (inferior, posterior, and anterior / central horns) contribute to the spiral coiling motion of the neo-cortex.

The left and right lateral ventricles connect with the third ventricle through the foramina of Monro. The third ventricle is at the very centre of the brain within the diencephalon and between the two thalami. The anterior portion of the third ventricle is gently anchored by the pituitary within the sella turcica while the cerebral aqueduct at its posterior aspect connects it to the fourth ventricle. The cerebral aqueduct or aqueduct of Sylvius carries CSF through the dorsal aspect of the midbrain and arrives at the fourth ventricle which is dorsal to the pons and ventral to the cerebellum.

The hydraulic buoyancy of each ventricle is vital to the overall expression of health, as palpated through the Primary Respiratory Mechanism, of the encephalon. The inner hydraulics of the ventricles supplies the inherent active force needed to give the encephalon freedom of movement in all of its parts.

3.7.3 Cisterns

The CSF hydraulics surrounding the encephalon exist within the subarachnoid spaces: "Here, the sub-arachnoid spaces are enlarged, forming cavities where varying volumes of cerebrospinal fluid can accumulate." (Paoletti p. 109, 2002) There are several cisterns surrounding the brain that appear to be present at key junctions of mobility. The Chiasmatic and Interpeduncular cisterns (together called the 'Basal') are just anterior and posterior to the infundibulum of the pituitary respectively. The Cistern of the great cerebral vein is posterior to the 'neck' of the midbrain provide a pool of CSF for the pineal gland directly in front of the straight sinus. Cerebellomedullary cistern inferior to the cerebellum receives the CSF which exists in the median aperture. Dissociation of the two cortical hemispheres is enhanced by the CSF which flows between them and above the corpus callosum – the interhemispheric cistern and the cistern of lamina terminalis. (Theime, p. 194, 2007, Paoletti p. 109, 2002, Forget, 2009a)

3.7.4 Cerebral Spinal Fluid Functions

Robert Fulford outlines six functions of the presence of CSF within the ventricles. These functions are the foundation of CNS preparation for endocranial treatment. The mobility is enhanced by full deployment of the ventricular system but the motility of the parenchyma of the encephalon needs the fluid interchange that comes with

free flowing CSF. The subtle expansion and retraction of the encephalon as a whole expresses its health best within a volumetrically balanced hydraulic environment.

3.7.4.1 Fulford's Six CSF Functions

1. Maintenance of the shape of the brain.
2. Maintenance of the shape of the skull in childhood.
3. The brain floats in CSF of nearly equal density. The brain is thereby buffered against impact.
4. Hydraulic dampening of the arterial pulse through the brain. First venous blood and then CSF is displaced to make way for the swelling of the brain following systole.
5. It forms a transport medium, mediating between the blood and the brain.
6. In draining to the venous system, it fulfils the function of the lymph system elsewhere.

(Fulford, p. 61, 2003)

3.7.5 Endocranial Spasms

Symmetrical motion of the overall encephalon is a necessary pre-curser to treatment using Philippe Druelle's endocranial concept. Symmetrical motion allows palpation of homogeneity of brain tissue itself. Treating the lateral ventricles first also makes the presence non-homogeneous brain tissue more obvious. "Treating the lateral ventricles reveals areas of spasm, makes densities more visible. It is important to leave the patient on a calm reference point." (Forget, 2009b) Densities, or spasms, are non-homogeneous regions that are felt as small concentrated regions of brain tissue. Traumatic spasms exist from a past physical impact and may give the impression of being imploded or drawn in to a crystallization in the matter as if in the direction of the force that created it. Emotional spasms may feel like a small radiating region of agitation within a localized shell. This indicates tissue that contains an emotional charge. (Forget, 2010)

The goal in assessing brain tissue is to resolve restrictions and inertia in each structure layer by layer and lobe by lobe, in order to bring globality and integration to the CNS and its functions. In palpation you seek to feel an integrated healthy 'floating' volume that expresses the ease of spiral motion around a calm reference. (Forget, 2010)

3.7.6 Palpation of Neuroanatomy

"One of the fundamental keys to diagnosis and technique is the ability to get within the cranium mentally and visualize all the activities going on." (Sutherland, p. 143, 1998) The skill to 'see' and 'listen' with our hands has been given to this discipline by the legacy of those before us, passed on from teacher to student one Osteopath at a

time. Palpation is a skill learned through practice and direct experience in giving and receiving. In Osteopathy as the practitioner's hands gather and come to know a wider and wider spectrum of information 'palpation messages' combine to create a sensory picture of what is happing within the three dimensions below.

Haptic technology is the new science of touch simulation currently being used in the field of robotic surgery to re-create tactile experiences in remote and or virtual settings. Through force feedback they duplicate the experience of doing surgery with hand-held instruments. In an interview with Richard Syrett about this new science, when asked about simulating hand to skin contact Dr. Kchenbecker replies,

> It is very challenging to replicate direct touch, to reach out and touch your shoulder, because there are so many different sensations overlayed, there's the distribution of pressures, there's the temperature, there's the motion and frankly it's really challenging to create and engineer a system that can replicate that large a range of sensations (Syrett, 2011).

'Volumetric analysis' is a neuroscience diagnostic term that could equally describe a palpatory practice that is as old as Osteopathy itself. Within the last ten years, beginning with a landmark study by Eleanor Maguire et al on structural changes in the hippocampi of London taxi drivers, Medical Science has begun to use structural MRI scans called Voxel-based morphometry to study volumetric differences of shape and density within the brain (Maguire, 2006). These are new methods being used in the neurosciences that have greatly added to spectrum of their investigations.

The Neuosciences are increasingly attempting to mimic the unique information-gathering qualities of palpation. The gap that currently exists between neuroanatomy seen through functional imaging and neuroanatomy 'seen' through volumetric analysis is still present however for us as Osteopaths this gap is 'bridged' by palpation. Therefore at present, in terms of the Neurosciences palpation divides us. Nonetheless we are able to reap the benefits of these new frontiers in Neuroscience as they inform our minds and our hands.

Stereognosis is defined as the ability to discern shape through touch. However it is more: the imaging technologies lack the uniquely Osteopathic ability to discern movement in combination with volume, and resistance as given by density and texture. Volume and density are also discerned on scales from 'liquid to solid.' Volume involves the interplay of motion in order to feel the three-dimensional weight of an object. Weight describes not only the singular weight of an object but also relation to gravity within a co-dependent network of anatomical structures. While doing practical training at the CEO, Montreal students were very often instructed to 'feel the volume.' Through time, and practice and supervision the practitioner is able to extend this skill to the volume of the

brain within the bony cranium. While it isn't the intention of this research to justify osteopathic practices of palpation, describing the ability to do so is central to the treatment techniques need to address lesions of the central nervous system.

3.8 Treatment Approach Based on Anatomy Descriptions

This researcher will describe the encephalon content from the viewpoint of its treatment by way of stereognostic palpation. The following order represents the Methodological approach taken during Global Osteopathic and Endocranial assessment and treatment.

3.8.1 Global Osteopathic and Endocranial Treatment

The Central Nervous System assessment and treatment protocol for this research was established by Genevieve Forget D.O. based on the Endocranial concept developed by Philippe Druelle D.O.. (Appendix P) Endocranial principles of treatment are an extension of the same principles the College d'Etudes d'Osteopathique promotes for Global Osteopathic treatment. (Appendix L)

The treatment methodology for this research includes the assessment of three terrains of anatomy:

1. **Musculoskeletal and Central chain**: the cranium, vertebral column, sacrum, pelvis, and central suspension of organs from SBS to pelvic sphere. (container and contents)
2. **Membranous reciprocal tension system**: spinal dura surrounds the CNS, most cephalic attachment at the crista gali, most caudal attachment at the coccyx
3. **CNS/Endocranium**

3.8.2 First Terrain- Musculoskeltal and Central Chain

The Musculoskeletal methods of treatment will not be described in this research. All patients were treated following the osteo-articular and musculoskeletal Methodologies of the CEO. In this paradigm health is first defined as mobility with the presence of vitality. Lesions types are listed from most restricted to least restricted. Treatment methodology begins through the mobilization of lesions along the cranial sacral axis that are the least palpably vital and most immobile. In all cases the vitality of the Primary Respiratory Mechanism that requires the movement of the sacrum between the ilia and the articular mobility of the cranial bones must be clearly established. (Magoun p. 23, 1976)

Global Osteopathic Methodological Order of Treatment – Lesion Priority:

- Systemic Vitality
- Compactions, Intra Osseous lesions: There is no motion with no vitality expression
- Scars and adhesions sufficiently present to prevent proper axis use
- Non physiological without respect to axis: force vectors and sheers of structures
- Non-physiological with respect to axis: paradoxes or atypical expressions but still respecting some axis.
- Physiological lesions: anatomy gets blocked in one of the movements it's normally allowed to have.
- Restrictions: reduced amplitude of motion without blockage

(College d'Etudes Osteopathiques de Montreal, Lesion Priority originated by Philippe Druelle DO, received - Autoregulation, Forget, 2009b)

3.8.3 Central Chain by Philippe Druelle D.O.

The Central chain consists of a series of suspended fulcrums within the core of body cavity of a subject, that when she is standing in gravity, have free motion. The components that make up the central chain have a role in reciprocally harmonizing and balancing the regional sphere they reside in, for example the heart within the thoracic cavity. An aspect of the central chain comes into resonance, meaning its best functioning within the three aspects of its existence, when its biomechanic, biodynamic and bioenergetics realities are volumetrically balanced on their own central fulcrum. Each anatomical aspect of the central chain also shares a role in the resonate health of other 'partnered' elements within the central chain. The heart, the third ventricle and the mesentery is one 'sub-functional' unit. The thyroid, and pancreas is another: "An arborisation of fascias distributes the load of its central chain element, upon its fulcrum, within a fascial network." (Forget, 2009b)

Central Chain Concept developed by Philippe Druelle DO (Appendix M):

- Vertex
- Third Ventricle (thalamus)
- Sphenobasilar Symphysis (pituitary)
- Parango-basilar fascia (attachments of the tongue)
- Middle Cervical fascia (thyroid, oesophagus, trachea)
- Pericardium – Heart

- Phrenic Centre – Thoracic diaphragm (anterior leaf)
- Crossing formed by Falx of the Liver, Lesser curvature of the Stomach and Head of the Pancreas
- Root of the Mesentery
- Isthmus of Uterus (female) or Denonvillier's Fascia (men)
- Central Tendon of the Perineum

(Forget, 2009b)

3.8.4 Second Terrain – Membranous

The membranous reciprocal tension system refers to the mechanical function of the meninges surrounding the brain and spinal cord. The dura is the outermost meninges. It encloses the hydraulic environment of the CNS and assists in the pumping of cerebral spinal fluid (CSF), arterial and venous blood. This membranous dural bag has a motion that is centred around Sutherland's fulcrum – the straight sinus. (Magoun, 1976) The aligned free motion of Sutherland's fulcrum is one of the primary criteria for justifying treatment the encephalon. (Appendix O) Sutherland wrote:

> "A fulcrum is a still mechanism over which a lever moves and from which it gets its power. In the use of a fulcrum, it may be changed to various areas beneath the lever, but it remains a still balance mechanism over which the lever operates and secures its potency. It is not the visualization of a point relative to one falx or another but the balance point where the three sickles adjoin."
>
> (Sutherland, p. 238, 1998)

Sutherland observed that the suspension of the fascias within gravity directly implicated the straight sinus. He experimented in his sensing of the confluence of sinus by standing on his head to feel different aspects of its suspension: "Such (fascial) dragging would likewise effect compensation or complication to the reciprocal tension membrane and a shifting of the fulcrum." (Sutherland, p. 280, 1998) Therefore the success of global osteopathic alignment of the patient, along with other visual and palpatory assessment tools, can be determined by the drag upon the membranous container of the CNS as felt at Sutherland's fulcrum.

3.8.5 Core Link

Core Link was used to assess and establish the free and gliding motion of the dural tube around the spinal cord and encephalon: "All parts operate as a unit of reciprocating function, including the spinal reciprocal tension membrane. This is sometimes referred to as the "core link" connecting the articular mechanism of the cranium with the sacrum to coordinate action." (Magoun p. 38) Fixed attachment points within the cranium along the falx cerebri

and tentorium cerebelli, around the ring of the foramen magnum, and the first and second cervical vertebrae have a relationship of reciprocal tension with the dural attachments at the sacrum which are strongest at the fifth lumbar / sacral junction. (Sutherland, p. 225, 1998) The goal of core link treatment technique is to establish a functional well-irrigated container for the brain and spinal cord that does not impinge on the free motion of the CNS. In reference to the reciprocal tension membrane system Sutherland wrote, "Disturbance to this physiological functioning signifies disturbance likewise to the normal fluctuation of the cerebrospinal fluid within which we find that "highest know element in the body."" (Sutherland, p. 225, 1998)

Philippe Druelle's use of the core link in preparation for endocranial treatment calls upon the practitioner to palpate and treat each layer of the meninges as well as the spinal cord itself. This is where the treatment of endocranial content begins. The layers to be released in order to achieve 'core link' are as follows: Muscle – bone – dura mater – arachnoid – pia mater – spinal cord – ependymal canal (Forget, 2009a)

Completion of treatment is achieved when there is global CSF flow around the spinal cord and within the ependymal canal: "While you are working with the spinal cord tissue you are also affecting the whole vascular tree. The vascular tree tonus is connected to nerve facilitation states." (Forget 2009a)

3.9 Third Terrain – Encephalon

3.9.1 Structural Neuroanatomy

In following the path of palpation to 'view' the central nervous system volumetric perception is fundamental to this work. Three global volumes make up the central nervous system: the cortex, the cerebellum, and the brain stem in continuation with the spinal cord. The cerebellum within the posterior fossa is a common site of tension. It acts as a point of balance between the encephalon and the spinal cord. (Forget, 2009a) After restrictions between the spinal cord and its container have been removed and the core link has freed the volume of the CNS as a whole within the dura mater's reciprocal tension system, the unique and separate elements of the encephalon may be perceived.

Paul Lee in his book *Interface: Mechanisms of Spirit in Osteopathy* writes,

> Radiographic studies have recently shown that the brain has dynamo-like activity. These investigators were not looking for motions in the brain that are slower than vascular pulsations, but their results nevertheless confirm that the diencephalons, brain stem and cerebellum, as Still declared one hundred years earlier, pump up and down, driving brain motion and CSF fluctuations." (Lee, p. 148, 2005)

Knowledge of the inherent motion of each aspect of the CNS allows the Osteopath to assess the presence or absence of the primary respiratory mechanism of the encephalon. In terms of volumetric density and form the structural anatomy of the CNS lends itself to three distinct layers of palpation or stereognostic 'outline analysis,' to borrow a term from the science of morphometrics. These three distinct layers are the cortex, the limbic system and the archaic structures.

3.9.2 Layer 1 – The Cerebral Hemispheres

Our palpation first meets the cerebral hemispheres at their cortical layer. The grey matter of the cerebral cortex is densely layered with several varieties of neurons aligned horizontally: "Cortical areas that are concerned primarily with information processing (e.g., primary somatosensory cortex) are rich in granule cells: the granular layers of these regions are also exceptionally thick." (Lawrence, p. 200, 2007)

This is the layer of the encephalon in which many nerve fibres end, such as the afferents of the somatosensory cortex and where many originate such as the efferents of the motor cortex just anterior to the central sulcus. It is a highly active surface that facilitates our capacity to feel, see, hear, taste, and interpret the world around us. While training in the endocranial concept class assistant David Bergstein D.O., author of *"Osteopathic Treatment of the Encephalon: A quantitative EEG study,"* he aptly framed one's approach to endocranial palpation by saying, "Before you place your hands on a patient be very aware that this is highly conscious material." (Personal communication, David Bergstein, 2009)

The cerebral cortex's primary respiratory mechanism (PRM) motion, in Inspiration does the following: "the cerebral hemispheres move relatively upward, shorten in their anteroposterior diameter and unfold laterally." (Magoun p. 35, 1976) The PRM is originally an embryological movement that expresses the inherent life and function of the brain, one portion of the central nervous system. Erich Blechschmidt, German embryologist who wrote *The Ontogenetic Basis of Human Anatomy* links the growing embryo's energetic search for nutrition as the primary motivating force which drives the creation and growth forces of our human form. Movement begins as a 'reaching out' for enrichment: "As the cerebral cortex is richly supplied by pial blood vessels, it follows that its surface growth will be very intense." (Blechschmidt p. 94, 2004) The momentum of these natural growth forces continues its presence throughout our lives not only in the continued expression of the primary respiratory motion. Children naturally reach out to fulfil their senses and to feed their rapidly growing ectoderm in health and curiosity.

3.9.3 Lobes, Fissures and Arteries

The global encephalon is comprised of eight lobes each having their own motion.

The movement of the entire encephalon relies on the mobility of its parts. The fluid motion of the CSF within the ventricles also helps to drive the motility of the encephalon from within. The fully expressed movement of each delineated structure is necessary for full arterial irrigation and venous return.

The environment of the cranial cavity is one in which the mobility and alignment of its different densities and structures affect its overall homeostasis. The hydraulic balance of arterial inflow, venous outflow and CSF production and circulation also intimately influence one another: "Oxygenation of neurons in the brain depends on cerebral perfusion pressure (difference of arterial and intracranial pressure)." (Barral, Croibier, p. 107, 1997)

After postural anchors and lesions which distort the lines of gravity have been corrected through global Osteopathic treatment of the body container and its contents the cranial cavity becomes more accessible. Compactions, sheers and torsion of the bones of the cranium are mobilized to allow the primary respiratory mechanism to express. When the PRM and vitality of the cranial sphere is there to support the health of the individual's biodynamic process the preparation work for treatment using the endocranial concept may begin. After having palpated global encephalon motion our palpation may discern the movement and lack of movement, volume and texture of isolated regions in individual lobes. There are five lobes in each hemisphere: occipital, temporal, frontal, parietal and insula.

3.9.4 Fissures

There are three main fissures in the cerebral cortex: the longitudinal fissure, the lateral fissure (Sylvian fissure) and the central sulcus (fissure of Rolando). The arterial pathways and venous sinus system surround the cortex and invaginate the cortical gyri and as well as each fissure. The middle cerebral artery (MCA) invaginates the lateral fissure (Sylvian), which separates the temporal lobe inferiorly from the parietal above.

The MCA supplies oxygen and nutrients to the lateral surface of the frontal, temporal and parietal lobes. It also feeds most of the internal capsule, Broca's area, Wernicke's area and the Sensorimotor cortex. The artery of the central sulcus is a branch of the MCA. It arises from the lateral fissure and sits within the length of the central sulcus.

The dissociative movement of the Lateral fissure and the volumetric presence of CSF in the lateral ventricles housed within the temporal lobes are essential for healthy cerebral perfusion. The interhemispheric

commissural fibres of the corpus callosum lay at the base of the great longitudinal fissure. The sagital sinus and falx cerebeli are suspended within this fissure. The two hemispheres of the cortex spiral out from this central cavity leaving space during inspiraton for the pumping of the sagital sinus. The anterior cerebral artery enters the medial surfaces of the right and left hemispheres and curls around the genu of the corpus callosum. The ACA provides nutrition for the frontal pole, medial face of the frontal and parietal lobes. It also enters the central sulcus at its medial fold and supplies part of the sensorimotor cortex. The cingulated gyrus which is the functional target site for this thesis's cognitive Stroop test is also supplied by the anterior cerebral artery.

The posterior cerebral artery supplies the base of the temporal lobes, the posterior medial aspect and poles of the occipital and thus the visual cortex. After it leaves the Circle of Willis it passes around the pons and supplies the optic chiasm, third ventricle, thalamus, and pineal gland. (Lawrence, p. 250, 2007)

The total volume of fluids within the cranium along with the parenchyma they surround and supply are an interdependent 'ecosystem' not unaffected by the body as a whole. Yuri E. Moskalenko a Russian scientist has worked with Osteopaths Viola Fryman and Philippe Druelle among others for many years to examine the cranial mechanism described by W.G. Sutherland. Moskalenko writes:

> The biophysical structure of the cerebrovascular system includes several groups of parameters. The main is complex parameters: cerebral blood flow, cerebrovascular resistance, brain blood volume and intracranial pressure which characterizes this system as a functional unit. The first two parameters belong mainly to the cerebrovascular system and the last to – to the CSF system." (Moskalenko, 2003)

3.9.5 Layer 2 – The Limbic System

Palpating through the structures of the neocortex leads us to the allocortex or limbic system, which means "forming a border around. (The brain stem)" (Black, p. 131, 1970) This is sometimes also called the mammalian layer of the brain. It is the seat of emotion and the standard bearer of our survival. Antonio Domasio says the emotion of the limbic system is programmed for action and is rooted in millennia old pre-packaged systems of survival-based non-conscious behaviour. This is action that occurs without having 'to think'. (Domasio, 2011) He distinguishes emotion from feeling in that feeling is emotion made conscious and is an expression of mind rather than gut instinct.

It can be said that the presence of the limbic system enabled the evolutionary growth of the neocortex and thus the development of conscious feeling. The limbic system is a quick decision maker that safeguarded our

survival. Its emotionality was there to discern safety from threat in any given moment and to create a way in the world which was free to choose homeostasis and, potentially, peace. (Domasio, 2011)

Evolution designed us such that an exploration of the limbic system may begin through 'the nose': "The olfactory nerves are the only cranial nerves to enter the cerebrum directly." (Moore, p. 1130, 2006) Olfactory information does not pass through the thalamus as translator. Olfaction travels immediately through the fast moving highways of the limbic system to the amygdala. This is where the sense of smell takes on its emotional quality. The amygdala receives this sensory information and uses it to interpret safety and social interaction. (Clark, p.216, 2010) It is here that according to Clark, Boutros and Mendez sensory information (auditory and olfactory) informs two functional divisions. An older division exists in the amygdala as it relates to the prefrontal cortex and a newer division exists in the hippocampus as it relates to the cingulate cortex. "The older division functions in the integration of affect, drive, and object association, while the newer division functions in explicit sensory processing encoding and attentional control." (Clark, p. 219, 2010) Functionally the amygdala and hippocampus are closely linked. As a result their relationship is one of the direct links that exists between attentional tasks and trauma experiences that affect the limbic system, amygdala, and prefrontal cortex.

Our first palpable limbic structure from this entry point is the hippocampal formation. The hippocampal formation makes up the floor and the medial lateral wall of the inferior temporal horn of the lateral ventricles. "The hippocampus is formed by an infolding of the inferio-medial part of the temporal lobe into the lateral ventricle, along the line of the choroid fissure." (Crossman, p. 172, 2000)

The hippocampus then follows of the shape of the rams horn of the lateral ventricle, and curls upward within the ring of its 'embrace.' Left and right hippocampal fibres, called the fimbria, become the crus of the fornix. They join under the corpus callosum to form the body of the fornix. As the fornix curls under the genu of the corpus callosum it splits and diverges left and right becoming the columns of the fornix. Both columns join the mammillary bodies of the hypothalamus. Some fibres ascend, pass through to the anterior nucleus of the thalamus and from there communicate with the cingulate gyrus.

The Mammillary bodies 'hug' the third ventricle from either side. The columns of the fornix "curve downwards, forming the anterior border of the interventricular foramen (foramen of Monro) and enter the hypothalamus where the majority of fibres terminate in the mammillary body." (Crossman, p. 174, 2000)

If palpating the limbic system from the cranial vertex caudad our first contact would be at the corpus callosum. The corpus callosum is a transverse axis of fibres however travelling longitudinally along its surface are lateral and medial stria belonging to the limbic system. These stria connect the amygdala with the nuclei of the septum pellucida. The septum pellucida is the thin sheet that separates the anterior horn of the lateral ventricles. "Two major routes exit the lateral amygdala. The stria terminalis projections to the septal nuclei and hypothalamus." (Clark, p. 180, 2010)

Globally the limbic system feels like a fine ring spiralling under our hands within the curve of the lateral ventricles.

> The goal of treating the lateral ventricles is to further establish the proper structure / architecture of the brain. They have an indirect effect on the limbic system structures and third ventricles. We treat the ventricles to get a washing / flush effect. They are like waterbeds that give shape and volume to the brain." (Forget, 2009a)

3.9.6 Basil Ganglia – Allocortex

The basil ganglia are also present to stereognostic touch. They are a group of cerebral nuclei, which are shaped like an angled disc with an incomplete set of spokes surrounding the central nuclei called the putamen. The basal ganglia are sitting within the inner convexity of the lateral ventricles. This grouping of nuclei angle out laterally as their bottom edge rests on the superior surface of the inferior horn of the lateral ventricle in the temporal lobe. "In a general sense the dorsal division is concerned with motor function whereas the ventral division functions in support of behaviour in the emotional realm." (Clark, p. 122, 2010)

3.9.7 Cingulate Gyrus

The cingulate gyrus is part of the allocortex. Maclean refers to the cingulate gyrus as the upper portion of the "ring of the limbic cortex. It is also collectively described as the Papez circuit (Crossman, p. 174, 2000). Although, the functional neurological test for this thesis, the Stroop test, is known to stimulate an MRI response in the ventral portions of the cingulated cortex, it is interesting to question to possible role that treatment of the lateral ventricles, limbic system and basil ganglia might have on cognitive activation testing. The Stroop test is reaction time based and relies quick motor responses after reading information on a screen.

> Increased understanding of structures such as the basal ganglia that influence those few milliseconds is helping unravel some of the mysteries of human behaviour. It is interesting that the main input to the basal ganglia comes from the cerebral cortex and that its output returns to the frontal cortex (motor, pre-motor, and prefrontal cortex). (Clark, p. 122, 2010)

3.9.8 Layer 3 – The Archaic

Just as the olfactory nerve leads us to the limbic system, the optic nerve, leads us to the diencephalon. The eyes are an extension of the archaic brain. The optic nerve decussates at the optic chiasm, travels under the base of the neocortex and continues around both sides of the 'bulb' of the diencephalon, it wraps left and right under the thalami and terminates in the lateral geniculate body after which filtered messages are sent to the visual cortex. "The diencephalon comprises, from dorsal to ventral: the epithalamus, thalamus, subthalamus and hypothalamus." (Crossman, p. 125, 2000)

The diencephalon is the brain's great translator of sensory and motor experience. It filters perceptual reality to give us only the essential information necessary to finding our way through the world. The hypothalamus sits within the ventral portion of the diencephalon. It mediates the CNS with the endocrine system through its connection with the pituitary. "The hypothalamus forms the floor and part of the sides of the third ventricle which dilates, it is believed, during inspiration." (Fulford, 2003) The thalami lay on either side of the third ventricle and comprise four/fifths of the diencephalon. (Lawrence, p. 210, 2007)

In palpation if the cortex is likened to a mushroom cap the diencephalon is the bulb at the top of the stem. Just below this bulb is the brain stem made up of the midbrain, pons and medulla. In palplating caudally from the cranial vertex the diencephalon is below the neocortex, under the corpus callosum, next under the fornix of the limbic system. It is at the heart of the ring-like structures of the limbic and lateral ventriclular systems.

3.9.9 Brain Stem

As we descend from the diencephalon into the brainstem we are following a longitudinal axis that in health pistons up and down in its PRM motion. The brainstem is made up of the midbrain, pons, and medulla. The midbrain, just under the diencephalon connects the subcortical brain stem to the cerebral cortex. The crus cerebri of the midbrain is the root of a bundle of long ascending and descending projection fibre tracts that fan out to form the internal capsule and corona radiata.

The cerebral aqueduct travels from the third ventricle through the midbrain to the pons where the floor of the fourth ventricle exists. (Lawrence, p. 299, 2007) The cerebellum is attached to the dorsal pons through the

cerebellar peduncles. Below the pons lies the medulla. "The brain stem rests upon the clivus, the medulla passing through the foramen magnum to become continuous with the spinal cord." (Lawrence, p. 239, 2007)

The three parts of the brain stem contain an abundance of cranial nuclei and it is here cranial nerves are attached except for the olfactory nerve. This is the very centre of internal homeostasis. It is the core aspect within us that motivates our actions for survival – to fulfil hunger, to stay warm, to stimulate our breathing, circulate our blood and protect ourselves when needed.

Understanding that trauma effects core regulatory functions is an important consideration in palpating anatomy.

> The circuitry of the brainstem and hypothalamus is most innate and stable, while the limbic system contains both innate circuitry and circuitry modifiable by experience, while the neocortex is most affected by environmental input (Damasio, 1995). It therefore would be expected that trauma would most profoundly affect neocortical functions, and have least effect on structures related to basic regulatory functions. However, while this seems to be true for the ordinary stress response, trauma (stress that overwhelms the organism) seems to affect core self-regulatory functions. (Panksepp, p. 340, 2004)

This region, the brain stem, shares one continuous longitudinal axis with spinal cord downward, and with the thalamus, through to the internal capsule upwards. This longitudinal axis within the CNS glides parallel to the Central Chain. (Forget, 2010)

3.9.10 Thalamus

When the peduncles of the midbrain rise to the cortex as the internal capsule, before it fans out it passes the thalamus. "The thalamus is bounded anteriorly by the head of the caudate nucleus and the genu of the internal capsule and posteriorly by the midbrain." (Clark, Boutros, p. 156, 2010) The thalamus and its radiating thalamic nuclei 'bridge' the deep brain with the cortex. This is the centre around which the spiralling motion of the hemispheres turns. In palpation we discover this archaic region via the crossroads of the cardinal axis that 'transect' the thalamus. (Forget, 2010)

> Regarding treatment of the encephalon Bergstein wrote, "Re-centring serves the structure/function relationship of the thalamus to the larger encephalon. The thalamus serves as a central relay station for all cerebral afferent and efferent signals. Given this centrally organizing function of the thalamus, it seems only natural that the thalamus is also found to be the central motion fulcrum for the encephalon itself." (Bergtein, 2009)

3.10 Justification of Cognitive Activation Test

In order to measure the effect of global osteopathic and endocranial treatment and its potential ability to treat the symptoms and global influences of trauma it is important to have a means of measuring the function of the neuroanatomy of the limbic system and its associated structures (thalamus, Anterior Cingulate Cortex (ACC), amygdala, hippocampal formation, limbic system). Two common tools of observation are neuroimaging (MRI, EEG) and cognitive activation tests such as the Stroop Interference. EEG is a direct means of looking at the endocranium. Cognitive activation tests are an indirect way of gaining insight into changes in neural function.

After completing their research entitled, *Influence du traitement Osteopathique sur le trouble de stress post-traumatique chez l'adulte*, and using questionnaires to gather objective measures Caroline Desilets and Katia Isaac-Villette found no significant difference between their experimental treatment group and placebo treatment group. In fact both groups demonstrated significant improvement. Desilets and Isaac-Villette made this recommendation for further research,

> The protocol should include instruments of measure used in the medical field e.g. EEGs, brain imaging pre- and post-treatment, that would allow to better objectify and visualize changes brought about by the osteopathic intervention at the level of the encephalon. (Desilets, Isaac-Vilette, p. XXVII, 2007)

In an effort to find a feasible way to collect neurocognitive data that would specifically target the limbic response circuit directly involved in PTSD this researcher was directed to the Stroop test and the fMRI work of Shin, Bush and Whalen. In Isaac-Villete and Desilets work they reported finding a higher number of endocranial lesions in the limbic system than in any other region. (personal communication, Isaac-Vilette DO, Oct. 24, 2009)

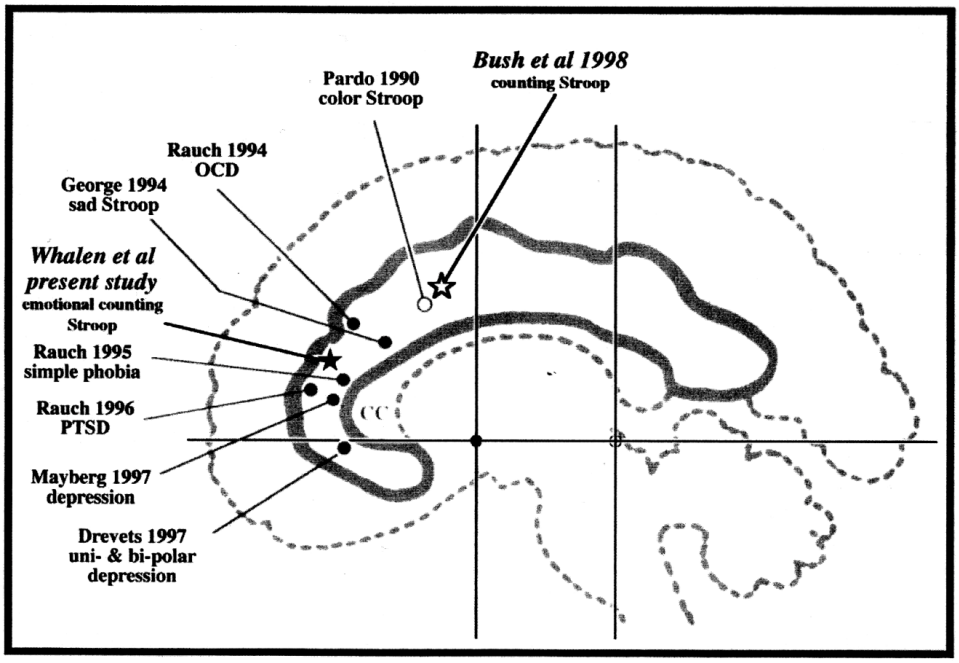
3.10.1 Stroop Test and the Anterior Cingulate Cortex

The work of Dr. Shin, and her colleagues Whalen and Bush have, over the last 15 years, been referenced my many in their field. They have rigorously examined their research findings by critically comparing them with the findings of their colleagues. Shin, Bush and Whalen are highly referenced for the work they've contributed to perspectives on PTSD and its neural correlates.

The Stroop test has often been used in conjunction with functional magnetic resonance imaging (fMRI). Dr. Lisa M. Shin, a neuroscientist at Tufts University, she and her colleagues have used fMRI to validate the Stroop test as an effective tool for investigating the responsiveness of the centers of the limbic system affected by posttraumatic

stress. (Shin, 2007) Shin and her colleagues were able to demonstrate consistent BOLD (blood oxygenation level – dependent) activation of the dorsal ACC (dACC) when administering the Counting Stroop test, and the rostral ACC (rACC) when administering the Emotional Stroop. The image below showing the anterior cingulate cortex illustrates the emotional Stroop activation site in the place marked 'Whalen et al present study emotional counting Stroop.' The counting Stroop is marked by the label 'Bush et al 1998 counting Stroop.'

Figure 1 Anterior cingulated cortex and Stroop test activation



(Whalen, 2006)

Shin, Bush and Whalen have made extensive use of cognitive activation tests to study neurobiological function of the ACC and associated regions. Whalen writes, "Our aim was to develop a probe of anterior cingulate function for future study of this region in anxiety disorders." Shin writes, fMRI anterior cingulate cortex (ACC) "findings (in PTSD patients) will help to better characterize functional brain abnormalities in this disorder." (Whalen 1998, Shin 2007) In the discussion portion of Shin's research titled, *Dorsal Anterior Cingulate Function in Posttraumatic Stress Disorder,* she recommends further study by writing, "ACC function could be measured before and after treatment to determine whether functional abnormalities normalize following successful treatment." (Shin 2007)

The above stated goals resonated with the intentions of this Osteopathic research, which sought to explore how endocranial treatment can be useful to patients with a history of trauma. This research was designed in the

hope of further exploring the results of the Shin, Bush, Whalen research as it relates to and informs Osteopathic perspectives and treatment.

3.10.2 Stroop Test and Motor Response

In her treatise, 'Consciousness' Louisa Burns DO recognized the value of using a battery of cognitive tests to gain insight into brain treatment when she wrote the following: "Tests of the reaction times, of the effects produced upon the blood pressure and pulse rate, the colour of the face and the dilation of the pupils by carefully chosen statements and questions, all these are of value in recognizing the nature of the disturbance." (Burns, p. 4, 2005)

According to Kawashima et al they found that activation of Anterior Cingulate cognitive division (ACcd) occurred when using finger movements paired with a visual stimulus in a 'GO / NO GO' cognitive activation task. This confirmed "the extensive reciprocal connections the ACcd maintains with both prefrontal cortex and lower motor areas in humans and other primates." (Bush, p. 179 1998)

The Stroop test using motor response fulfils a dual purpose by soliciting the lower motor neurons of the brainstem and upper motor neurons in the neo cortex in order to attend to the task and follow instructions. "Stroop tasks required the subject to utilize a top-down generated processing strategy by modifying behaviour based on instructions." (Bush, p. 179,1998) One caveat to using motor response reaction times is that Stroop test imaging results using a motor response versus a verbal response have less target site consistency. "Neuro-imaging studies using cognitive/motor tasks (i.e., those emphasizing attentional allocation / response selection) do show some variability but rather consistently activate the ACcd." (Bush, p. 277, 1998) Another contributing factor to the 'Stroop Effect' is the ACC acts as a stress filter that allows the brain to focus on survival in the present moment or merely gives it the ability to deal with a stressful task. Traumatized individuals are no longer able to engage the ACC as an effective filter and thus have longer Stroop test reaction times when faced with emotionally challenging stimuli. (Allman, John, p. 113, no year)

Chapter 4: RESEARCH METHODOLOGY

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4.1 Research Type

This research is a quantitative chronological study. It consisted of one treatment group that acted as its own control group and who were tested in four objective trials. Two trials prior to treatment were the control measures. Two trials after the treatment phase provided the outcome measures. The effect of Global Osteopathic treatment in combination with Endocranial treatment was the focus of this research design.

Table 6: Research design

Preliminary Research Phase

1. Recruitment	**2. Screening** Exposure to war and Inclusion Exclusion criteria	**3. Scheduling** 4 trials 6 treatments

Research Phase

Time Line	Procedure	
Week 1 – Trial 1	Intake, History taking Control Testing: WHOQOL-bref, 3 Part Stroop Test	Control
3 week pause		
Week 4 – Trial 2	Control Testing: WHOQOL-bref, SF-36, 3 Part Stroop Test	Control
Treatment Phase A (one week apart)	3 treatments: Structural Functional Musculoskeletal, Core Link etc.	3 weeks
Treatment Phase B (two weeks apart)	3 treatments: CNS Treatment, Spasm Treatment	6 weeks
Week 14 – Trial 3	Outcome Testing: WHOQOL-bref, 3 Part Stroop Test	Outcome
3 week pause		
Week 17 – Trial 4	Outcome Testing: WHOQOL-bref, SF-36, 3 Part Stroop Test Closure	Outcome
End of Official Experimentation		
Treatment notes reviewed for Global Osteopathic and Endocranial sub-group inclusion criteria	2 sub-groups identified: Global Osteopathic and Endocranial group, Global Osteopathic group	Analysis

4.2 Recruitment Strategy

Five months prior to the start of research an information meeting was conducted by this researcher, in Velika Gorica, Croatia just south of the countries' largest city, Zagreb. The intentions of this research were discussed with a group of Osteopathy students from The Akademija Osteopatije, Velika Gorica who had offered to recruit subjects. In this information meeting we discussed the fact that we were looking for adult children of war who were 3 to 14 years old between 1991 and 1994, and answered questions about who would fit that profile. At that time recruitment notices were provided for distribution. (Appendix D) Social media, e-mail mail-outs, and word of mouth contact were the primary methods used for gathering subjects. Recruitment was co-ordinated by the thesis assistant and independent assessor who through telephone contact screened subjects who met The War Exposure, and Inclusion / Exclusion criteria. (Appendix E) A total of twenty-seven subjects met our criteria.

4.3 Experimental Procedures

The following are the procedures and plans used for communicating with subjects, providing them with a schedule and informing them in general about the research commitment the had chosen to participate in.

4.3.1 Scheduling and Communication

Prior to trial testing and treatment, on a one to one basis, the independent assessor set the subjects schedule for the entire seventeen-week commitment. Subjects were booked on the same day for each visit to maintain consistency. They were encouraged to follow that schedule for the length of the research however re-scheduling was done when needed. Subjects had the independent assessors contact number and e-mail as well as this researchers cell phone number and e-mail. Due to possible language barriers we felt that keeping open lines of communication was important. During the treatment phase subjects were encouraged to call the independent assessor to clarify questions or concerns they may have or to give information about conditions they want to explain but don't have the English vocabulary for. We also let subject know that they were not required to share the story of their trauma exposure however they were also free to communicate whatever they wished to at any point in time. Providing information to subjects about the communication plan was an important first step in establishing trust. The second element in creating trust was being consistent in our action plan and schedule for the Objective testing and Treatment Phase.

4.3.2 Objective Testing Procedure

Control Trials 1 and 2

Testing was conducted by the independent assessor, Zvonka Tomasović. All testing and treatment happened the independent assessors' centrally located Osteopathic office in Zagreb. Subjects were scheduled by appointment spaced an hour and a half apart. When subjects arrived in the waiting room for the **First Trial testing (pre-treatment control, Week 1)** they were given personal history and consent forms to signed and submit. Objective testing was conducted in a private office. They were first given the WHOQOL-bref to fill out. When that was completed they were given instructions about how to do the Three Part Stroop test. Subjects were seated in front of the computer in a chair with leg space. They told how to place their fingers on the button press response box. There were asked not to blur their vision while performing the test but simply to read the word on the screen, count the number of words and press the correct button representing one, two, three or four. They were also instructed to respond quickly but not to sacrifice accuracy for speed. At the first trial there were given a short practice run to make sure they understood the procedure. The Stroop test lasted eight minutes. The independent assessor remained in the room. It was agreed she would stay out of their line of vision and attend to a book so as not to distract them. (Stroop test instructions and procedures: Appendix I, J)

The Second Trial testing (pre-treatment control, Week 2) occurred three weeks after the first trial in the 'fourth week' of the research schedule. The same procedures were followed. Subjects arrived in the waiting room and were taken to the same private office to do the objective testing. On this occasion participants completed the WHOQOL-bref and the SF-36 Health Survey. They were given a review of the Stroop test procedure and then performed the same Three Part Stroop Test they had completed three weeks earlier. Each subject was reminded of their treatment appointment which would begin the following week. They were also reminded of the communication plan and encouraged to call the independent assessor translations, or clarification at any time.

The Treatment Phase Procedures

Subjects were treated in the same private office they'd done the objective testing in. Their appointments were one hour each scheduled in the late afternoon and evening in order to fit with their work and school schedules as well as with the independent assessors' own office use. There was no receptionist. Subjects had a waiting room to sit in. Each subject was informed in advance that they would be greeted by the independent researcher. Each treatment began with a health interview, history taking and then postural and global mobility testing. Treatment occurred over nine weeks.

Subjects were treated once a week for the first three weeks during **Treatment Phase A**. Treatment phase A had the goal of normalizing physiological and non-physiological without respect to axis lesions, establishing vitality, PRM, central chain alignment, preparing the CNS for treatment through core link, dural movement around Sutherland fulcrum, Encephalon preparation. (Appendix: L, M, O, P)

After treatment phase A subjects had one week with no treatment. In the fifth week of the treatment phase, **Treatment Phase B** began. Treatments occurred every other week until completion of three treatments. Phase B had the goal of gaining encephalon motion around a resultant axis centred on the thalamus, establishing coherence in the central chain and with the third ventricle, heart and mesentery. These were the integration goals that preceded and followed mobilization of the encephalon and treatment of traumatic and emotional endocranial spasms. (Appendix P)

The last week of treatment was this researcher's last week of contact with the research subjects.

Outcome Trials 3 and 4

In the week directly after their last treatment their **Third testing (post-treatment outcome, Week 14)** was conducted. The independent assessor met them at their prescheduled appointment and in the same office they'd been attending for each research meeting they received the WHOQOL-bref to fill out. They then performed Three Part Stroop test in manner that it was administered in their second and third trials.

Subjects had a three-week break and arrived for their pre-scheduled **Fourth testing (post-treatment outcome, Week 17)** administered by the research assistant. The WHOQOL-bref and the SF-36 were administered and the Three Part Stroop test was conducted one last time.

The hard copy data set for the first to third Trials which included all SF-36 and WHOQOL written tests, all treatment notes and intake forms, was transported back to Canada by the primary researcher. Hard copy survey results for the fourth Trial were transposed onto spreadsheets and e-mailed to the primary researcher. The research assistant agreed to keep the hard copy versions for third Trial testing until completion of this research.

Endocranial and Global Inclusion Criteria

After completion of the entire research subject treatment notes were examined. Fourteen subjects were identified as meeting the inclusion criteria which addressed the hypothesis (Appendix Q). Subjects who achieved a minimum of 3 out of 7 criteria for self sustained mobility and motility in three categories within the endocranial sphere were included in the hypothesis related Endocranial subgroup. The remaining subjects were referred to as the Global

subgroup. Statistical analysis was also done for the Whole subject group however their results can only be considered to refer to Global Osteopathic treatment and were not the focus of the hypothesis.

4.3.3 Subjects: Croatian Adult Children of War

In order to recruit adult children of war and create as homogeneous a subject group as possible this research was conducted in Zagreb, Croatia, now over 15 years after their war of independence (1991 to Dec. 14, 1995). Participants in this Chronological Research group were a minimum of three to a maximum of fourteen years old during the four-year period of the war. Young adults born between January 1970 and December 1992 fulfilled this criterion. (Appendix E)

4.4 Inclusion / Exclusion Criteria

The Croatian research team was able to recruit twenty-seven young adults who were 21 to 34 years of age within this research year and were born between 1977 and 1990. All participants were living in and near Zagreb, the capital city. Each participant qualified based on the following inclusion / exclusion criteria.

Exclusion Criteria

- Neurodegenerative disease (multiple sclerosis, Parkinson's disease, ALS, etc)
- Psychiatric disorders
- Acute cranial pathology including: fracture, swelling, infection, or tumor
- Recent history of symptomatic brain injury, recent concussion, unexplained syncope
- Acute spinal neuropathology including: disc rupture, stenosis, radiculopathy, etc.
- Acute pain condition
- Current orthodontics (braces, retainers, etc.)
- Glaucoma
- History of brain tumor
- History of epilepsy
- Psychotropic medications
- Pregnancy
- Born prior to January 1st 1984 and after December 31st 1991.
- Did not live in Croatia at any point from 1991 to 1995

Inclusion criteria

- Expresses good health and meets the inclusion/exclusion criteria.
- Was 3 to 14 years of age in 1991 to 1995.
- Meets criteria on the Exposure to War guidelines. (Appendix H)
- Has expressed an understanding of their commitment to participate and has submitted their intention to participate prior to objective testing.
- Is able to complete the objective testing in four prescheduled meetings for the Three Part Stroop test, WHOQOL-bref, and SF-36 Health Survey.
- Is able to attend a minimum of six pre-scheduled treatment sessions in order to fulfil the criteria for Treatment Phase A and Treatment Phase B of this research.

4.5 Measurement Instruments

4.5.1 Croatian Language Versions

All tests and intake materials were provided for the subjects in Croatian. A translator was hired to translate history taking and in-take forms. The World Health Organization in Geneva Switzerland was able to provide a WHOQOL-bref in Croatian. The originator of the Croatian SF-36, Dr. Gorka Vuletić, provided a validated version of this test. Dr. Vuletić also provided the analysis. The Stroop Test words were translated and edited for relevance by psychologist Đurđa Sucević. This reseacher spent time learning basic Croatian phrases in order to conduct postural testing and give basic treatment instructions. This fundamental knowledge was useful however all subjects had a basic to excellent knowledge of English.

4.5.2 World Health Organization Quality of Life Scale

The World Health Organization in 1994 developed a quality of life scale that could be used internationally. This scale is currently available for use and was chosen in order to emulate the treatment design of Desilets and Isaac-Villette who also used it in their 2007 thesis for the CEO on PTSD. The scale consists of 26 questions randomly divided into four domains. The participant answers using a 5 point scale ranging from very poor to very good, very dissatisfied to very satisfied and so on. The WHOQOL-bref measures quality of life in four Domains: the physical, psychological, social, and environment. Permission to use the WHOQOL-bref was given by the World Health Organization in Geneva, Switzerland. (Appendix U and V)

4.5.3 SF-36 Health Survey

SF-36 is a short multifunctional health questionnaire comprising 36 questions (Ware, 2000). It represents a theoretically based and empirically authenticated selection of questions on two general health concepts – physical and psychological health. Hence the four types of scales or conceptually diverse health measurements relative to the following health assessments or indicators: a) functioning on the level of behaviour, b) estimated wellbeing, c) limitations of the social life and realization of central life roles, and d) personal self-assessment of the overall health. Each questionnaire item relates to one of the following eight health domains: physical functioning (PF) (10 items); role limitation due to physical problems (RP) (4 items); bodily pain (BP) (2 items); perception of general health (GH) (5 items); vitality and energy (VE) (4 items); social functioning (SF) (2 items); role limitation due to emotional problems (RE) (3 items); mental health (MH), referring to absence of anxiety and depression (5 items); changes in health (CH) as one unit referring to changes in health relative to one year ago (five levels from 'how much the condition is better than a year ago' to 'how much the condition is worse than a year ago'), not expressed as a scale, but still useful for the evaluation of average change in the health status over a period of one year prior to monitoring.

Total score measurements of individual health are transposed into a standardized scale of 0 (minimum) to 100 (maximum). The higher the result in each scale, the better the subjective health. Psychometric evaluation showed good psychometric qualities of the Croatian version of SF-36 (Maslić Seršić and Vuletić, 2006), for which *Andrija Štampar* School of Public Health in Zagreb procured a license and permission for use. (Vuletić, Gorka, 2011 provided through personal correspondence)

4.5.4 The Stroop Test

Finding an objective tool that was internationally portable, and could validly measure functional changes that would directly reflect changes in structural neuroanatomy presented a unique challenge. That challenge was taken up quite elegantly and simply by a test developed 74 years ago which has consistently and successfully been used in the field of cognitive research ever since.

John Ridley Stroop developed the Stroop test in 1935. It is a test designed to present the subject with a mental challenge created by a simple cognitive conflict. He found that when subjects were presented with a list of colour words written in congruent and incongruent colours, (red written in red ink versus blue written in green ink), it took longer for subjects to name the colours when the word did not agree. Stroop adopted his mentor Cattell's

explanation that, "reading words was much more practiced than naming pictures or colours - introduced (ing) the concept of automaticity to psychology." (MacLeod, p. 18, 2005)

Stroop speculated that once reading skills were acquired, reading a word occurred in a single step whereas naming the colour of a written word involved numerous steps. To test this researchers added a control by including 'non' words that only needed to be named for their colour such as; ++++++, typed in green. With the presence of a control, a congruent, and a non-congruent stimulus, the Stroop test consistently demonstrates significant variance.

The Stroop Effect has continued to play an important role in the study of cognitive ability and neuropsychological processes. It has been a very adaptable test and has proven to be a consistent means of targeting specific brain centers, specifically in the Anterior Cingulate Cortex (ACC), in order to understand attention and learning, memory, and other basic cognitive processes. (MacLeod, p. 34, 2005)

To address the need to attempt to test specific neurological functions and their target sites as precisely as possible while nonetheless using an indirect cognitive test, this researcher chose to duplicate the reaction time based Stroop design used by Bush, Shin, and Whalen in numerous MRI studies which showed the site of neural activation in the Anterior Cingulate Cortex during testing. This would allow this researcher to use the fMRI data collected in their research in an attempt to use their findings to gain understanding about our own.

4.5.5 Stroop Test and Treatment Assumptions

It is the assumption of this researcher that the subjects in this 'high-risk' trauma-exposed subject group who may be functioning in their daily lives with cognitively structural adaptations due to developmental traumatology they will demonstrate difficulties in performing the Stroop test. The next assumption is that if global osteopathy and endocranial treatment is able to effectively treat encephalon lesions and integrate endocranial structures with the rest of the body this positive effect will be evident in the Stroop test results.

4.5.6 Three Part Stroop Test

The Stroop test, as used for the purpose of this research was a reaction time and accuracy-response based cognitive test performed on a computer. An external reaction time response box for data input by the subject was used to insure response time accuracy. The Stroop test was presented as one test with three distinct parts and was therefore named, the Three Part Stroop. Its three parts encompass three domains presented in the following order: the emotional past, neutral cognitive present and the emotional present.

4.5.7 Emotional Counting Stroop Test

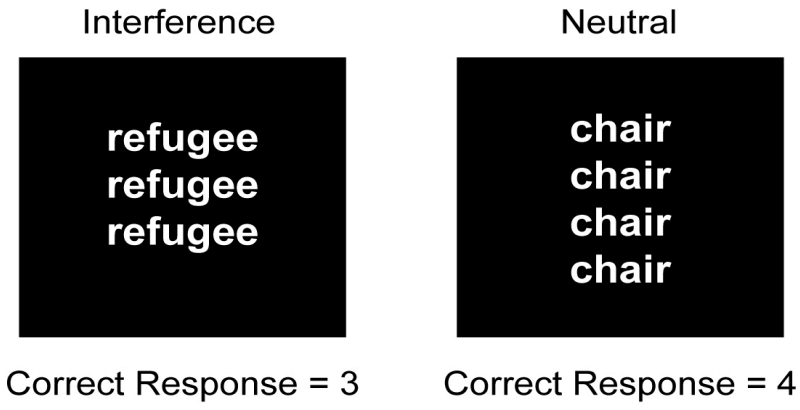
In the field of neuroscience the emotional Stroop test has been used to assess the impact of cognitive function in patients with PTSD. The emotional counting Stroop test presents patients with 1 to 4 of the same words on the computer screen. They must count these words and enter their response into a response pad. They are asked to use two fingers of the left hand and two fingers of the right hand to press one of four buttons depending on the answer. Some words are neutral and some are emotionally 'loaded.' The emotionally loaded words are specifically negative words drawn from terms specific to Croatia. For patients with war exposure specifically negative words were refugee, bombing, hunger, etc. In order to compare emotional and non-emotional response times neutral words from household objects were used like, drawer, mirror, table etc. For the purpose of this study specifically negative words were generated with the help of Research Psychologist Đurđa Sučević in Zagreb, Croatia. The same word test words were given four times to this one chronological research groups.

Table 7 Word stimuli used for ecStroop (emotional counting Stroop)

	Neutral	Interference
1.	Cushion	Deceit
2.	Glass (drinking)	Torture
3.	Plate	Enemy
4.	Chair	Genocide
5.	Television	Refugee
6.	Spoon	Hate
7.	Glass	Fear
8.	Lamp	Shelter
9.	Telephone	War
10.	Bed	Bombing
11.	Towel	Murder
12.	Table	Victim
13.	Bowl	Arms
14.	Window	Accident
15.	Key	Uncertainty
16.	Tablecloth	Flee (imperative)

Six blocks of words were presented alternating Neutral with Interference. Therefore three neutral word with 16 words in each block were alternated with three interference blocks also consisting of 16 words each.

Figure 2 Stroop trial windows – 1

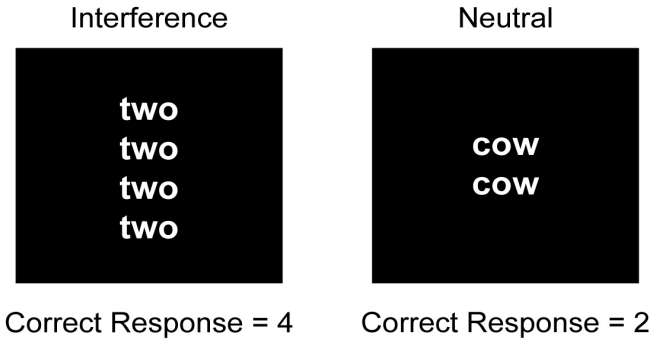


4.5.8 Counting Stroop Test

The non-emotional counting Stroop (cStroop) "was seen to activate a network of brain regions involving attention, response selection, motor planning, and motor output." (Bush, p. 274, 1998) When using the emotional counting Stroop (ecStroop) with the counting stroop both tests give insight into fundamental cognitive and emotional processes that may be challenged by trauma-exposed experience.

The Counting Stroop test uses the same principle of presenting incongruent information to the testing participant. Once again 1 to 4 of the same words are presented on the computer screen. The participant counts them and enters the answer on the response pad. Congruent neutral information is presented by, for example, counting the word 'cat' four times. Incongruent information is presented, for example, by showing the word 'two' four times requiring the correct answer 'four'.

Figure 3 Stroop trial windows - 2



Sample stimuli from the counting Stroop.

Table 2. Word stimuli used for cStroop (counting Stroop)

	Neutral	Interference
1.	Chicken	One
2.	Mouse	Two
3.	Cat	Three
4.	Duck	Four
5.	Fish	
6.	Bird	
7.	Horse	
8.	Pig	
9.	Cow	
10.	Monkey	
11.	Deer	
12.	Elephant	
13.	Lion	
14.	Rabbit	
15.	Sheep	
16.	Goat	

4.5.9 Everyday Stroop Test

On the advice of Croatia based retired research psychologist Đurđa Sučević who did extensive work with this population by conducting Peace Building Camps for children in the mid 1990's, another domain was added. While together designing the Stroop test word lists Sucevic made a case for presenting words that are a currently relevant reflection of the elements which create stress in their present day lives. She pointed out that present day stress words may measure young people's stress more readily than words drawn from the vocabulary of war they may have been too young to remember. Hence an everyday stress Stroop test was constructed. Words that reflect the cultural and economic challenges of present day Croatia were interspersed with neutral words drawn from nature.

Table 3. Word stimuli used for the edcStroop (every day counting Stroop)

	Neutral	Interference
1.	Rain	Poverty
2.	Sun	Crisis
3.	Leaf	Quarrel
4.	Flower	Disappointment
5.	Snow	Looser
6.	Apple	Unemployment
7.	Lake	Injustice / Unfair
8.	Forest	School
9.	Moon	Debt
10.	Cloud	Guilty
11.	Tree	Divorce
12.	Water	Homeless
13.	Earth	Struggle
14.	Star	Disease
15.	Mountain	Unhappy
16.	River	Parents

4.5.10 Stroop Test Equipment and Technical Support

The above tests were designed using SuperLab 4.0 stimulus presentation software for building consistently presented experiments that can also be translated into different languages. (Appendix R) The most important feature of this system is a Cedrus Universal USB response pad. This is an external pad that ensures the recording of accurate response times. This feature is one of the primary criteria that makes this a validated measuring instrument. Standard computer hard drives and their applications are unreliable as measuring tools. The response pad records response time externally and then the SuperLab program records the time response on data sheets.

Biopac Systems Canada Inc., Montreal branch is a company, which provides data analysis, acquisition and research quality tools internationally. Their representative in Montreal, Guy Jennings, advised and guided the process of building this test using the SuperLab software. This researcher did the input and command recordings for all 288 trial entries in Croatian. Mister Jennings provided this researcher with online 'remote control' tutorials on data input, he supervised and crosschecked the Stroop test design for consistency and accuracy. (SuperLab 2008)

4.5.11 Administering The Stroop Test

One computer was designated for use for this study. The designated computer, with the SuperLab software and the Universal USB response pad was transported to Croatia and used only for objective testing for the transferring of data to the cyber account. The researcher trained the independent assessor how to use the testing equipment. The independent assessor was provided with typed step-by-step procedural instructions. (Appendix I, J) Four mock trials were given with volunteers who were not involved in the research were conducted. This researcher monitored the three mock trials. The independent assessor did one practice trial alone with a volunteer in order to review the routine. We attended to the table height and chair position so that the subject could sit directly in front of the computer. The response box was place in front of the computer pad in such a way as to keep a consistent distance from the computer screen for each subject. The assessor remained present while the Stroop test occurred but stayed silent and out of the subjects sight line.

4.5.12 Stroop Test Procedure

The following instructions were provided which outline the directions given to each subject.

Instructions for Patients – Stroop Test

1. Obtain informed consent following the established institutional guidelines.

Psychophysical Procedures

2. Tell subjects that sets of one to four identical words will appear on the screen, and instruct them to report via button press, the number of words in each set, regardless of what the words are.
3. Instruct subjects that the keypad buttons represent responses one, two, three and four, from left to right, and that they should use the index and middle fingers of the left and right hands to respond. (place them on the buttons before starting)
4. **Explicitly instruct the subjects**: **i)** that the sets of words will change every 1.5 seconds. **ii)** to "Answer as quickly as possible, but since getting the correct answer is important, do not sacrifice accuracy for speed." **iii)** "do not 'blur your vision' in an attempt to make the task easier – keep the words in sharp focus."
5. After instructions are reviewed, and just prior to formal testing, have subjects complete a 1-min computerized practice test. (6 neutral trials and 4 interference trials will be shown). Reviewing the responses here ensures that the subject understands the task and can perform correctly without requiring excessive practice.

Formal Testing for the Three-Part Stroop

1. Formal testing will begin with 30 seconds of fixation on a '+' sign. The participant should remain looking at the '+' sign with fingers on the key pad and wait for the test to begin.
2. The formal testing version will have 16 neutral trials followed by 16 interference trials in each section. There will be three sections (parts). A five second fixation pause (+) occurs between each section. The subject should remain looking at the '+' sign with fingers on the keys and wait for the next test to resume.
3. The test will be 8 minutes long and will consist of three sections.

4.5.13 Osteopathic Assessment and Treatment Records

Osteopathic assessment and treatment was given to the Chronological Treatment subjects in two phases. Both phases of treatment were recorded however only Treatment notes for the endocranial sphere were examined for significance and for identifying subgroups. Treatment Phase A records were examined for interest and for relevance relative to the outcomes of Treatment Phase B. (Appendix X)

4.6 Osteopathic Treatment Strategy

The osteopathic treatment plan was driven by the methodology of the CEO, the College d'Etudes Osteopathiques of Montreal methodology as created by Philippe Druelle D.O.. In the first three weeks the primary researcher treated patients three times with a focus on clearing compactions, non-physiological without respect to axis lesions, ensuring proper vitality and PRM restoring the integrity of the central chain, and endocranial cardinal axis. The primary researcher gave the last three treatments to patients every other week during the final six weeks with the goal of treating the endocranium using the endocranial concept, and addressing possible traumatic and emotional spasms within the cranial sphere. Endocranial treatment was given when appropriate access was available within body mechanism of the individual. All subjects were treated according to their needs throughout the nine-week period.

This researcher prepared for this treatment regime by attending training courses for traumatic (I), emotional (II) and transgenerational (III) endocranial spasms as developed by Philippe Druelle DO and taught by the CEO. In order to treat PTSD this research limited its focus to treatment protocols up to the emotional spasm (II) training. Validation for palpation skills, up to and including emotional spasms, was given by Genevieve Forget D.O. after a six hour examination day were in three volunteer subjects were examined by this researcher. (Appendix C)

4.7 Determination of Sample Size and Pre-Study

For reasons of the logistics involved in conducting research in Croatia a pre-study was not done. A comparable sample group could not be found in Nova Scotia. The impact cultural differences may have had on pre-study results could not be legitimately applied to potential results in Croatia. The Stroop test was also designed in Croatian for a war exposed demographic. The equivalent test in English would not have been relevant.

Statistical analyst Beth Bruce, recommended choosing one sample size and reporting it as the overall scale for the test which appears to be the best indicator the primary outcome measure that the research is examining. The SF-36 was chosen. The larger number of the two was recommended. Therefore 41 participants for pre and post testing would provide 'power.'

For SF-36 scores, using Total Physical Health Scale

If the true difference in the mean response of matched pairs is 60 with a standard deviation of 75.6, we will need to study 19 participants for pre and post treatment scores to be able to reject the null hypothesis that this

response difference is zero with probability (power) 0.8. The Type I error probability associated with this test of this null hypothesis is 0.05.

For SF-36 scores, using Total Mental Health Scale

If the true difference in the mean response of matched pairs is 53.3 with a standard deviation of 118, we will need to study **41** participants for pre and post treatment scores to be able to reject the null hypothesis that this response difference is zero with probability (power) 0.8. The Type I error probability associated with this test of this null hypothesis is 0.05.

For WHOQOL scores, using Total Physical Scale

If the true difference in the mean response of matched pairs is .83 with a standard deviation of 1.51, we will need to study 28 pairs of participants for pre and post treatment scores to be able to reject the null hypothesis that this response difference is zero with probability (power) 0.8. The Type I error probability associated with this test of this null hypothesis is 0.05.

For WHOQOL scores, using Total Psychological Scale

If the true difference in the mean response of matched pairs is 1.14 with a standard deviation of 1.76, we will need to study 21 pairs of participants for pre and post treatment scores to be able to reject the null hypothesis that this response difference is zero with probability (power) 0.8. The Type I error probability associated with this test of this null hypothesis is 0.05.

4.7.1 Variables

Independent (predictor) Variable

Osteopathic intervention as defined by the assessment and treatment methodology.

Dependent (outcome) Variable

The dependent variables will be the objective measures provided by the Counting Stroop test (cStroop), the Emotional Counting Stroop test (ecStroop), the every day stress Counting Stroop (edcStroop) and the World Health Organization Quality of Life scale (WHOQOL-bref) and the SF-36 Health Survey. Tests will be completed by the entire chronological experimental group.

4.7.2 Study Personnel

One research assistant was present for the experimental portion of this research. She fulfilled many roles. She recruited and scheduled subjects. She provided the office used for this overseas work. This researcher was in contact with her prior to arriving in Zagreb in order to co-ordinate action plans and timelines. She provided continuity for the research subjects by being their primary contact person. This one research assistant also put in many hours as Independent Assessor. An additional assistant was employed for doing translations. He translated all health forms and intake forms to Croatian and then back to English so this researcher could make use of them.

4.7.3 Ethical Considerations

This research was initially designed as a randomized control study. After meeting with osteopathic colleagues at The Akademija Osteopatije in Velika Gorića, Croatia, who would be recruiting for this research it became clear that having an untreated control group would not be suitable. Invaluable advice on this matter was given by Croatian research psychologist Đurđa Sučević. She observed that the post war political millieux has continuously overlooked the needs the main population. And to ask trauma-exposed people to be tested and not treated for something that we in Osteopathy have a unique ability to address falls short. Along with, Đurđa Sučević, Velda Lulić D.O., and the research assistant Zvonka Tomasović all agreed the research needed to be designed to treat every patient. In order to acknowledge this decision a Chronological Research design was decided upon by the CEO Advisory Committee. (see Appendix A) As another ethical consideration all subjects were informed that anonymity would be preserved and informed consent was practiced.

Chapter 5: DATA ANALYSIS AND RESULTS

Chapter 5: Data Analysis And Results

The analysis for this research will present the significant SF-36 Health Survey and WHOQOL-bref results first and then proceed to the Stroop test analysis. The significant results that relate directly to the hypothesis; that Global Osteopathic and Endocranial treatment will improve quality of life results for trauma-exposed subjects will be emphasised. Fourteen out of twenty-five subjects met the inclusion criteria for endocranial treatment and comprise the subject group relating to the hypothesis. Eleven subjects received Global Osteopathic treatment. Their results are presented for the sake of illuminating the overall results. Following the subgroup evaluation the significant results for the whole subject group of twenty-five, who collectively received Global Osteopathic treatment, will be presented. It must be noted that the hypothesis only concerns the 14 subjects who were identified in the treatment notes as meeting the 'Endocranial and Global Subgroup Inclusion Criteria.' (Appendix Q) The findings for the Global subgroup and Whole groups are there to further inform, where possible, about this trauma-exposed subject group.

5.1 Data Analysis Procedure

All health surveys and World Health questionnaires were administered and filed by the independent assessor, Zvonka Tomasović. The independent assessor labelled them with patient code numbers and the trial date. Upon completion of the treatment phase this researcher entered the data on excel spreadsheets under the instruction of Gorka Vuletić.

The first two Trial tests, given three weeks apart, provided the control measures. After a nine-week treatment phase the control measures were compared with the outcome measures gathered in the last two trials, which were also administered three weeks apart. The Hypothesis concerns only the significant results for the group who received both endocranial and global treatment however between sub-group measures were included when the results added to our understanding of global and endocranial treatment response.

The data set was analysed by a group of three statistician analysts. Gorka Vuletić and Beth Bruce shared responsibilities for analysing the SF-36 Health Survey and WHOQOL-bref. Descriptive data was generated for the SF-36 using a paired Wilcoxon for Independent Group analysis (single sub-group). The SF-36 was administered twice, once during the second trial and again in the fourth trial. The WHOQOL-bref was given over four trials. Independent group data for the WHOQOL-bref was analysed across four trials using the Freidman and also the

Wilcoxon. Group analysis was done for the SF-36 and WHOQOL using ANOVA. ANOVA was also used for all Three Part Stroop test analysis.

All Stroop test data was analysed by Dr. Soren Bondrup-Nielson. The raw data was stored by the independent assessor in a password controlled cyber account, and was managed and further saved on hard drive by a research assistant in Canada. The independent assessor in Croatia and assistant in Canada were the only ones to have the cyber account password during the field research. The data set was converted to spreadsheets by the primary researcher after the field research was completed.

5.2 Stroop Test Data Changes

Stroop data was examined for accuracy. It was discovered the Stroop design program unexpectedly recorded first and second button presses if the subject pressed the response button more than once during an individual word trial. The program was expected to record only the first button press therefore each spreadsheet had a different total number of button presses making it impossible to collate the data. In consultation with Guy Jennings and Dr. Bondrup-Neilson it was decided that only the first responses would be included and second responses deleted. Also all '0' value responses were removed so as not to skew reaction time results.

A second issue with the data occurred during analysis. All three parts of the Three-Part Stroop test were analysed to find the mean reaction times for Interference and Neutral trials. The three tests were further analysed to find the total mean reaction time difference between Trials for both Interference and Neutral stimuli. It was in this second analysis that the data became corrupted for the third part of the Three Part Stroop test – the Everyday Stress Stroop. It was decided to throw out the mean reaction time difference analysis between Trials for the Everyday Stress Stroop. Dr. Lisa Shin also recommended this researcher consider examining only the first four minutes of the of the eight minute test. Therefore in discussion only the first two tests were considered. The accurate data for the third test was included in this report for usefulness as a future reference.

5.3 Statistical Analyses

Researcher and statistician Dr. Gorka Vuletić offered her services to this research. She is one of the originators of the Croatian version of the SF-36 (Maslić Seršić and Vuletić, 2006). She and her colleagues used the SF-36 to conduct a nationwide health survey of 5048 people, (1%) of the Croatian population. She is currently a

professor at the School of Psychology, Faculty of Philosophy in Osijek and the School of Public Health, Medical faculty University of Zagreb.

Beth Bruce RN PhD is a published research consultant with 15 years experience in research design consultation and evaluation.

Dr. Soren Bondrup Nielsen Head of the Biology Department Acadia University, is an author of natural history and has done extensive population studies on beetles and birds. He has been teaching statistical analysis and doing research for over 30 years.

Dr. Dianne Looker provided input on data analyses and interpretation of results. She is a Professor of Sociology at Mount Saint Vincent University in Halifax, NS. She has taught quantitative analyses for thirty-five years.

5.3.1 Sample Demographics

In total twenty-seven subjects attended the pre-treatment testing and treatment phase of this research. Twenty-five subjects completed all testing requirements. One patient was lost in the follow up testing for unknown reasons, one was unable to attend the third testing trial due to out of country education commitments therefore both sets of data were removed.

Out of the twenty-five participating subjects sixteen were female between the ages of 23 to 32. Nine subjects were male ranging from 21 to 34 years old. The endocranial and global osteopathic treatment group of fourteen had 5 males and 9 females whereas the Global treatment group of eleven had 4 males and 7 females. This subject group was born in the same generation within a 13 year time span (21 to 34 years old). The median age was 28. Seven were currently students (5 women, 2 men), three were unemployed (female) and fifteen were employed (8 women, 7 men). Seven subjects were single, eighteen were married or in relationships. Nineteen reported they were in good to excellent health, six reported fair to poor health.

Table 8 Health reports by gender

How would you describe your current state of health?	Female	Male
Excellent		2
Good	12	5
Fair	3	2
Poor	1	

The inclusion/exclusion and Exposure to War criteria was designed to control for as much demographic

homogeneity as possible. The inclusion/exclusion criteria along with the exposure to war criteria were the only screening devises used. No tests to determine PTSD, no self-esteem scales or depression scales were used.

Overall this was a generally healthy group of young adults. They were all born and lived within Croatia. They grew up in families that experienced relatively the same cultural / political milieu. Their trauma exposure concerned the same events of war within roughly the same time span. They differed in that some had a more intensely direct exposure to war and others had indirect exposure for example in communities that were not bombed but were under constant threat of being bombed. Ten subjects experienced indirect exposure, in fringe communities with family members and neighbors serving at war, fifteen experienced direct exposure, in bombed regions and evacuation zones.

5.4 SF-36 Health Survey Subgroup Result Analysis and Interpretation

*Hypothesis #4: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood.

This hypothesis speculates that the group who received Global Osteopathic treatment combined with treatment using the Endocranial concept will have a more coherent structure after receiving a minimum of six treatments in nine weeks. These subjects will have higher SF-36 scores than their baseline measure when tested 13 weeks later. The SF-36 interviews subjects about the previous four weeks. This survey was administered in the second and fourth Trials in order to gain insight about how their quality of life perspectives may have changed across time and about how their lives may have influenced them since the first testing trial. Where applicable between group comparison and/or analysis was done to isolate further information about the independent variable: treatment of the cranial and endocranial sphere.

The overall significant results for both subgroups and the whole treatment group using non-parametric Wilcoxon signed ranks are as follows:

Table 9 SF-36 Significant Measures

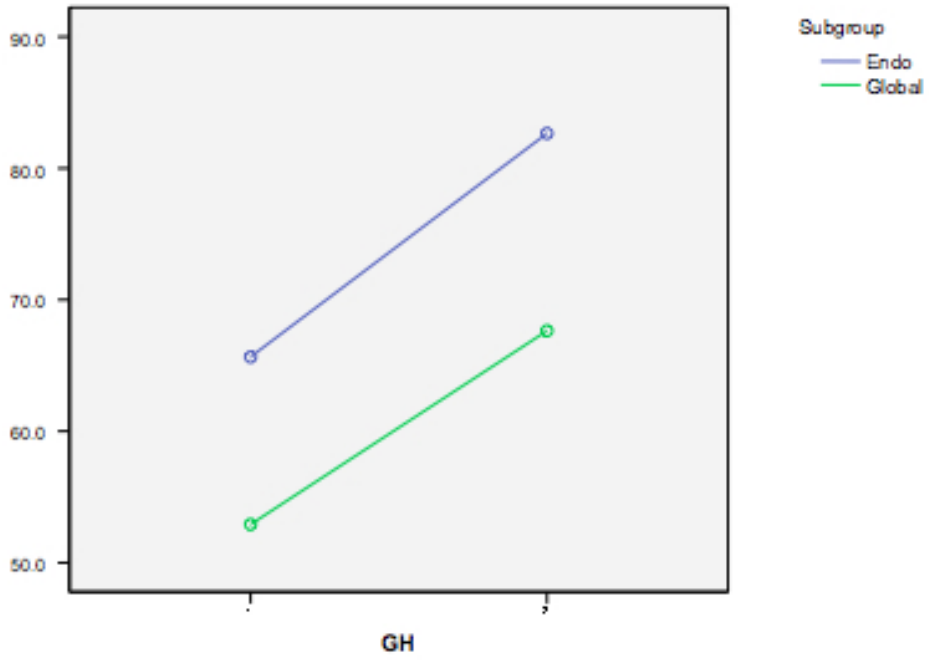
Global Osteopathic and Endocranial / Global Osteopathic subgroups, Whole Group Results

Domains Across time between pre and post treatment scores	**Global and Endocranial Group** (N=14)	**Global Group** (N=11)	**Whole Group** (N=25)
Wilcoxon Signed Ranks	**Difference over 2 trials**	**Difference over 2 trials**	**Difference over 2 trials**
Physical Functioning (PF)	$p < .015$	NS	$p < .013$
Role Physical (RP)	$p < .05$	NS	$p < .010$
Role Emotional (RE)	NS	NS	NS
Social Functioning (SF)	$p <. 054$ marginal	NS	$p < .015$
Mental Health (MH)	$p < .032$	NS	$p < .020$
Energy/Vitality (EV)	NS	$p < .058$ marginal	$p < .027$
Body Pain (BP)	NS	$p < .088$ marginal	$p < .036$
General Health Perception (GH)	$p < .010$	$p < .004$	$p < .000$

The Endocranial group achieved four significant scores with one marginal. The Global group achieved one significant score with two marginal. The whole group combined achieved seven significant scores in all domains except Role Emotional.

5.4.1 SF-36 Significant Group Effect – Anova – Between Group Analysis

Figure 4 General Health Perception (GH) Plots



Between Group Analysis – General Health Perception (GH)

1. Are there significant differences in scores over measurement times?

***Yes.** Both groups change similarly over time. (Time effect F = 23.14, p = .001)

2. Do overall group means differ?

***Yes,** significant difference in overall mean scores were detected. (Group effect F = 4.88, p = .04)

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time. (Group interaction* Time) F = .12, p = .73

Trends: Groups changed over time but both groups changed similarly, increasing. Though a significant group effect was found (p = .04) the Endocranial Treatment group had a higher GH score prior to treatment but also achieved significant improvement after treatment. A common pattern of 'parallel results,' as shown above by the difference between the two subgroup appeared in most Health survey results. This is due to this research design's post treatment sub-group selection decision. This post treatment selection effect is evident occurred in five domains. (GH, RP, SF, EV, and BP)

5.4.2 SF-36 Group Effect

The following is chart is a synopsis of the Endocranial versus Global subgroup's 'between group' parametric analysis. There is a 'time effect' difference in all measures except Role Emotional but no 'time group effect' in eight domains.

Figure 5 SF-36 ANOVA between groups analysis: Eight-Domain Synopsis

Endocranial versus Global subgroups over time

Subscale	Time Effect	Group Effect	Time* group Effect	Comment
Physical Function	Yes $p < .02$	No	No	endocranial group increased more than global group, larger sample needed
Role Physical	Yes $p < .008$	No	No	
Role Emotional	No	No	No	endocranial group increased and global group decreased, suggesting a trend, larger sample needed
Social	Yes $p < .02$	No	No	
Mental Health	Yes $p < .05$	No	No	endocranial group increased while global group remained stable, larger sample needed
Vitality	Yes $p < .04$	No	No	
Body Pain	Yes $p < .02$	Marginal $p < .08$	No	
General health	Yes $p < .001$	Yes $p < .04$	No	

5.4.3 Sf-36 Significant Conclusions

This research concludes that in paired testing subjects who received combined Global Osteopathic and Endocranial treatment significantly improved four out of eight objective SF-36 domains, with one marginal ($p<$

.054). Global Osteopathy combined with Endocranial treatment was beneficial for adults who experienced war-related trauma in childhood.

The SF-36 Health Survey showed significant improvement for the Endocrancial group in physical functioning, role physical, mental health and general health. The Endocranial group improved marginally ($p < .054$) for social functioning. There was no significant improvement for role emotional or body pain. All domains except Role Emotional showed change over time. The pattern for both the Endocranial and Global subgroups, (except in the SF-36 role emotional test), is for improvement on all measures. The two groups are too small with too much variability to detect significant group effect and interference differences. Although there are no group effects between Endocranial versus Global subgroups detected statistically in seven out of eight SF-36 domains, there are several scales that demonstrate the groups are behaving differently. General Health perception is the only domain that shows a significant group effect ($p < .001$) even though both subgroups improved significantly in this score. (Appendix Y, Z for All SF-36 data)

Significant results were seen for the whole group of 25 subjects in seven out of eight domains. Role emotional again showed no significant changes. Significant results concerning the whole subject group have more statistical power than the subgroups. Therefore, it can be stated more statistical certainty that there was a positive effect from Osteopathic treatment with this traumas exposed subject group. Their physical domain scores exceeded power (19 subjects needed). Therefore the results in the physical domains may not be restricted to this subject group but may also apply generally to this at-risk population. The mental health domain scores have less power and though significant in this subject group cannot be generalized to an overall population. The statistical results for the Endocranial and Global Osteopathic treatment group demonstrate conservative support for the Hypothesis that Osteopathic in addition to Endocranial treatment would improve quality of life.

5.4.4 WHOQOL-Bref Results Analysis and Interpretation

***Hypothesis #3**: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective World Health Organization Quality of Life bref (WHOQOL-bref) scores in adult subjects who experienced war-related trauma in childhood.

This hypothesis speculates that the group who received global osteopathic treatment, combined with treatment using the endocranial concept will have a more coherent structure after receiving a minimum six treatments over nine weeks. Subjects will therefore have higher WHOQOL-bref outcome scores than their two baseline control

measures when tested 10 and 13 weeks after the pre-treatment scores. The QoL was given in each of four Trials. Its questions provide a sampling of their lives at four different points in time over a total 17 weeks period. It was interesting to note that relative to the first control Trial some of their control scores noticeably decreased and some increased in the second Trial prior to receiving treatment. This may simply be due to the random effects of daily life or possibly a placebo effect. Where applicable between group comparison and/or analysis was done to indicate the independent variable: treatment of the cranial and endocranial sphere. (Appendix AA, BB, CC for all WHOQOL-bref data)

5.4.5 Physical Domain Results (WHOQOL-Bref)

Table 10 Endocranial and Global Osteopathic Treatment – Subgroup Analysis

Wilcoxon Signed Ranks Test

(non-parametric single sample analysis between consecutive Trials)

N=14	Physical2 – Physical1	Physical3 – Physical1	Physical4 – Physical1	Physical3 - Physical2	Physical4 - Physical2	Physical4 - Physical3
Z	-.079(a)	-2.943(b)	-2.611(b)	-3.016(b)	-2.357(b)	-1.602(a)
Asymp. Sig. (2-tailed)	.937	.003	.009	.003	.018	.109

Physical scores increased in Trial 3 and Trial 4, after Global Osteopathic and Endocranial treatment, over pre-treatment Trial 1 and Trial 2. Trial 4 was similar to Trial 3 scores (both post treatment scores).

Friedman Test across Multiple Trials

This is a non-parametric test used for multiple across time trials total measures.

- There is a significant difference in physical scores across time measurements. Four combined Trials $p < .001$

***Hypothesis Questions based on Independent Variable:**

1. Did global osteopathic and endocranial treatment improve objective WHQOL-bref scores in adult subjects who experienced war-related trauma in childhood?

   ***Yes.**

2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

   No. Both groups changed significantly over time.

Table 11 Global Osteopathic Treatment - Subgroup Analysis

Wilcoxon Signed Ranks Test

N=11	Physical2 – Physical1	Physical3 – Physical1	Physical4 – Physical1	Physical3 - Physical2	Physical4 - Physical2	Physical4 - Physical3
Z	-1.017(a)	-1.742(b)	-1.797(b)	-2.201(b)	-2.532(b)	-.741(a)
Asymp. Sig. (2-tailed)	.309	.082	.072	.028	.011	.458

Physical scores increased in Trial 3 and 4, after Global Osteopathic treatment, over pre-treatment Trial 2. Trials 3 and 4 were similar. Trials 3 and 4 marginally increased over Trial 1.

Friedman Test across Multiple Trials

- There is a significant difference in physical scores across time measurements. Four combined Trials $p < .013$

Table 12 Osteopathic Treatment - Whole Group Analysis

Wilcoxon Signed Ranks Test

N=25	Physical2 – Physical1	Physical3 – Physical1	Physical4 – Physical1	Physical3 - Physical2	Physical4 - Physical2	Physical4 - Physical3
Z	-.773(a)	-3.368(b)	-3.205(b)	-3.715(b)	-3.376(b)	-1.833(a)
Asymp. Sig. (2-tailed)	.440	.001	.001	.000	.001	.067

Physical scores over time increased Trial 3 over Trial 1 and 2. Similar scores at Trial 4 as Trial 3 could be considered marginally lower in time 4 ($p<.07$)

Friedman Test across Multiple Trials

- There is a significant difference in physical scores across time measurements. Four combined Trials $p < .000$

5.4.6 Psychological Domain Results (WHOQOL-Bref)

Table 13 Endocranial and Global Osteopathic Treatment –Subgroup Analysis

Wilcoxon Signed Ranks Test

N=14	Psychological2 Psychological1	Psychological3 Psychological1	Psychological4 Psychological1	Psychological3 Psychological2	Psychological4 Psychological2	Psychological4 Psychological3
Z	-.052(a)	-2.446(b)	-2.150(b)	-2.099(b)	-1.502(b)	-.638(a)
Asymp. Sig. (2-tailed)	.958	.014	.032	.036	.133	.524

Psychological scores increased, after Global Osteopathic and Endocranial treatment, at Trial 3 over pre-treatment Trial 1 and Trial 2. Trial 3 and 4 scores did not different.

Friedman Test across Multiple Trials

- There is a significant difference in psychological scores across time measurements. Friedman Test: 4 combined Trials $p < .010$

***Hypothesis Questions based on Independent Variables:**

1. Did endocranial and global osteopathic treatment improve objective WHQOL-bref scores in adult subjects who experienced war-related trauma in childhood?

   *Yes.

2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

   Yes. Though groups behaved similarly the Endocranial group showed significant improvement whereas the Global group did not.

Table 14 Osteopathic Treatment – Whole Group Analysis

Wilcoxon Signed Ranks Test

N=25	Psychological2 Psychological1	Psychological3 Psychological1	Psychological4 Psychological1	Psychological3 Psychological2	Psychological4 Psychological2	Psychological4 Psychological3
Z	-.164(a)	-2.539(b)	-1.744(b)	-2.190(b)	-1.340(b)	-1.567(a)
Asymp. Sig. (2-tailed)	.870	.011	.081	.028	.180	.117

Psychological Scores increase time 3 over time 1 and time 2. Time 4 similar to time 3

Friedman Test across Multiple Trials

- There is a significant difference in Psychological scores across time measurements. Four combined Trials $p < .025$

Table 15 WHOQOL-bref Significant Measures

Global Osteopathic and Endocranial / Global Osteopathic subgroups, Whole Group Results

Domains Across time between pre and post treatment scores	**Global and Endocranial Group** (N=14)	**Global Group** (N=11)	**Whole Group** (N=25)
Friedman Test across Multiple Trials	Difference over 4 trials	Difference over 4 trials	Difference over 4 trials
Physical (WHOQOL)	p <.001	p <.013	p <.000
Psychological (WHOQOL)	p <.010	NS	p <.025

5.4.7 WHOQOL-Bref Significant Conclusions

The above analysis concludes that in two out of four WHOQOL-bref domain scores those who received Global and Endocranial Osteopathic treatment significantly improved their scores. The Endocranial group experienced significant improvement in physical and psychological domains of the WHOQOL-bref. In terms of statistical power these are considered conservatively significant and may or may not apply generally to this 'at-risk' population. WHOQOL scores for the Social and Environmental domains were not found significant for either subgroup. This could be, in part, due to sample size. The WHOQOL-bref showed significant improvement for the Global group in only the physical domain, again this must be viewed as conservatively significant. The Whole group results (N=25) naturally have more statistical power and showed an absolute change between before and after treatment results in the Physical domain (p<.000). Power analysis showed a need for 28 versus 25 subjects needed to reject the null hypothesis. The Psychological domain showed significant change in overall results (p<.025). The psychological scale for the QoL had statistical power. This research exceeded the 21 participants needed to reject the null hypothesis. Therefore it can be stated that Global Osteopathic treatment had a significant effect on this subject group and results may apply to this general 'at-risk' population. More research is needed.

5.4.8 Significant Three Part Stroop Test Results

Hypothesis # 1: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective counting Stroop (cStroop) reaction times in adult subjects who experienced war-related trauma in childhood.

Hypothesis #2: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective emotional counting Stroop (ecStroop) reaction times in adult subjects who experienced war-related trauma in childhood.

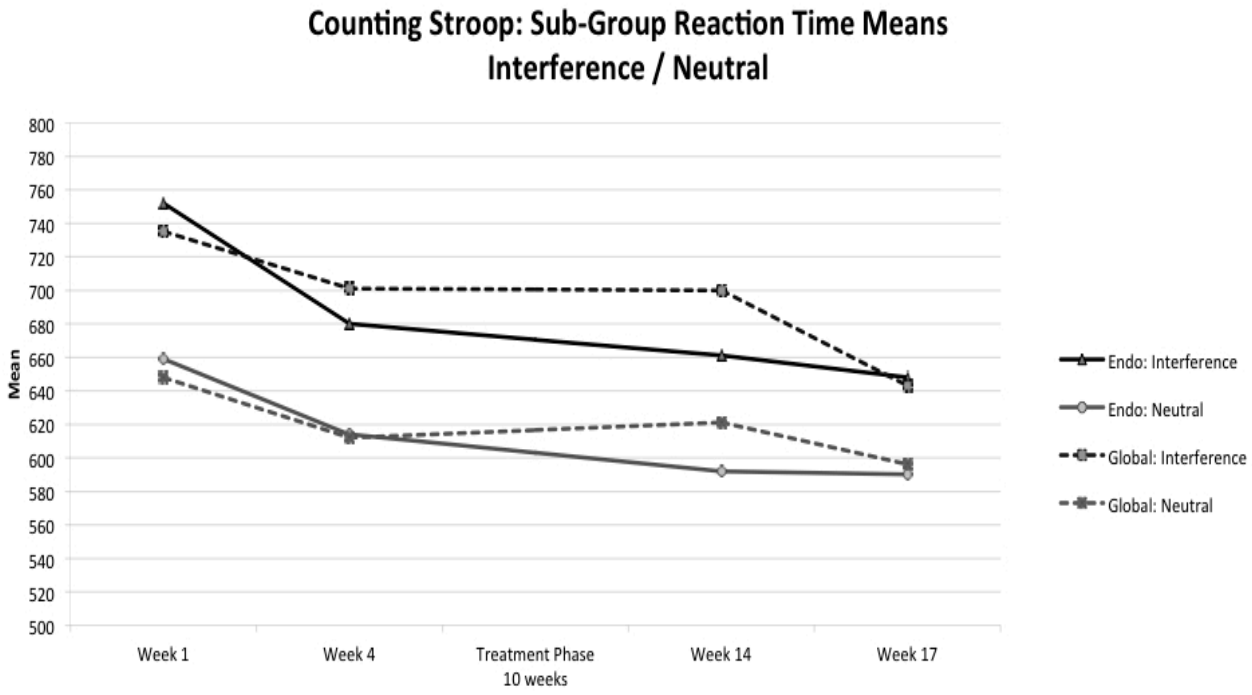
A combination of global and encocranial osteopathic treatment was expected to significantly improve reaction time scores in subjects who received treatment using the endocranial concept. It was this researcher's belief that the endocranial concept will improve overall function of cognitive processes due to the integrated motility and vitality of the encephalon. The concept underlying this belief was that trauma-exposed individuals have restricted encephalon mobility, motility and compromised vitality that may result in interference with integrated cognitive processing abilities. It was surmised that a cognitive activation test might demonstrate a link between improved endocranial health and cognitive function as measured through reaction time.

5.4.9 Stroop Test Reaction Time Results

There were no statistically significant differences in reaction times between groups in any of the four trials. Overall both subgroups improved their reaction times to the same degree over 4 Trials. On average the whole subject group (N=25) improved their total reaction time by roughly 70 milliseconds (msec). However, their rate of improvement differed between subgroups and between Trials. A clinically interesting change occurred in the reaction time patterns between the second and third Trials. The Global Osteopathic and Endocranial group versus Global Osteopathic group's reaction times grew farther apart. The Endocranial group maintained a trend of improvement. Their rate of improvement between Trial 1-2 and Trial 2-3 was the same for the Emotional Stroop. They improved by 20 msec. between Trial 2-3 versus 58 msec. between Trial 1-2 in the Counting Stroop. The Global group achieved the same or slightly poorer reaction time scores in the Third Trial than in the Second Trial. They were -3 msec. slower between Trial 2-3 versus 57 msec. faster between Trial 1-2 in the Emotional Stroop. They were -5 msec. slower between Trial 2-3 versus 35 msec. faster between Trial 1-2 in the Counting Stroop. It is worth noting that the third testing trial was scheduled in the week directly after completion of nine weeks of treatment. This divergence of scores in the third Trial is illustrated by Counting Stroop mean reaction time chart

below which shows 4 Trials, represents the two subgroups and shows interference and neutral word reaction time differences. (a descending line equals an improved / faster reaction time)

Figure 6 Counting Stroop Results



Although each sub-group improved reaction times in a continuous negative growth curve until their scores merge in the 4th trial a consistent divergence of reaction times occurs in each test of the Three Part Stroop. Low to moderate 'between sub-group' P values in the 3rd Trial reflect the fact that the Stroop test results between subgroups grew further apart. The P values listed below illustrate this divergence in reaction time scores between four trials though the 'divergence' does not become significant it demonstrates an effect that would be interesting to test in the future against an untreated control group.

Table 16 Trends between Endocranial and Global subgroups

3 Part Stroop Test	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**
Emotional Stroop	p <0.71	p <0.96	p <0.24	p <0.96
Counting Stroop	p <0.65	p <0.71	p <0.26	p <0.98
Everyday Stress Stroop	p <0.6	p <0.86	p <0.55	p <0.79

5.4.10 Additional Significant Findings

In order to examine an additional dimension of reaction time improvement further an analysis of variance was done by examining the 'Mean Reaction Time Increases between Trials 2 and 3. Two Stroop test domains showed significant difference in the rate of reaction time (RT) improvement between subgroups: the Emotional Stroop Interference words and the Counting Stroop neutral words.

5.4.11 Emotional Stroop Significant Findings

A significant difference between subgroups was found when using ANOVA to measure the Individual Mean Increase between pre-treatment Trial 2 and post-treatment Trial 3. This analysis looks at how many individuals improved their reaction time scores by 'how much' in the Interference and Neutral block, and then compares the rate of improvement between subgroups. The Emotional Stroop and the Counting Stroop each had 6 alternating interference and neutral blocks with 16 words in per block. The Emotional Stroop was the first in the three-part Stroop test. Each word trial was 1.5 milliseconds. The Emotional Stroop test had a total of 96 words and lasted 2 minutes and 40 seconds after which there was a 40 second fixation pause. ANOVA analysis detected a significant difference of $p < .04$ in the 'mean increase by individuals' analysis between Endocranial and Global sub-groups in the Interference blocks. The Endocranial group had a mean RT improvement (faster RT) of 40.2 msec (SD 55.2) compared with the Global group's negative mean (slower RT); -4.0 msec (SD 50.1).

Figure 7 Emotional Stroop – Mean increase difference

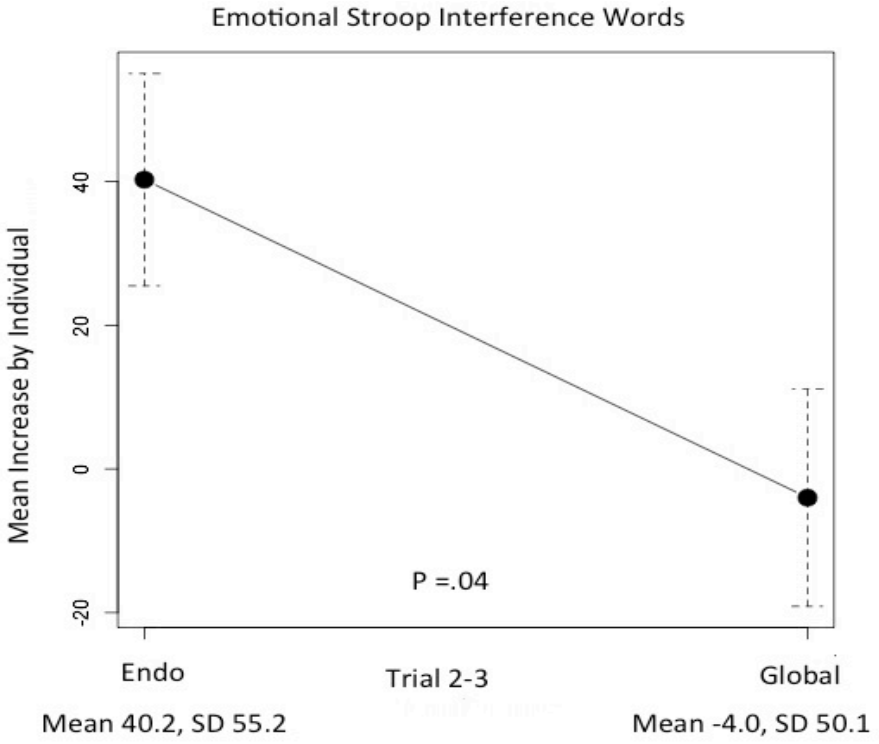


Table 17 Mean Reaction times for Emotional Interference

Treatment Style		**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**	**Total Mean RT average**
Endocranial	Emotional Interference	664	632	592	586	619
Global	Emotional Interference	680	621	625	587	628

5.4.12 Counting Stroop Significant Findings

The Counting Stroop Test was the second part of the three-part stroop test and lasted 2 minutes and 40 seconds. This test began at the 3 minute 10 second mark after the Emotional Stroop test. More individuals in the Endocranial treatment group exhibited faster reaction times (numerically lower) in the Neutral word blocks after treatment than in the Global treatment group. The Global group, conversely, had a negative RT compared with Trial 2. The Endocranial group mean increase in reaction time demonstrated by ANOVA analysis was 21.6 msec (SD 23.6). The Global treatment group had a slower (numerically higher) mean reaction time decrease of -9.3 (SD 45.3)

in Trial 3 directly after the treatment phase was. Bush, in his research using the Counting Stroop test with 9 healthy subjects reported mean RT increase of 46 msec (SD 20) during the interference blocks. (Bush, p. 273, 1998)

Figure 8 – Counting Stroop – Mean increase difference

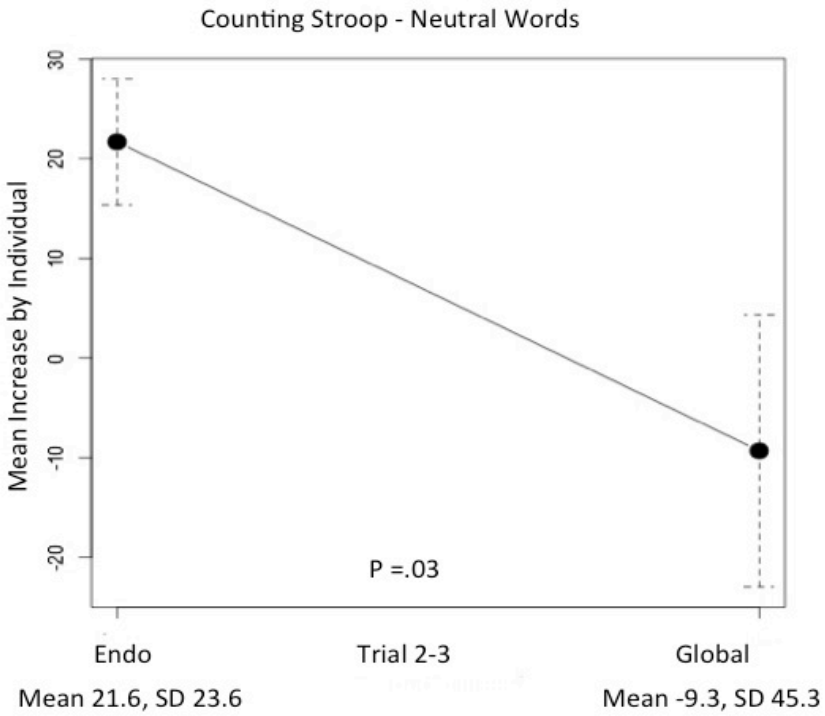


Table 18 Mean Reaction times for Counting Neutral

Treatment Style		**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**	**Total Mean RT average**
Endocranial	Counting Neutral	658	613	592	590	614
Global	Counting Neutral	648	611	621	596	619

To clarify, the overall mean reaction times between subgroups were not significantly different in Trial 3 however in both Emotional Interference and Counting Neutral test domains more Endocranial subjects improved upon their Trial 2 reaction time after Global and Endocranial Osteopathic treatment. Conversely, more Global subjects had slightly slower reaction times (numerically higher) in Trial 3 than in Trial 2.

Bush recorded significant Counting Stroop mean improvements in the Interference trial reaction times in single sitting trials with healthy individuals. Although we cannot make a direct comparison in this research – we

looked at total Interference and Neutral trends per testing Trial rather than change within one testing event, we can say the Counting Stroop interference block, in this research, did not show significant improvement between groups or between trials. Measuring significant Interference or Neutral improvement within one testing event was not analysed. The Endocranial mean increase was 18.2 msec, SD 59.8. The Global mean increase was lower at 1.6 msec, SD 61.9. (P=.505) In this research significant differences were found in the Neutral rather than the Interference trials. It was evident in Interference and Neutral blocks in each Stroop domain (Emotional and Counting) that the Endocranial treatment group mean increase reaction times improved more steadily than the Global treatment group in Trials 3 when measured against Trial 2. The only two domains showing significant mean improvement differences were: the Counting Stroop Neutral Block and the Emotional Stroop Interference Block.

When comparing each individual's total mean reaction time for the Three Part Stroop between Trial 2 and 3 this researcher found that five subjects in each group had reaction times that stayed the same. Three Global subjects became 'worse,' as well as one Endocranial subject whereas three Global subjects scored 'better' versus eight Endocranial subjects improving upon their reaction times.

Table 19 Stroop Test Individual Means: Trial 3 compared with Trial 2

Post treatment trial 3	Global Sub-group (N=11)	Endocranial Sub-group (N=14)
Same	5 (45%)	5 (35%)
Worse	3 (27%)	1 (7%)
Better	3 (27%)	8 (57%)

5.5 Conclusion

Hypothesis # 1: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective counting Stroop (cStroop) reaction times in adult subjects who experienced war-related trauma in childhood.

The above hypothesis is not supported.

Hypothesis #2: Global osteopathic and endocranial treatment following the methodology of the CEO will improve objective emotional counting Stroop (ecStroop) reaction times in adult subjects who experienced war related trauma in childhood.

The above hypothesis is not supported.

Although the above Hypothesis are not supported it can be said:

Stroop test analysis demonstrates that while receiving Global Osteoapthic and Endocranial treatment there is a trend showing more subjects will improve their reaction times at a steady rate than subjects who receive Global Osteopathic treatment. Some subjects while receiving Global Osteopathic treatment appear to show a trend toward the experience of an interference effect within one week after receiving treatment. The Stroop test demonstrated these subgroup differences were temporary. Both groups reached what may be the Stroop test 'floor effect' as demonstrated by the fact that both groups merged in the Fourth Trial. (MacLeod, 2005) (Appendix DD, EE, FF for all Stroop data)

5.6 Demographic Variables

5.6.1 Normative Data

The treatment group as a whole had a good representation of men (9) and women (17). In terms of the demographic of the endocranial and global subgroups they remained gender balanced. The endcranial group had 5 men, and 9 women. The global group had 4 men and 7 women.

The entire subject group presented as homogenous. They were within a 13-year age span. 15 were employed and 10 were students. 19 subjects reported good to excellent health. 6 reported fair to poor health. Of the 6 who reported fair to poor health 3 were in the Global group and 3 were in the Endocranial group. Two subjects

had previous accidental physical injuries that presented a challenge in treatment, but nonetheless passed the inclusion criteria. Both remained in the Global treatment group.

This researcher did not do a detailed review of the global Osteopathic osseous membranous results. This would be a worthwhile recommendation in another study. In this researcher's superficial review of subjects and their treatment results over 9 weeks there were no overt differences between subjects who came to be in the Endocranial group and subjects who were in the Global group.

5.6.2 Normative Data – SF-36

Statistician for this research Gorka Vuletić along with other colleagues in Public Health conducted an extensive SF-36 Health Survey through the School of Public Health, Zagreb Croatia that was published in 2000. Health Practitioners surveyed almost 5000 people throughout Croatia between 1997 to 1999. This research compared its subject group to Croatian normative data for Croatian adults aged 25-44, two to four years after the war. The *Croatian Health Survey – SF-36* gathered random samples from health centres in four regions of Croatia: "The total sample represents approximately 1% of the general population." (Jureša, 2000) The purpose of the study was to assess the quality of life in the Croatian population during their post-war transition years.

Table 20 SF-36 Health Survey normative comparisons for Trial 2 and Trial 4

The Osteopathic Treatment of Adults who experienced war as children
The Croatian Health Survey
Canadian normative data for the SF-36 health survey

Domains, Means, Standard Deviation	**Canadians** 25-34 years old	**Croatia** 25-44 years old (1997-1999)	**Global** pre-Tx. 21-34 years old (2011)	**Global** post-Tx	**Endocranial** pre-Tx. 23-31 years old (2011)	**Endocranial** post-Tx
PF						
Mean	**92.4**	**82.83**	79.54	85.00	76.42	92.85
S.D.	**14.6**	**25.91**	19.55	14.83	19.75	8.70
RP						
Mean	**87.1**	**76.07**	**40.90**	70.45	**58.92**	85.71
S.D.	**29.3**	**36.80**	42.23	41.56	41.14	21.29
BP						
Mean	**77.0**	**74.06**	**55.55**	66.66	74.60	80.95
S.D.	**21.8**	**26.51**	28.10	25.81	18.70	23.64
GH						
Mean	**79.0**	**62.97**	52.90	67.63	65.64	**82.64**
S.D.	**16.1**	**19.40**	20.30	16.75	20.43	12.02
VT						
Mean	**64.9**	**56.64**	41.36	50.90	50.00	61.07
S.D.	**17.7**	**19.24**	22.81	20.95	26.96	18.41
SF						
Mean	**86.3**	**78.04**	**55.55**	67.67	**57.14**	71.42
S.D.	**20.3**	**23.36**	27.21	18.22	24.20	16.71
RE						
Mean	**82.9**	**77.08**	72.72	63.63	**57.14**	71.42
S.D.	**32.3**	**37.09**	32.72	45.83	42.22	36.64
MH						
Mean	**75.9**	**64.70**	64.72	66.18	59.71	73.42
S.D.	**15.7**	**17.85**	15.05	20.50	18.92	14.34

(Jureša, 2000, Hopman, 2000)
Tx = Treatment

Though the SF-36 whole group results are not listed above the researcher can report that as a group these subjects scored lower than the national normative averages in 7 out of 8 domains. General Health Perception showed a mean value of 60.00 versus 62.97 in Croatian Health Survey (see SF-36 Whole group Appendix). After Osteopathic treatment as a group they improved upon the national average in 4 domains (PF, RP, GH, MH) and equalled them in two. (VT, SF) Body Pain and Role Emotional remained lower than the above presented norms.

Prior to treatment both endocranial and global groups scored below the Croatian average for their age group in Role Physical (RP), Vitality (VT) and Social Functioning (SF). In addition, the Global group was lower

that the Croatian norm in Body Pain (BP) and General Health Perception (GH) making a total of 5 domains below the norm. The Endocranial group had a total of 4 domains below the national average in 2000, adding Role Emotional (RE). The conclusion is that trauma exposed children, in adulthood, exhibit 'at risk' tendencies by scoring lower than national averages in some measures according to the SF-36 Health Survey.

After treatment all Endocranial subjects achieved scores in the normative range for Croatia and exceeded those scores to match four Canadian normative values in Physical Functioning (PF), Role Physical (RP), General Health Perception (GH), and Mental Health (MH). The Global group also improved three scores to match the national health average, specifically these were RP, GH, and VT. They sustained their national health averages in Physical Functioning and Mental Health as did the Endocranial group. However, two scores remained below the Croatian average for the Global group before and after treatment (BP, SF) and they decrease in one score (R.E.). As a result the Global treatment group finished with 5 domains at the Croatian norm. Two stayed the same, these were Body Pain (no change) and Social Functioning (no change) - while Role Emotional decreased. The conclusion is that although 4 scores were below the national average (10 years earlier) the Endocranial group demonstrated a resilient ability to improve their quality of life scores after global osteopathic and endocranial treatment.

The Global group demonstrated that their vitality and mental health responded to 9 weeks of Osteopathic treatment and came to meet the national averages; however, it appears the treatment timeline was insufficient to create significant improvement in all measures. The Global subject group improved their SF-36 averages in all measures except one (RE). Therefore, it cannot be said that Global Osteopathic treatment was inappropriate for them.

Overall, the Croatian comparative data seems to indicate the presence of some factors acting upon the demographic chosen for this research that reveal some challenges. It is possible that some influences may exist within the culture in the two different time periods being compared. Five years after the war there may have been a level of optimism concerning their recovery. Now 15 years later the reality of the on-going challenges of economic recovery may have an influence on this generation who are now in the workforce. Although this may still be true the unemployment records don't support this entirely. At the time the Croatian Health survey was conducted unemployment rose from 10% to 14% between 1997 and 1999. Unemployment rates were comparable at 13.4% during the period of this research. This rate was on the rise however from an 8% low in 2008. (Retrieved from: International Monetary Fund index for Croatia)

When asked to comment on this research groups lower health scores now 10 years after her original work Gorka Vuletić said, "Yes, definitely, they are facing a high level of stress. They are young adults in post-war period in the country 'in transition.' We had and still have socioeconomic difficulties, high unemployment rate, slow economy and privatization which results in fewer places for employment. They are now stepping into this." (personal communication, February 11, 2012)

Another possibility for their tendency for lower average results is that this subject group accurately 'self-selected' their participation based on an actual need. Subjects chose to attend this research because they were aware of a need for treatment. It is difficult to say where perception of a problem ends and the presence of a 'measured' problem begins. This researcher would suggest these two elements have a reciprocal influence. Therefore as children of war what they 'lived' physically and emotionally in the past, in consideration of their perception in the present has a valid relationship. The normative data set seems to confirm the accuracy of their self-perception.

Even though these subjects were not screened for PTSD (in order to emphasize a 'survey' approach), and the data does not support the presence of PTSD, data does support the presence of 'an effect' within an 'at risk' demographic. We must conclude that although it is difficult to know a patient's source of stress, clearly it is important in the Osteopathic field to support patients in their naturally inherent ability to manage it. Their internal link to their own health resources and personal self-sustainability is the focus of this work.

5.6.3 Normative Data – Whoqol

Table 21 WHOQOL Normative Comparisons

The Osteopathic Treatment of Adults who experienced war as children
Amir, Lev-Wiesel Child Survivors and Comparison Group

Domains	Child Survivors (n=43)	Comparison Group (n=87)	Whole Group (n=25)	Endocranial Group (n=14)	Global Group (n=11)
Physical	**14.31 (3.69)**	16.04 (2.50)	**14.40 (2.88)**	**14.40 (2.90)** / 16.32 (1.69)	**14.39 (2.98)** / 15.22 (2.13)
Psychological	13.86 (2.39)	15.86 (1.99)	15.09 (2.47)	15.33 (2.77) / 16.48 (2.0)	**14.79 (2.13)** / **14.84 (2.58)**
Social	14.35 (2.67)	15.74 (3.09)	15.79 (2.71)	15.62 (3.2) / 15.62 (3.2)	16.00 (2.06) / 15.51 (3.28)
Environmental	14.73 (2.04)	14.84 (2.73)	14.36 (2.22)	14.42 (1.76) / 15.14 (2.0)	14.27 (2.79) / 14.13 (2.83)

(Amir, 2003), Means and Standard Deviations (in parenthesis)
For Trial 1 and Trial 4: shown respectively by back slash /

This study's subject group as a whole has WHOQOL Physical domain scores that are comparable to the Amir, Lev-Wiesel Child Survivors group and lower than their Comparison Group. The Amir, Lev-Wiesel subjects were childhood Holocaust survivors during WWII. Their test scores were recorded in 2002 fifty-five years after the war. (Amir, 2003)

Findings show that trauma exposure during childhood can exhibit long-lasting physical risk indicators that are present, in the case of this study group, in 21- to 34-year olds, 15 years after war exposure. This comparison with Holocaust survivors differs in that the Holocaust survivors were all over 55 years of age. The Amir, Lev-Wiesel study defines a child survivor as someone 16 or younger when WWII ended. The Amir, Lev-Wiesel study was conducted in Israel. (Amir, 2003)

In the Physical score, the Endocranial group achieved a normative value by the 4th Trial. The Global Group improved but remained at a mid-range value. The only other 'non-normative' value was exhibited by the Global group who showed a Psychological score in the mid-range between Child Survivors and the Comparison Group. Their Psychological score did not reach a normative comparison by the end of 9 weeks of Global Osteopathic treatment. The Endocranial group was equal to the Amir Comparison Group in Psychological scores. Both Endocranial and Global groups were the same as the Amir comparison group in Social and Environmental scores.

In general, the WHOQOL comparison reveals a subject group that is on par with normative values gathered in Israel. As with the SF-36, the endocranial group achieved normative scores in all 4 Domains in the last Trial test taken 4 weeks after completion of treatment. The Global group again had mixed comparative results. We can conclude that other factors are at work in the Global subject group that did not remain an influence on the Endocranial group in the Physical domain.

5.6.4 Treatment Records

Treatment data was examined in order to understand the range of variation or homogeneity this subject group represented in terms of Osteopathic lesions based on the Endocranial Treatment group inclusion criteria. (Appendix Q) Demographic and treatment data was collated in order to expose patterns that may be specific to each subgroup or the group as a whole.

Upon initiation of treatment 68% (17/25) of subjects had no PRM (primary respiratory mechanism). Sixty percent of subjects (15/25) had distinct encephalon findings (DEF) such as global encephalon retraction, absence of mobility and motility (inherent motion), compaction of the archaic to limbic and volumetric densification of the brain stem parenchyma. Patient assessments indicated treatment using global Osteopathy in addition to endocranial treatment was appropriate for this subject group of 25.

Fifteen subjects were found to have distinct encephalon findings (DEF). These fifteen subjects were not limited to one group or the other but were divided equally between subgroups. Five subjects with DEF also had PRM at the onset of treatment. The five subjects who had DEF as well as PRM at onset of treatment were all able to receive endocranial treatment. It was also noted that two of the five who had DEF and PRM at onset of treatment had received osteopathic treatment in the past, with one month off as an inclusion criteria for joining this research. Only two of the 10 subjects with no PRM in addition to DEF qualified for endocranial treatment. Eight subjects with DEF and no PRM at onset of treatment remained in the Global treatment group. This means 73% of the Global group subjects had distinct encephalon findings and no primary respiratory mechanism present at the beginning of treatment. All subjects had systemic vitality and PRM by the end of the treatment phase. It was noted however that the presence of distinctive encephalon findings in addition to a lack of PRM at onset of treatment significantly reduced the likelihood of successful endocranial treatment in this research.

Table 22 Treatment Findings at Onset of Research

ENDO	PRM	DEF	Spasm Tx	Prior Tx	GLOBAL	PRM	DEF	Prior Tx
1	Yes	Yes	E	Tx	1	Yes		
2	Yes	Yes	E		2	Yes		
3	Yes	Yes	E, T	Tx	3	No		
4	Yes	Yes			4	No	Yes	Tx
5	Yes	Yes			5	No	Yes	
6	Yes		E	Tx	6	No	Yes	
7	Yes				7	No	Yes	
8	No		T		8	No	Yes	
9	No		T		9	No	Yes	
10	No		T		10	No	Yes	
11	No		E		11	No	Yes	
12	No		T					
13	No	Yes						
14	No	Yes	T, E					

PRM (Primary Respiratory Mechanism) at onset of Treatment Phase
DEF (Distinct Encephalon Findings) at onset of Treatment Phase
Prior Tx – Ongoing Osteopathic treatment prior to joining Research Program
E – emotional spasm
T – traumatic spasm

5.6.5 Endocranial Spasms

Seventy one percent of subjects in the Endocranial subgroup received endocranial spasm treatment. Four out of the 14 who achieved a minimum of three CNS criteria for Endocranial treatment, (Appendix Q, X) and were included in the Endocranial subgroup, did not receive spasm treatment. A state of readiness for spasm treatment did not present itself in these four subjects.

Ten out of 14 subjects included in Endocranial group had spasms treated:

- 4 had traumatic spasms treated
- 4 had emotional spasms treated
- 2 emotional and traumatic spasms treated

If given endless access to a statistician's time it would have been interesting to look at the objective measures results for the ten subjects who received endocranial treatment. However in consultation with Genevieve Forget D.O. she felt that two to three months of integration time would best reveal true effects of endocranial spasm treatment.

Chapter 6: DISCUSSION

CHAPTER 6: DISCUSSION

In taking an overview of what was achieved in this study we can see the results that emerged show information on a variety of fronts that could lead to future 'action plans.' Information about childhood exposure to trauma and its influence in adulthood was drawn from the comparative results of Quality of Life scales in this research for the whole subject group with Normative Data from other research sources. It was found that trauma exposure may have had an effect on this subject groups quality of life however other present day factors cannot be eliminated as an influence. Statistical results for the whole group had power in the SF-36 Physical component scales for the necessary minimum of 19 subjects. Conversely the WHOQOL whole group result had statistical power in the Psychological Domain with 21 subjects necessary for validity. The QoL Physical Domain required 28 subjects, the SF-36 Mental Health components required 41 subjects for significance. Because most SF-36 scales combine Physical and Mental components Sf-36 results can be considered conservatively significant.

Using a Chronological Inter Subject research design revealed a pattern over four Trials which suggests that Osteopathic treatment improved quality of life of twenty-five subjects. This research design also revealed different behaviour trends between the Endocranial subgroup and the Global subgroup. Even though the hypothesis for this thesis only concerned the subjects who received Global and Endocranial treatment, and the statistical analysis was not done for the sake of 'quantitative comparison' we can see that the different trends present in each group suggest subjects who were able to receive Global Osteopathic and Endocranial treatment experienced more significant score changes in both Health Surveys and generally performed better in all domains.

Information in this research was also gathered from the Three Part Stroop test results that did not show a significant difference between subgroups but rather revealed a treatment effect, measured through a cognitive activation test, that 'might be' an expression of indirect, long axis Global Osteopathic treatment in the Global subgroup versus short axis, direct Endocranial treatment in the Endocranial subgroup. The results are inconclusive but invite much speculation.

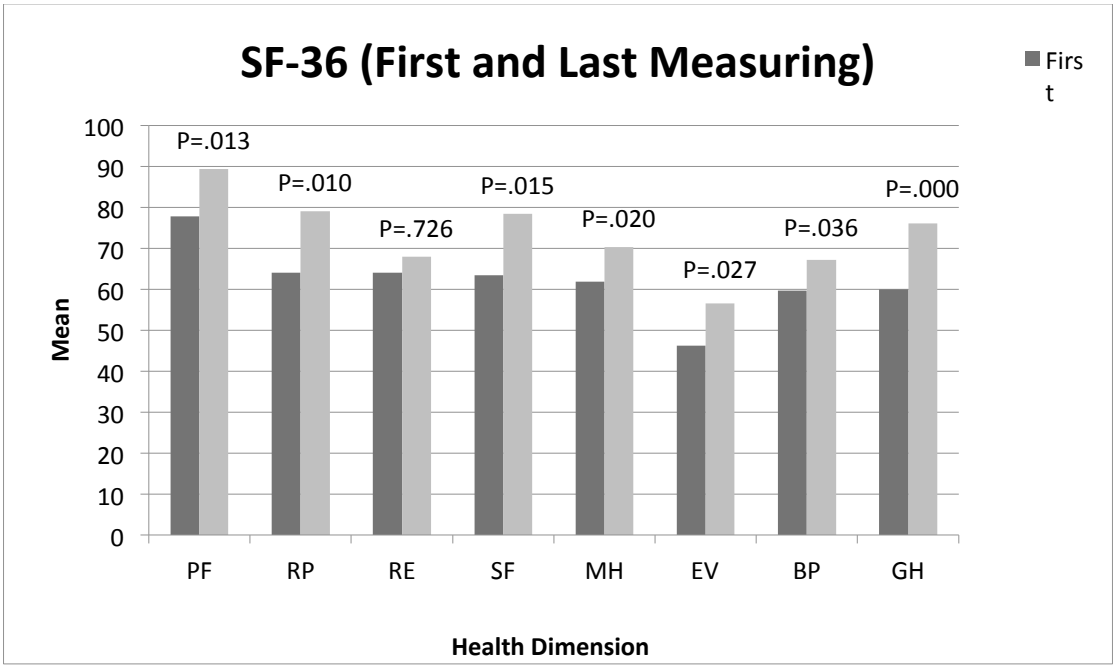
This research provides an Osteopathically based overview of an at risk subject group by having taken a 'survey approach' to this research. This researcher feels that the treatment findings and objective testing results for this subject group reveal some trends that require further investigation. Further research could build upon these

findings in order to formulate better questions and better tools to understand the needs of a trauma-exposed population.

6.1 SF-36 Whole Group

In this Chronological study the SF-36 appeared to reveal the most significant results. When looking at all objective measures for the whole group (n=25) we can say that 9 weeks of Osteopathic intervention was advantageous for all subjects. Whole group results revealed significant change (p>.05) in 7 out of 8 domains, Role Emotional was the only exception.

Figure 9 SF-36 Whole Treatment Group



Whole Treatment Group N=25, Trial 2, Trial 4

6.1.1 Perception Change

Subjects also exhibited a shift toward improved outlook. This was measured by the SF-36 'Change in Health' dimension. As stated in the Data and Analysis, this Health Dimension does not ask about present conditions but rather asks subjects to evaluate how much change they've experienced in the previous year. The change in health results show that a greater number of subjects believed they changed more over the past year after 9 weeks of Osteopathic treatment than they did before receiving treatment. Their view of the past changed relative to how they

felt in the present. Before treatment 40% of subjects believed they were *somewhat better* and *much better* than the year before. After treatment 60% of subjects held this belief. Prior to treatment the *much better*, *somewhat better* and *about the same* categories totalled 68% after treatment they totalled 88%. Prior to treatment 32% reported changing for the worse (*much worse* and *somewhat worse*) after treatment 12% gave this report. After treatment no one reported being *much worse*. It is interesting to see that their view of the past can change. This is an important attribute for resilience and renewal in daily life.

Table 23 SF-36 Change in Health – Whole Group

Change in health	category	N=25	Column N %
health relative to one year ago 1st measuring	much better	4	16.0%
	somewhat better	4	16.0%
	about the same	9	36.0%
	somewhat worse	7	28.0%
	much worse	1	4.0%
health relative to one year ago 2nd measuring	much better	7	28.0%
	somewhat better	8	32.0%
	about the same	7	28.0%
	somewhat worse	3	12.0%
	much worse	0	.0%

In a study titled *Memory bias for emotional information in children and adolescents with post traumatic stress disorder: a preliminary study,* Moradi et al based their research on evidence that adults with PTSD "revealed an explicit memory bias in favor of recalling negative emotional information, particularly if the information is related to the participants' emotional concerns." (Moradi, Ali, 2000) Moradi found the same results in adolescent subjects. Research such as Moradi's functions on the hypothesis that memories sometimes are a reflection of present emotional states: we remember the past in a certain way in order to justify the present. In this case the Change in Health measure reveals a positive memory bias. This is a positive health indicator that rejects a PTSD diagnosis.

It is also interesting to note that the Role Emotional (RE) scale was the only domain neither group showed

significance in. However one group scored well in Vitality (VT) and the other in Mental Health (MH). All three of these domains have a high 'mental component' factored in which in the SF-36 reflects emotional well-being. Though it seems contradictory that they can have an improved perception of their previous year but not improve in Role Emotional it in fact makes sense when we realize that RE asks questions about how much time they have, are they rushed, and how much they are accomplishing. These questions are designed to draw out a sense of their present milieu within the last four weeks; whereas the Mental Health score focuses on whether they feel happy, peaceful, sad or nervous. These are much more general emotional terms that don't engage presently felt pressures of 'roles' within a rushed timeline. Vitality also asks general questions about how much energy and vigour versus fatigue they have. Interestingly, the Global group scored low on the RE 'time pressured' scored but a near significant p value ($p<.058$) on Vitality. Maybe it is possible to say that having energy makes one feel better about the previous year even with the pressures of time. (Ware, John, p. 3132, 2000)

6.1.2 SF-36 Subgroups

In light of the Osteopathic belief that mobility is the hallmark of health, it is interesting to note the degree to which post-treatment evaluation of encephalon mobility and vitality divided the group into categorically distinctive results. Even though they all show degrees of improvement the more mobile of the two groups (the Endocranial group) appears to be 'enjoying' their health simply with more ease.

Rolin Becker declared, "Motion is not life. Motion is a manifestation of life." Then Becker adds,

> All motion and movement are effects, whether they be thought processes, emotional experiences, or body physiological mechanisms. In order to have motion and movement, it is necessary to include the automatic, shifting, suspension still points or fulcrums that allow these motions and movements to exist.
> (Becker, p. 50, 53, 1997)

Rollin Becker DO has often stated the link between stress, thought, emotion and mobility. Philippe Druelle DO refers to the effect of the overall phenomena of ease in mobility as resonance. He has given the image of a bell to explain this. A bell that is not in action has no sound. But a bell free to move may manifest and express life. Though each group has mobility they are in various stages of resonance in the discovery of their own unique tone. (Stark, 2000)

6.1.3 Global Subgroup

As a sub-group the Global treatment group results show marginal improvement in 3 domains (RP, BP, EV) and one significant score (GH). Two of the marginally improved domains occurred in regions the Endocranial group

did not show significant gains. These were Energy/Vitality (EV, $p < .058$) and Body Pain (BP, $p < .08$). An explanation for the fact that the Global group showed a mean increase in Vitality and Body Pain scores whereas the Endocranial group did not can be seen by looking at each group's relative scores prior to treatment. The Global group started with lower scores in Vitality and Body Pain and thus had more room for improvement in terms of gaining energy. In terms of normative comparisons the Global group scored below the SF-36 Croatian National averages in Vitality and Body Pain. The Endocranial group on the other hand scored higher in terms of body pain at the start of research. They did not make significant gains in Vitality nonetheless they rose to exceed the National average.

To give another perspective as to the areas the Global group did and did not improve in it is clarifying to note, for example, that even though they did not improve their Mental Health score, in the pre-treatment test they had the same mean (Global group: 64.72) as the Croatian Health Survey (64.70) and they improved that score slightly after treatment (Global group: 66.18). Compare this with the Endocranial group who were slightly lower than the national average (Endo: 59.71 to 73.42) but improved significantly to match the Canadian average (75.9) after treatment. The relative need for change was different in the two subgroups.

6.1.4 Endocranial Subgroup

The Endocranial treatment group showed significance in 4 domains (PF, RP, MH, GH) and one marginal. (SF) Three of the domains that they improved in, relative to themselves, were comparable to the Croatian National norms for the SF-36 prior to treatment (PF, MH, GH). Only one score was distinctly lower than the National average. Yet, three additional domains, that they did not show statistically significant gains in improved enough to match the National norms after treatment whereas they were lower before treatment. As a result this group exceeded all Croatian National average SF-36 scores after treatment. When examined as an independent treatment group it can be concluded that subjects who received Global Osteopathic treatment in combination with endocranial treatment significantly improved in quality of life.

SF-36 Between Group Significance Trends

The most significant score for both groups independently was in General Health Perception. Although they both improved significantly this was, paradoxically, the only domain in which they also differed greatly. The ANOVA between group analysis showed a Group Effect of $p < .04$.

General Health Perception (GH) was the only significant probability value achieved by the Global group ($p < .004$). This score was also lower than the Croatian National average but then rose to exceed the national average. General Health Perception domain questions reflect 'poor versus excellent health expectations.' (The SF Community – SF-36 Health Survey Update. Pg. 11, 12)

In scoring, GH is clustered with the Physical outcomes but in its mental component it measures expectation rather than present condition. It is possible then to speculate that though their Body Pain (BP) score improved only marginally their optimism in terms of positive expectations as part of the measure 'within' GH influenced the significant outcome for this score. The same can be said for the Endocranial group: this was also their best independent probability value ($p < .010$). It is interesting for this researcher to notice that the General Health Perception score factors in 'expectations.' Change in Health Perception represents a view of the past where as Role Emotional surveys the present. Their view of the past measured well, expectation was the best and the view of the present had yet to change.

6.1.5 SF-36 Inter-subject Design and Triangulation

The results interpreted from health surveys such as the SF-36 are based on subscales that measure mental and physical health based on validity studies for general health. When using inter-subject research designs, the health measure is significant or not, directly in relation to the baseline the subjects generate 'for themselves.' If they are already expressing health in one particular domain the treatment gains will be smaller. If they have 'room to grow' by having a low score in one domain they are more likely to show significant improvement.

An inter-subject study using a Chronological design in this research required a triangulated analysis of results to compare two treatment groups with normative data from other sources. (Tables 20, 21) This comparison analysis was used in order to authentically determine if Osteopathic treatment not only had an effect, but if there was a need present in the first place. The normative data indicated that a need appeared to exist.

6.1.6 SF-36 Conclusions

A triangulated analysis between SF-36 results for this research with the Croatian SF-36 Health survey (Juriša, 2000) produced the following conclusions:

- In terms of Osteopathic treatment we can conclude that a significant effect was demonstrated on the group as a whole.

- A conservative significant effect was demonstrated in half of all SF-36 health domains in subjects with greater endocranial mobility.
- A marginal effect was demonstrated in half of all SF-36 health domains in subjects with less endocranial mobility.
- An improvement upon all National SF-36 norms occurred in subjects with greater endocranial mobility.
- An improvement in five out of eight National SF-36 norms occurred in subjects with less endocranial mobility.

6.1.7 Osteopathic Implications

In view of Osteopathic methods of treatment the following are possible factors of influence:

6.1.8 Central Chain Factors

The subjects are responding to the benefit of good structural alignment. Their anatomical centres are in resonance which means there is a flow of oxygen and nourishment to vital organs. The CSF will not be inhibited from providing nutrients to the CNS or joining the interstitial fluids and improving lymphatic function. In other words the subject may use their energy for themselves rather than expending energy on accommodating lesions. According to Philippe Druelle the elements of the central chain have a harmonic resonance that in health expresses the natural unity and wholeness of our anatomical structures: "We are not looking at the pericardium, the root of the mesentery, or the SBS in isolation. These central chain elements were once and still are, embryologically linked. All the elements were once present in one cell, therefore, potential for harmonic resonance exists." (Stark, 2000)

6.1.9 Biochemical Factors

Osteopathically if we speculate why endocranial work appeared to improved outcomes, we can look to a reduced allostatic load. The relationship of hormonal-chemical and immune response mechanisms may not have to work as hard to maintain homeostasis. The hypothalamic-pituitary axis will function more efficiently within a centered third ventricle. This in combination with proper global structure and function supports the endocrine function systemically.

> The organs of the endocrine system do not have structural connections. This makes it important to understand the development of the HPA- axis and underline vascular approaches in treatment. Blood flow is the main connection thru which hormonal information travels from the hypothalamus via pituitary to the adrenals.
>
> (Williams, 2010)

When the emotional environment is in balance the body's chemical environment is naturally supported. In turn cells, fluids and tissues can support the HPA and reduce the engagement of the cycle of stress that may bring cortisol function into its normal daily rhythm. In Sutherland's Contributions of Thought, he writes about the interchange of CSF and blood that is the delivery system for Stills' concept of the body's natural drug store. Sutherland states, "You, as one of the mechanics of the cranium, become a pharmacist in your art of knowing this mechanism – not merely the articular mechanism and that little fulcrum of the falx and the tent, but the fulcrum in the fluctuation of the cerebrospinal fluid, its still point. Bring the fluctuation of the cerebrospinal fluid down to its rhythmic balance where all the fluids have the immediate interchange between the cerebrospinal fluid and the blood." (Sutherland, p. 342, 1998)

6.1.10 Positivism

One factor that very likely had an effect on treatment outcomes was the fact that this was viewed as a positive experience. The subjects were cared for. There was also an 'extra sense' of being cared for because of the 'specialness' involved in someone from another country who was willing to making such an effort for them. When asked why this researcher came to them specifically this researcher shared her story that an awareness of Croatian war children began with conversations in Japan with a Japanese NGO worker, Naomi Yodokawa. She replied, "You mean people think about us?" 'Yes' was an answer that this researcher is certain became a positive part of the milieu of Osteopathic treatment for her and maybe for others. Also, the final testing was in April versus January so spring was in full bloom. Even if these things created a bias these symbols of growth and re-birth were welcomed by this researcher. The work was very much indeed like raking leaves off of crocuses.

6.2 Whoqol Discussion

The QoL, as it is often called, was the second of the two quality of life surveys given in this study and the only one administered at all four Trials. It provides the best 'visual map' to illustrate the overall trends of this chronological research. The Whole group measure in the Psychological chart below demonstrates a consistent baseline control. The first and second trials have comparable scores. And an improved score occurs for the whole group as well as the subgroups between Trial 2 and 3 however, it falls again four weeks after the completion of treatment. This overall trend appears in the other three QoL domains. It appears that the 'positive experience' effect that naturally happens with hands-on care oriented work boots the scores directly after treatment. Three weeks later

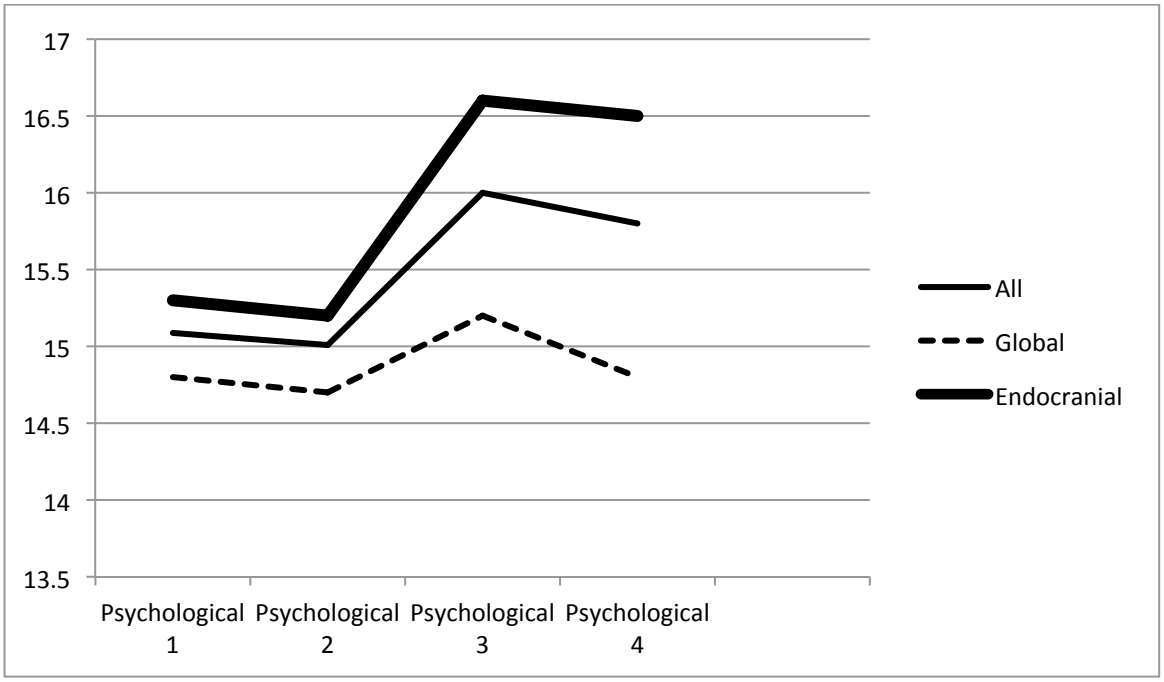
a ‘reality shift’ occurs and their quality of life score probably reflects the ‘state’ that they are able to maintain without support.

As we can see below the Global group who did not have a significant combined Freidman score virtually return to their original baseline control score, whereas the Endocranial group begins at a higher control score, improves significantly with a combined Friedman of $p < .010$, and sustains a ‘quality of life state’ that is still significantly greater than their baseline. Trial 1 versus Trial 4 was $p < .032$.

It is interesting to note that this group of 25 was in fact not homogeneous when taking Osteopathic treatment milestones into account. There was in fact a lot of trait variability in a group that had a high demographic correlation. It is possible this reflects the degree to which resilience plays a role in the long-term effects of trauma exposure. Are we seeing the anchored presence of developmental traumatology or are we seeing the average effects of life on any random group of young adults? Without a pure non-exposed control group this can’t be answered empirically. However normative data does indicate the Global group is moderately below the Amir, Lev-Wiesel norms. More research is required.

From an Osteopathic view-point in consideration of the dual treatment methodology, global and endocranial, in this research if we consider the effects of physiological versus non-physiological axis we may gain insight into the different patterns here. The QoL Psychological domain measures not only body image, negative and positive feelings but also concentration, memory and learning. These elements are attributes of cognitive coherence. It is possible that the Endocranial group was able to sustain a cranial sphere axis as part of their overall physical integration because they received direct treatment in that realm. The Global group, generally speaking, did not achieve the same level of access to the cranial sphere as there were incomplete and on-going integration processes in their osseous membranous realm. The cranial sphere will always react to ‘long distance’ fascial drags on Sutherland’s fulcrum. (Sutherland, Contributions of thought) If we may presume to correlate a physical influence on cognitive integration this may be one possible explanation for the inability to make or sustain gains in the Psychological domain of the QoL.

Figure 10 WHOQOL-bref Psychological Domain – 4 Trials



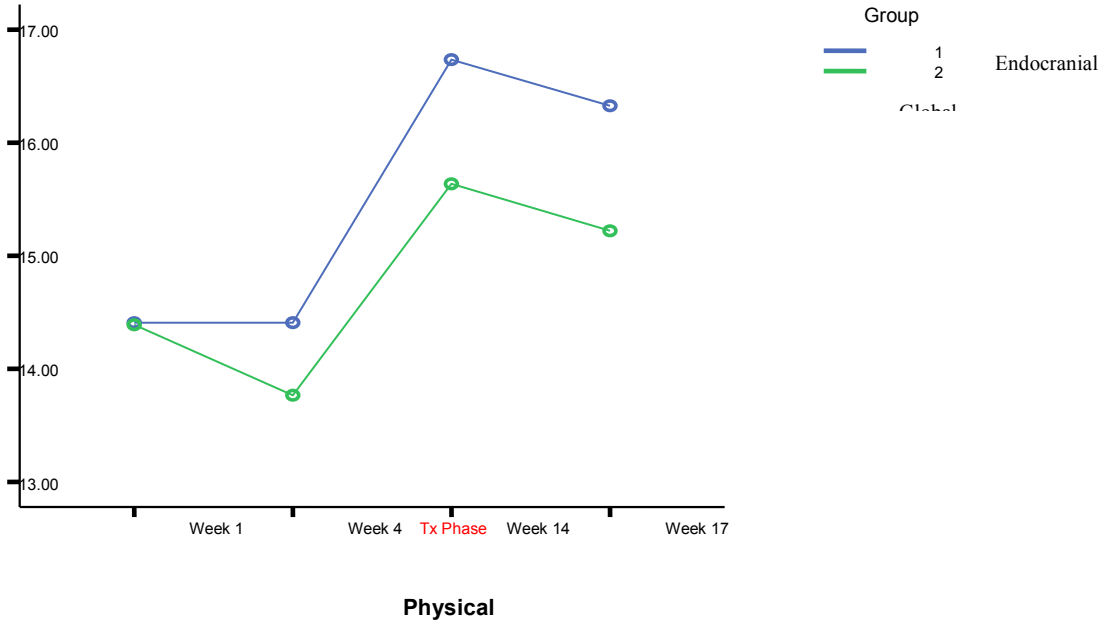
The QoL Physical Domain scores illustrate another statistically relevant illustration that describes the likelihood that this whole subject group fits a trauma-exposed profile. As stated in the Demographic and Normative Data review their combined Physical score was the only measure in the comparative data that matched the Amir, Lev-Wiesel Child Survivors baseline. They begin below 'an average norm'; however, they all make significant gains.

The Chronological pattern of their Physical scores tells a slightly different story than the Psychological scores. There is a measure of homogeneity in their baseline control in that they all begin in the same place in Trial 1 and diverge from there. The difference between the two subgroups is not significant in the second Trial but a trend of difference begins to emerge. However this could simply be normal 'life variance.' Again there is a drop in the fourth trial that might reflect an adjustment to normal life reality. The overall Friedman for the Whole group and the Endocranial group was $p<.000$ and $p<.013$ for the Global group.

It may be concluded that both Global Osteopathic and Endocranial treatment, separately and together, supported this group enough to make significant gains. As with the Psychological score the Endocranial group appears to have been able to sustain their sense of physical well-being 4 weeks after the close of treatment. The

Global group also sustains their gains in the osseous membranous realm. The Physical QoL surveys their ability to sleep, rest, act and work comfortably.

Figure 11 Plot Physical Scores



6.2.1 Whoqol-Bref Conclusions

Overall the Chronological design revealed interesting trends as shown by the QoL. In order to really overcome the 'positive experience' effect, again it would be beneficial to have an untreated control group. It would also be valuable to test the entire group three months after treatment to see what 'baseline' in living they are sustaining. It is also believed that endocranial spasm treatment effects are not entirely revealed until a few months have passed. Certainly having a 'one year later' retesting sample would also provide insight into the 'hoped for' long term quality of life effects of Osteopathic and Endocranial treatment.

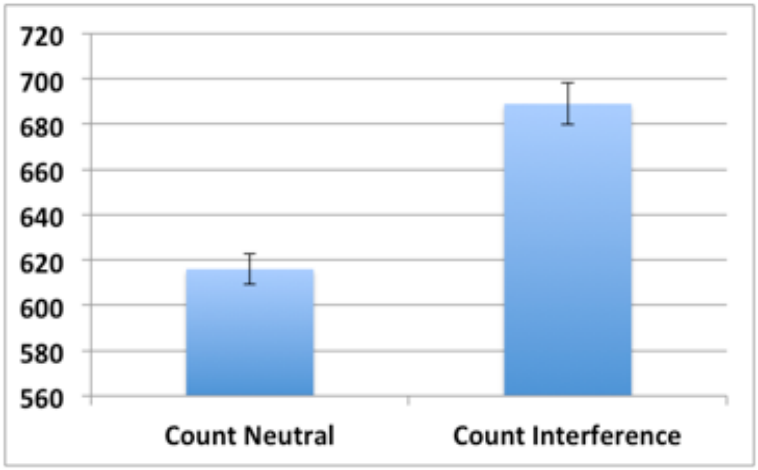
6.3 Stroop Discussion

6.3.1 Normative Stroop Data Comparisons

This subject group expressed a total reaction time in milliseconds for neutral and interference that was comparable to Bush et al in his study *The Counting Stroop: An Interference Task Specialized for Functional*

Neuroimaging – Validation Study with Functional MRI. (Bush, 1998) This study contrasted Counting neutral and interference reaction time for the total group at 617 milliseconds (msecs) and 690 msecs respectively. Bush's health subjects reaction times were 613 msecs for neutral and 710 msecs for interference. This contrasts with Shin's PTSD subject scores at 821, neutral and 772, interference. She contrasted this group with trauma-exposed subjects who scored in a similar range as the PTSD subjects: 830, interference and 754, neutral. The above comparisons might suggest that this research subject group did not fit the PTSD or trauma-exposed comparisons but rather had reaction times that were within a normal range according to Bush's work. (Bush, 1998, Shin, 2007) Unfortunately the total interference/neutral reaction time differential for this research was added up over 4 Trials and the Shin, Bush totals were for one Trial. Therefore this is by no means a pure comparison however it is an indicator that this Stroop design and function seemed to be comparable. This researcher would recommend doing this analysis for each 'word window trial' within in one testing if this work were repeated.

Figure 12 Counting Stroop Test: Neutral and Interference comparison for Whole Group



Another test comparison that confirms the similarity of this Stroop test structure with Bush is that his overall increase p value differences, between total interference and neutral reaction time scores, was $p < 0.001$ (Bush, p.274, 1998). This research achieved the same differential. ($p < 0.001$). In healthy subjects Shin found the 'distance' between the interference and neutral score became smaller with repeated practice. Shin measured each word trial window to demonstrate this pattern of narrowing difference between Interference and Neutral. This researcher was not able to do that analysis but, again, it would be another possibility.

6.3.2 Stroop Expectations

Based on the recipe laid out by Shin, Bush, and Whalen, this researcher expected to find a baseline of reaction times before treatment that would improve significantly after treatment. If there was a significant difference between before treatment and after treatment reaction times, versus no significance, between control Trials 1 and 2, and outcome Trials 3 and 4, then it might be surmised that a treatment effect had occurred.

Lisa Shin observed that subjects with PTSD had slower reaction times than healthy subjects when performing the Emotional Stroop. (Shin, p. 935, 2001) "In the Combat versus General Negative comparison (words), the non-PTSD group exhibited significant fMRI blood oxygenation level-dependent signal increases in rostral anterior cingulate cortex, but the PTSD group did not." (Shin, p. 932) Therefore if trauma exposed symptoms existed in this subject group, and we were able to have a treatment effect on cognitive integration, subject reaction times should increase in Trials 3 and 4. Reaction times should be different between subgroups, indicating trauma influence versus no trauma influence. Reaction times might match PTSD versus healthy subject scores recorded by Shin and Whalen. Reaction times might rise to become significantly better than their control baseline. There was however no significant difference between Endocranial and Global groups. This researcher originally hoped to see where this subject group would land on the spectrum between the reaction time range of PTSD subjects and health subjects.

Even taking into account practice effects, that is, a general improvement over time, it was apparently still possible that reaction time speed would improve with better cognitive processing and integration. Research about practice effects differ: "Intuitively, extended practice with the Stroop task should lead to reduced interference as subjects develop a strategy for coping more successfully with the task. This result has indeed been observed, but not always." (MacLeod, p. 181, 1991)

6.3.3 Interpreting The Stroop

On the topic of interpreting the Stroop test in a specific way Stroop researcher Colin MacLeod gives this cautionary warning:

> Interpreting the results of Stroop experiments as evidence for a particular type of processing or for a particular process is suspect. It is important to devote considerable thought to the nature of the processing that is happening and not to assume a kind of one-to-one mapping between task and process, as is too often done.
>
> (Macleod, 1991)

MacLeod makes an important point that although we know that emotional and counting Stroop tests stimulate consistent regions of the anterior cingulate cortex it is the neural network as a whole that is functioning in a cascade of events that may take different pathways under different circumstances. One advantage to using a motor response (button press) Stroop test is that motor response fulfils a dual purpose by soliciting the lower motor neurons of the brainstem and the neo cortex in order to attend to the task and follow instructions. (MacLeod, 1991) Tasks that demand cognitive integration of combined functions are well-suited to potentially respond to the integrative global nature of Osteopathic treatment.

6.3.4 Stroop Osteopathic Goals

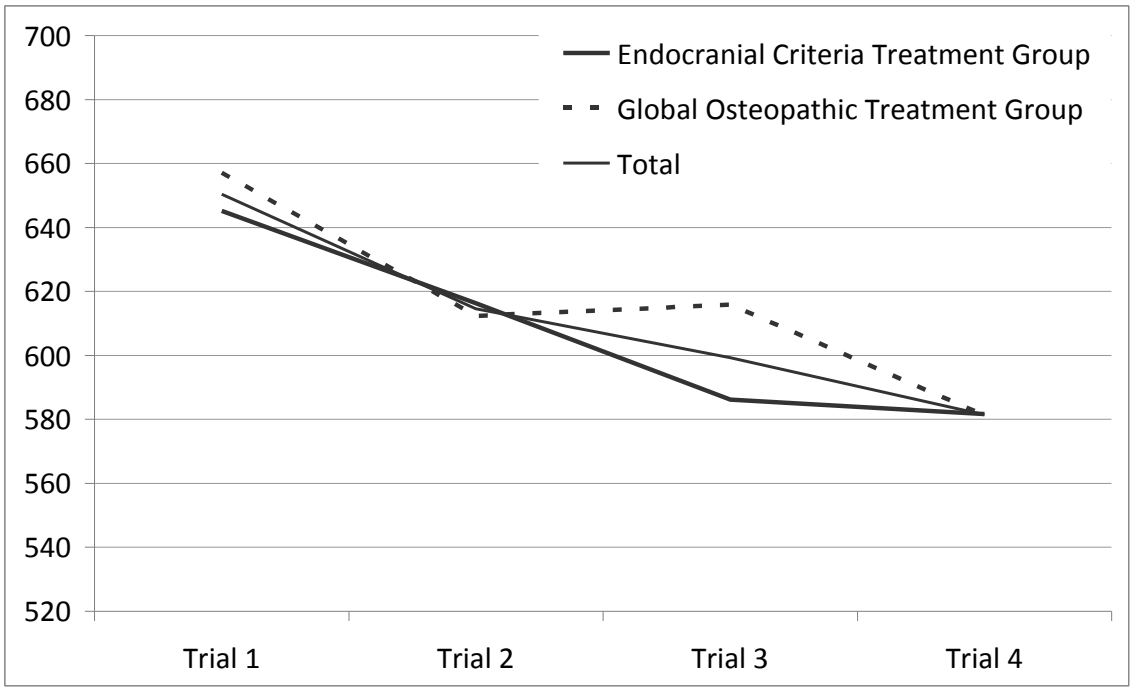
Another motivating factor for using a neurocognitive test was to attempt to find an indicator for endocranial treatment effects. How do we know we are actually affecting neurocognitive structures? Recent research done by David Bergstein D.O. on Philippe Druelle's cranial concept in Osteopathy was able to demonstrate through electroencephalography (EEG) the ability to produce volumetric changes in the encephalon that improve global function. (Bergstein, 2009) As demonstrated by Bergstein's work, even within the realm of neuroanatomy, it is possible to Osteopathically affect global cranial structures. He was able to employ EEG to view images of the global encephalon in order examine treatment effects in different regions. He did not however test cognitive function.

Therefore the Stroop test as a reaction time based cognitive activation test was used in the hope of gathering information about one region of brain function. The function of the ACC (or limbic cortex) acts as our 'external window' into the endocranial realm. It was hoped that what is known about the cognitive functions of the ACC, based on MRI / Stroop test research would indicate an effect on encephalon function as a whole. It appears that half of this goal was realized. The Stroop results do show a unique effect after treatment; however, 'what' the root cause of the effect remains unknown and begs further study.

In a personal correspondence with Dr. Lisa Shin (February 29, 2012), in asking her if she could interpret the inconsistent pattern that emerged in the third Trial which happened directly after treatment, she wrote the following: "I'm not really sure how to interpret this, to be honest, especially since most findings were not significant. The only findings that are worth thinking about are those that were significant. (between subgroups) I don't understand what those group differences mean (in the third trial) if both groups are the similar at the final endpoint." She is referring to the divergence of reaction time scores in the Emotional Stroop test chart below. These results confounded Dr.

Shin; however, from an Osteopathic perspective they present us with some interesting questions, which will be discussed.

Figure 13 Whole Group Stroop RT totals – Emotional Counting Stroop (part 1 of 3 part Stroop)



Vertical Axis = reaction time in milliseconds
Note: 9 week treatment phase between Trial 2 and Trial 3

6.3.5 Stroop Discussion Osteopathic Perspective

Our goal in Osteopathy is to facilitate the integration of structure and function. In attempting to answer the question "Can a cognitive functional test detect structural encephalon changes due to Endocranial treatment?" we look to function to see if it reveals integrated structure. It is the theory of this researcher that the diverging Stroop test scores in third Trial, which happened in each part of the Three Part Stroop test, is the result of two different structural conditions expressing themselves in the Endocranial and Global subgroups.

The endocranial groups Stroop test reaction times decreased in a smoother and faster negative arch in each aspect of the Three Part Stroop test in the 3rd Trial administered one week after their final treatment. In the third Trial the Global group sustains their pre-treatment reaction time score or does slightly worse. If this result is linked to treatment response, then it is possible that they are showing two different expressions of health.

The Endocranial group demonstrates the presence of a sustained personal axis during Stroop testing. The global group may be presenting evidence of a shifting axis that is still in transition while the body organizes itself in adapting to treatment changes. In consideration of the fact that the Stroop is a neurocognitive test, Genevieve Forget D.O., pointed out that the Endocranial group received direct treatment on the anatomy that was being treated – the encephalon. They received a 'short axis' treatment that reinforced or established their endocranial axis. The Global group received osseous membranous treatment external to the endocranium which meant they had a 'long lever' treatment. Their endocranium was influenced indirectly from a distance. The body needs time to integrate long lever work because the aspects of the anatomy you didn't treat directly do their own work of adapting after Osteopathic treatment.

The Endocranial group on the other hand expressed a 'foundation' of PRM and the ability to sustain mechanical axis, emotional axis, a cognitive endocranial axis, core link, and central chain. The axis that maintained themselves which are external to the endocranium are all part of a state of readiness that includes and sustains the parenchymal health of the CNS.

At present in following the Stroop paradigm of Shin, Bush and Whalen the most acknowledged way to discern significance Stroop test scores is by observing a distinct difference between treatment groups. They confirm their significant results by correlating fMRI BOLD results. A significant difference in reaction time between the two subgroups did not exist.

In knowing that the Stroop test appeals to the ACC as it's mediator of information processing and action, it seems to be safe to say that the diverging reaction times are either an expression of integration or non-integration expressed by the anterior cingulate cortex as mediator.

6.3.6 Stroop Conclusions

1. Osteopathic treatment appears to have had an influence on cognitive processing that is a reflection of lower motor neurons and upper motor neurons as mediated by the anterior cingulate cortex.

2. The Stroop test appears to have been able to reveal distinctive 'treatment effects' from two different methodological Osteopathic approaches, one that treated the container globally and the other that treated the container globally as well as the encephalon directly.

Clearly more study is needed.

6.3.7 Stroop Questions

The results leave many questions and room for further speculation and research.

6.3.8 Performance Floor

McLeod has this to say about the Stroop performance floor: "The results of Roe, Wilsoncraft, and Griffiths (1980) confirm that manual responding is affected more quickly by practice, which is interesting given that manual responding is faster to begin with and therefore closer to a 'performance floor.'" (McLeod, p. 181, 1991)

- If manual responding (button press) is closer to the performance floor when is the 'floor' reached?
- Is the performance floor the same for everyone? Why did all subjects reach the same performance floor?
- Would an untreated control group reach a different performance floor and sooner?

6.3.9 Practice Effect

If both treatment groups had improved their reaction time score in a gradual negative curve (curving down) this researcher would have said the results probably demonstrated the improvement that comes with repeated measures in doing a skill-based test and that the results showed no effect of treatment in the Stroop. However, as stated this did not happen.

- If the Global results were influenced by a practice effect why did they perform slightly worse in the Third Trial?
- If the Global results were influenced by a practice effect why didn't they make an incremental 'practice effect' improvement in the Fourth Trial rather than the larger improvement that caused them to merge reaction times with the Endocranial group?
- Was the Endocranial group better at not losing their Stroop skills learned in Trial 1 and 2?

6.3.10 ACC Effect

- If imaging was used would the Global group have been shown to experience low fMRI blood oxygenation level-dependent signal increases in rostral anterior cingulate cortex when doing the Emotional Stroop in the third Trial?
- If imaging was used would the Endocranial group have been shown to experience significant fMRI blood oxygenation level-dependent signal increases in rostral anterior cingulate cortex when doing the Emotional Stroop in the third Trial?

6.3.11 Endocranial and Osteopathic Treatment Effects

- Is it possible the Global group result show a treatment effect in the third Trial and an integration effect in the fourth when they merged with the Endocranial group?

It is a common belief among Osteopaths that treatment may take 2 to 3 weeks to integrate.

- Did the Global group integrate their treatment after 3 weeks and thus merge with the Endocranial group?
- What would their Stroop scores be if re-tested three months after treatment?
- Why did the Endocranial group Stroop improve their reaction times in a smooth negative curve?

- Were they uninfluenced by Endocranial and Osteopathic treatment?
- Did Endocranial and Osteopathic Treatment have a compatible effect and integrating influence on their cognitive processing?
- Were the Endocranial results a reflection of being 'on their encephalon axis' and the Global group 'not on their encephalon axis?'

6.3.12 Anatomy

An Osteopathic view of anatomy in looking at the parallel longitudinal axis of the Central Chain and the Core Link system may explain the divergent results in Trial 3. Each subject in the Endocranial group achieved a patent dural glide in core link with full PRM motion of expansion and retraction. Some subjects in the Global group also responded well to core link. However others were not able to establish a consistent longitudinal axis from the endocranium, down the spinal cord to the coccyx. Therefore this researcher was not able to gain entry to the CNS even though a level of vitality was present in the cranial sphere.

The structures of the Central Chain and the Core Link are parallel to one another and both glide longitudinally in their movement. Within the vertebral column and boney cranium the CNS participates in this vertical gliding motion within one of its cardinal axis. The structures that participate in the vertical axis are the brain stem, reticular formation, corona radiate and internal capsule. This is one of three Cardinal Axes in the encephalon that are component dimensions of the coiling of the global encephalon around a resultant axis.

If a subject does not achieve the self-sustaining motion of the CNS's longitudinal axis as it relates to core link the collective coiling motion of the CNS will not be present. This is also why it is important not to do encephalon treatment prior to freeing the longitudinal axis first in the Central chain and second in the core link. Leaving 'anchors' or restrictions in the regions directly linked to the endocranium are specifically felt at Sutherland's fulcrum. Restriction at this balance point may indicate the presence of undue pressure on the encephalon.

In this study this researcher found 'Core link' was the single most effective treatment approach for gaining access to the endocranium. If a subject was able to achieve and then sustain a good core link this generally opened the way to effective CNS preparation work.

6.3.13 Stroop Test Challenges

Earlier in this research endeavour this researcher wrote the Stroop test was an *elegantly* simple cognitive test. Now this researcher would write the Stroop test is a *deceptively* simple cognitive test. The Stroop test, for this

research, was functioned efficiently, was administered properly, and was executed by the subjects easily, and data was gathered systematically, and collated systematically. However, as a novice, creating the Stroop, which required entering 288 words multiple times, in Croatian, and collating four trial-time results for 25 people was time very time-consuming although it wasn't difficult. And the prospect of seeing what a cognitive activation test might reveal was inspiring. What was vital to the process was having two very patient statistics analysts spend hours creating the result sheets. The statistics search began by looking for what this researcher 'expected' to find and ended by discovering an unexpected but unique pattern.

Ideally, if the potential information the Stroop could provide were to be fully realized an expert in the test should be consulted. The interpretation of unexpected results can be very difficult; for almost every affirmative finding in the Stroop there is another to counter it. Experts agree however that the Stroop is a reflection of neurocognitive function but 'how' and 'why' in all of their details is still as mysterious to neurocognitive scientists as a verifiable cause for the primary respiratory mechanism is to Osteopaths. On the other hand that very fact might point to their common link. Lastly, the Stroop test also has many variations and therefore it is difficult to compare results with other researchers unless, as this researcher did, you choose to duplicate another research study's design.

6.4 Chronological Research Design Discussion

This research followed a Chronological design. The first two trials spaced three weeks apart acted as the control measure. A nine-week treatment phase occurred. The last two trials spaced three weeks apart provided the outcome measures. This type of design has some biased control issues, one because the subject group wasn't randomly selected and two because of different timelines between the control phase, treatment phase and outcome phase, which may also contribute to week power. Statistical power is improved if it can be said the research subjects in fact exhibit the traits the researcher intends to investigate. Therefore a review of normative data was undertaken. (Tables 20, 21) The overall population data results derived from the *Croatian Health Survey – SF-36* confirmed this research had normal control measures for its desired target population. (Jureša, 2000) Subjects scored below their national average SF-36 Health Survey scores (1997 – 1999) in 7 out of 8 domains. One out of four domains in the WHOQOL matched child survivors of Holocaust scores. Therefore we can state that it seems these control results were an adequate baseline for comparison even though the time line between first and second trials was short relative to the nine-week treatment phase.

6.5 Subgroup Identification and Variance

Another possible bias in this study occurred. Due to this researcher's design choices, 'subject variance,' one common statistical hallmark used for improving power, was abandoned. Rather than use random selection to create two groups at the beginning of research sub-groups were identified after the treatment phase was completed. However what appeared to be negative design attribute from a statistical point of view in fact had some positive implications.

Endocranial motility became the only factor that separated subjects into two groups. This design choice meant that the randomness of sample variation was lost. Randomness is usually chosen in a research design to create an unbiased distribution of subjects between groups. It is hoped this will result in an even distribution of possible traits that if 'consciously selected' by the researcher would create bias. However real differences did exist due to the spectrum of Osteopathic treatment used. Subjects did in fact receive categorically different ranges of Osteopathic treatment. This is the nature of Osteopathic methodology and treatment – to treat the patient in keeping with their needs in that moment.

During the Treatment Phase this researcher regarded the subjects as 'one group,' which means the treatment differences, whether endocranial or global approaches were used, were not pre-determined. During the treatment phase all subjects were treated according to the Global and Endocranial Osteopathic methodologies, their present needs, and the readiness of their personal structure. Treatment notes for this group of 25 were examined for their differences base on Endocranial treatment inclusion criteria. (Appendix X) Therefore subgroup identification was based on treatment evaluations and outcomes, which resulted from this researcher's palpation assessment records. Therefore each subgroups 'sameness' of behaviour was due to palpation based on a well-structured Osteopathic and Endocranial assessment criteria created by Philippe Druelle DO and developed by Genevieve Forget D.O..

Selecting subgroups using Osteopathic criteria was an unconventional research choice that created a deliberate bias in order to view differences in treatment response. This researcher understood at the onset of research that two groups would exist after treatment was completed. It was also expected that both groups would improve in their post treatment scores compared with the control. Therefore their differences were indeed a reflection of real difference between the two groups. Those differences provide us with clinically significant information. 'Encephalon motility matters.'

Ideally however a more conventional approach to research would use an untreated control. Future research could look into doing a control trial with a placebo or sham to try and isolate the effect of Osteopathic treatment.

6.6 Palpation Conclusions

Subgroup identification was based on seven standards of endocranial motility, "which is defined as, independent physiological motion of cranial content – ventricles and encephalon terrain." (Forget DO, consultation 2010), This Design choice discovered two things:

1. Post-treatment subgroup identification unintentionally validated encephalon palpation skills.
2. Sub-group identification that rigorously adhered to the Endocranial Group Inclusion criteria was positively correlated with consistent subgroup differences in SF-36, WHOQOL, and Stroop test performance difference trends.

Comparing groups for their differences simply based on endocranial motility provided some unexpected points of view. It was possible to conclude that Philippe Druelle DO's endocranial palpation techniques and assessment protocols developed by Genevieve Forget DO, when followed, were effective tools in distinguishing differences in endocranial motility. Data concurs that differences in endocranial motility were reflected in consistent performance differences between groups.

It must be clarified however that even though a trend for performance difference was revealed between Endocranial and Global subgroups it cannot be said that these results directly validated endocranial treatment. In a review with Genevieve Forget D.O. she stated that it would be difficult to isolate and 'confirmed' positive endocranial treatment results considering this researcher's timeline for treatment and testing. Forget D.O. has found, clinically, that endocranial spasm treatment in particular needs two to three months to integrate before testing results can measure possible effects.

6.7 Future Research

This research feels it would be interesting to conduct more Osteopathic research that is paired with cognitive testing. The Stroop test generated a result that appears to be connected to Osteopathic treatment this tells this researcher that the Stroop test would be worth repeating. Conducting a study using a post-graduate research team would be ideal. It would also be highly recommended to create one version of the test that could be used in numerous consecutive studies. The Counting Stroop provided this researcher with the most variation in scores. Subjects reported it was also the most challenging for them to perform, but also was their favourite test. It is also

emotionally neutral which eliminates the potential for different effects based on different emotional backgrounds. The Stroop test could be used in repeated studies to test the theory of indirect long axis Osteopathic work versus direct short axis work. Treating two groups using these different methods then comparing results with an untreated control group might be useful.

On the theme of cognitive integration and 'on axis' encephalon mobility it would be interesting, on one single day, to simply divide 40 people into two groups, those with a high rate of encephalon integration and those with a low rate, using the Endocranial group inclusion scale and then administer the Counting Stroop test. This could be done once with different groups numerous times. This would avoid the influence of practice effects. If endocranial assessment is able to 'select' integrated encephalon structure and motility and then compare groups and correlate that with faster Stroop times, it might be possible to begin to correlate Osteopathic assessment and treatment with treatment of cognitive function.

In general the Stroop test could be and effective and noninvasive tool for exploring the results of Osteopathic treatment in a region of function that is difficult to target without access to EEG and fMRI scans. Although it might be viewed as providing 'open ended' results that create more questions than answers, the questions can be as valuable as the answers.

In terms of studying a trauma-exposed subject group if the right conditions were available it would by useful to attempt to isolate 'expected symptoms' by screening subjects for depression. Pain and emotion scales could also be used to determine 'at risk' subject conditions as part of inclusion criteria testing.

Another survey approach to research could be done by treating an 'at risk' population that added the use a series of short methodologically based check lists to screen categories of reaction and symptoms. It could be observed if different trauma reactions were different in different populations. For example, the tsunami victims in Japan experienced a single traumatic event. This is very different from a war, which is often endemic to one region. This researcher would hypothesis that the quality and character of somatic restrictions might differ.

A researcher could also do qualitative work to attempt to define the genre 'trauma exposure in childhood' as it relates to the field of Developmental Traumatology as viewed through Osteopathic perspectives on Embryology.

It is the hope of this researcher that a review team of interested Osteopaths could be created in order to share ideas about present needs and / or research regarding trauma-exposure treatment, mental health, and

Osteopathy. Such a team could begin to conceive and co-ordinate efforts in defining goals, perspectives, and to survey the field in general. It would also be useful to do 'in house' research to standardize quality of life and mobility scales that reflect Osteopathic principles.

6.8 Self-Critique

At the beginning of this study this researcher understood that not all subjects would be able to receive endocranial treatment and that there would be a second subgroup however the volume of analysis that created was unanticipated. This researcher's knowledge of statistical analysis was not sufficient enough to know how to ask the right questions to get specific answers. This prolonged the research analysis until 'saturation' of understanding was achieved and this researcher was finally able to 'see through' the data. An understanding of the degree to which statistical analysis may 'isolate variables' was uncharted territory. Another research study would be much easier to conduct after now having made the 'maps.'

This researcher was very fortunate to have a research assistant who was so well organized and dedicated to this study that the practical experiment went very well. The subjects responded to this overall feeling of organizational 'security' and participated with a dedication that also made the research easy and a pleasure to conduct.

There were challenges for this research when it became time in the treatment process to attempt a transition from Global Osteopathic work to Endocranial work. Each subject was, naturally, on his or her own time line in terms of his or her own body rhythm and needs. It became clear that Endocranial work was not within the scope of what was needed for some at that time yet for others it was. It was also clear that in palpating what was present within them they were taking this researcher into new treatment territory. They were balancing far more vectors of influence within their lives and physical frames than this researcher had experience of in her own life or for that matter in her experience as an Osteopathic practitioner.

As an Osteopathic practitioner this researcher discovered a need to 'find' a deeper receptacle within in order to make space and to be present in a way that was qualitatively different. This researcher realized that she was 'meeting challenges' in them rather than 'being a space' where challenges could work themselves out. Events to facilitate this change came and the people and the space needed to make sense of and integrate those changes were there. An understanding of and new experience of …the spectrum of experience ….the scope of witnessing… the degree to which one absolutely releases the patient to the integrity of their own healing mechanism… even as there

are pressures that are new…was an ever shifting adjustment of… presence… in order to be a space where a fulcrum for their change could be realized. The events of this research, the immersion that occurred with the people, the culture, the friendships made, the time and the space created many opportunities to realize these therapeutic changes.

Chapter 7: Conclusion

CHAPTER 7: CONCLUSION

The goal that initiated this research was 'to become familiar with the somatic terrain of adults who experienced childhood traumas, in this case the traumas of war.' This researcher should add that in doing so, it was also the intention of this study to explore ways to further utilize this knowledge in service of them. From an Osteopathic point of view it is not difficult to acknowledge that academically standardized health surveys only go 'half way' toward representing the measures of health we are interested in looking at in Osteopathy. This is not to take away from the fact that surveys are very useful. They are good general indicators of pre-treatment need and post-treatment effect. However, mobility testing is a more specific determinant in representing Osteopathy's definition of health, which include not just functional life style standards but also wellness standards such as fullness of vitality and personal self-expression.

If we are really to come to terms with Osteopathy's role in treating mental health as it is linked to Osteopathic definitions of vitality, then paradigms of testing and measuring that reconcile mobility on all levels with predictors of quality of life, and vice versa, need to be created. Health surveys alone cannot be the primary determinant of pre-treatment need and post-treatment outcome. Questions such as, 'Which quality of life scores are most positively correlated with osseous membranous mobility? Which quality of life scores are most positively correlated with endocranial mobility?' need to be quantified through meta-analysis. A study that might correlate pure mobility scores with parallel readings in quality of health could be gathered through a repeatable coordinated research initiative in order to create a combined Osteopathic mobility and quality of life score that would reveal an overall standard of health based on fundamental Osteopathic principles. Creating a standardized Osteopathic Health Survey would also codify and give voice to another standard of public health.

As we continue to learn more about how to describe the natural fit between osteopathy and the body, we grow our profession for others. In looking at 'the big picture' for Osteopathy in relation to our work and our communities our research goals could simply be:

Grow a body of work that can be a foundation for using Osteopathic principles and perspectives to expand and redefine structures of practice and policy, based on our changing knowledge of who we are and how we function as people, in and through each aspect of our physical, emotional, mental, and spiritual designs.

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APPENDICES

APPENDIX A: HYPOTHESIS REFORMULATION REQUEST

Collège d'Études Ostéopathiques
2015, rue Drummond, bureau 500
Montréal (Québec) H3G 1W7
Téléphone: 514 342-2816 | Télécopieur: 514 731-7214

Montreal, March 29th, 2012

Mrs. Jan Tait
1494 Hamilton Road
Berwick, (NS)
B0P 1E0

Object: Modifications requested on your protocol entitled: *Trauma – the Impact of War on Children 15 years later - an osteopathic approach*

Mrs. Tait,

Your request to modify the formulation of your research' hypothesis have been studied. Since the change you suggest implies only a modification about the labeling of the hypothesis, these changes are approved. You are authorized to remove the word "assessment" from your initial hypothesis.

You are also authorized to separate your different hypothesis from one another. This should in fact bring more clarity to your methodology.

Also the adding of the SF-36 Health Survey to your study is approved.

Please include your letter with this one in appendix 2 of your final document.

Sincerely,

Martine Nadon
Research program of the CEO

APPENDIX B: MODIFICATION OF RESEARCH PERMISSION

Collège d'Études Ostéopathiques
7400, boul. Saint-Laurent, bureau 211
Montréal (Québec) H2R 2Y1
Téléphone: 514 342-2816 | Télécopieur: 514 731-7214 | www.ceo.qc.com

November 9, 2010

Mrs Jan Tait
290 Longspell Rd, RR#2
Kingsport, NS
B0P 1H0

SUBJECT: Modifications to your research methodology

Mrs Tait,

The following is the answer from the Research committee concerning your request:

The ethical aspect as well as the feasibility of your research justifies your request. We, the research team, would agree that you remain with one group in your experimentation. However, for the group to become its own control group we request that there are at least two evaluations prior to treatment. These two pre evaluations should be spaced by two to three weeks (one month is preferable) so as to ensure that the patient's baseline is established prior to the treatment phase of the research. Treatment should in turn be followed by one to two evaluations. Those two post treatment evaluations allow seeing short and long term effect. In this case the research can be titled as chronological.

Thank you and we wish you great success,

Martine Nadon, D.O.
Research program CEO

APPENDIX C: VALIDATION FORM FOR ENDOCRANIAL TREATMENT

Encephalon Dynamics and Endocranial Spasms Validation Test

Conducted by Genevieve Forget D.O.
Collège d'Études Ostéopathiques (CEO)
2015 rue Drummond, 5e étage
Montréal, (Québec) H3G 1W7

for Jan Tait
Thesis Candidate (CEO - Halifax)
To fulfil treatment requirements for thesis work titled: 'The Osteopathic Treatment of adults who experience war as children.'

Osteopathic post-graduate skills for Encephalon Dynamics and Endocranial Spasms developed by Philippe Druelle D.O. for courses I and II were tested.

- Endocranial Course I: Evaluation and treatment of the Encephalon. Endocranial spasms Part 1: Restoration of brain dynamics and ventricular activity following traumatic or toxic injuries.

- Endocranial Course II: Endocranial Spasms of Emotional origin

Endocranial Validation Test Schedule:

8:30am to 3:30pm, December 21, 2010
Total: 6 hours

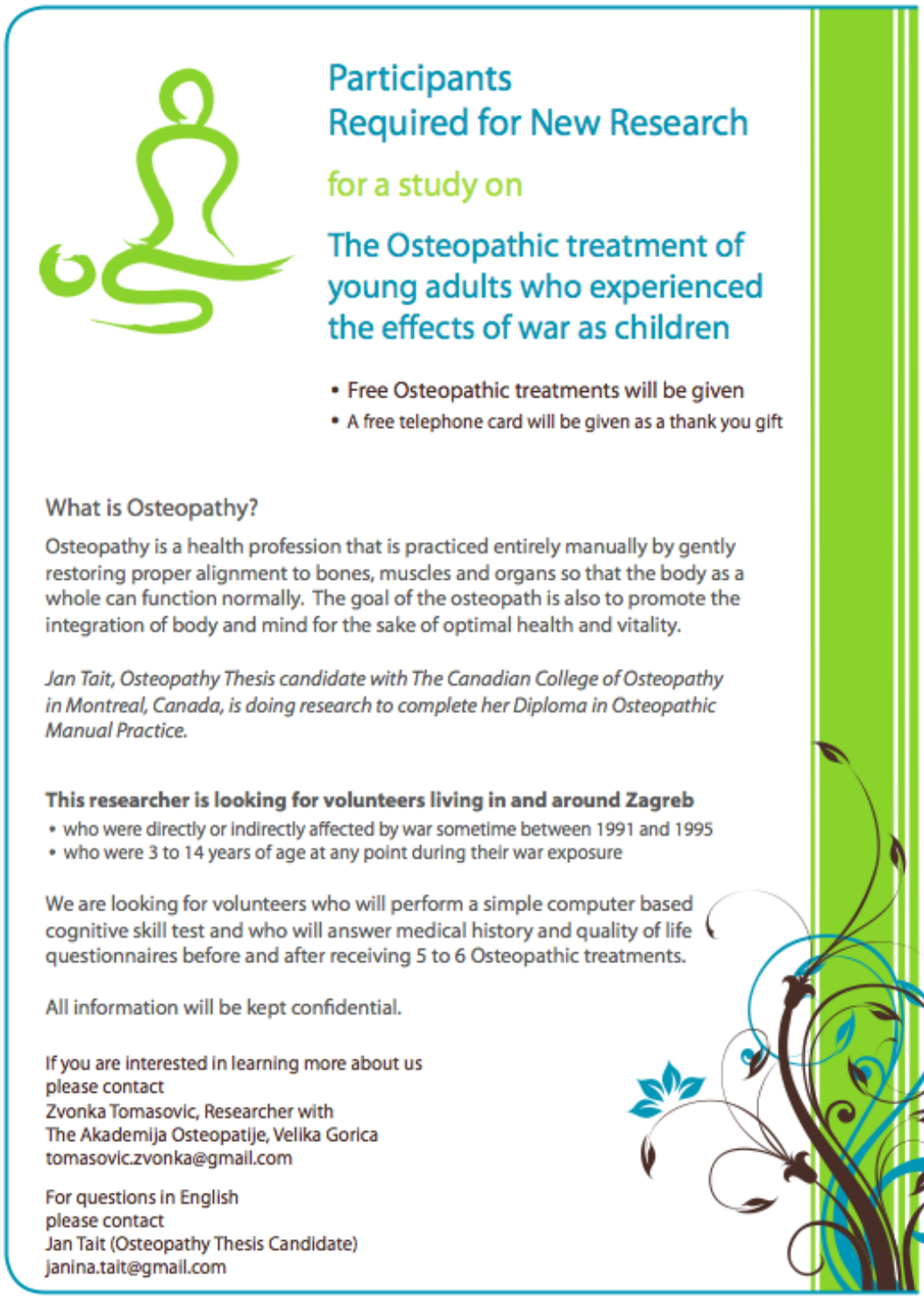
Three patients were treated each of whom presented CNS issues of various kinds. (2 hours per patient)

Goal of testing:
- Review and demonstrate CNS treatment protocol as developed by Philippe Druelle D.O.
- Review and demonstrate the different skills needed to do a full treatment for each patient.

I Genevieve Forget confirm that Jan Tait completed the above testing requirements.

Date: 2011/11/03.

Appendix D: Recruitment Notice (English / Croatian)



Participants Required for New Research

for a study on

The Osteopathic treatment of young adults who experienced the effects of war as children

- Free Osteopathic treatments will be given
- A free telephone card will be given as a thank you gift

What is Osteopathy?

Osteopathy is a health profession that is practiced entirely manually by gently restoring proper alignment to bones, muscles and organs so that the body as a whole can function normally. The goal of the osteopath is also to promote the integration of body and mind for the sake of optimal health and vitality.

Jan Tait, Osteopathy Thesis candidate with The Canadian College of Osteopathy in Montreal, Canada, is doing research to complete her Diploma in Osteopathic Manual Practice.

This researcher is looking for volunteers living in and around Zagreb

- who were directly or indirectly affected by war sometime between 1991 and 1995
- who were 3 to 14 years of age at any point during their war exposure

We are looking for volunteers who will perform a simple computer based cognitive skill test and who will answer medical history and quality of life questionnaires before and after receiving 5 to 6 Osteopathic treatments.

All information will be kept confidential.

If you are interested in learning more about us
please contact
Zvonka Tomasovic, Researcher with
The Akademija Osteopatije, Velika Gorica
tomasovic.zvonka@gmail.com

For questions in English
please contact
Jan Tait (Osteopathy Thesis Candidate)
janina.tait@gmail.com

Traže se sudionici za novo istraživanje

za studiju o

osteopatskom tretmanu mladih punoljetnika koji su doživjeli posljedice rata kao djeca

- Davat će se besplatni osteopatski tretmani
- Dat će se besplatna telefonska kartica kao poklon zahvalnica

Što je osteopatija?

Osteopatija je zdravstvena profesija koja se prakticira posve ručno nježnim vraćanjem pravilnog rasporeda kostima, mišićima i organima tako da tijelo kao cjelina može funkcionirati normalno. Cilj osteopata je i promicanje integracije tijela i duha radi optimalnog zdravlja i vitalnosti.

Jan Tait, diplomantica iz osteopatije na Canadian College of Osteopathy u Montrealu, Kanada, vrši istraživanje da zgotovi svoju diplomsku radnju iz osteopatske manualne prakse.

Ova istraživačica traži volontere koji žive u Zagrebu i okolici

- koji su izravno ili neizravno bili pogođeni ratom u neko vrijeme između 1991. i 1995. godine
- koji su imali 3 do 14 godina u bilo kojem trenutku tijekom svoje izloženosti ratu

Tražimo volontere koji će obaviti jednostavni računalno temeljeni test kognitivnih vještina i koji će odgovoriti na upitnike o povijesti bolesti i kvaliteti života prije i nakon dobivanja 5 do 6 osteopatskih tretmana.

Sve informacije bit će tretirane kao povjerljive.

Ako ste zainteresirani da saznate više o nama
molimo kontaktirajte
Zvonku, istraživačicu u
Akademiji osteopatije, Velika Gorica

Za pitanja na engleskom
molimo kontaktirajte
Jan Tait (Osteopathy Thesis Candidate)
janina.tait@gmail.com

Appendix E: Exposure to War Criteria

Exposure to War Inclusion Guidelines

(Used by Research Assistant)

Direct Exposure

A. - Living in a front line war zone at some point during the war

- Having gone to bomb shelters

- Exposure to noise of gunfire

- Exposure to noise of bombing

B. - Being given refugee status

- Being displaced to a safer region

C. - Being separated from one's nuclear family

- Directly experiencing the effects of war in the form of government sanctions and rationing.

D. - War injuries

- Captivity

Indirect Exposure

E. - Having experienced personal loss from the death of one's nuclear family member.

- Having experienced personal loss from the death of relatives or friends.

- Parent or family member was directly involved in war

F. - Worrying about the war spreading (living on fringe of war zone)

- Perceiving the stress of adults

- Fear for one's safety or the safety of the family

- Having an awareness of a loss of stability and control in one's daily life and future.

G. - Exposure to media (watching TV in the home etc.)

- Exposure to war debates and attitudes of parents and grandparents.

List developed by Patricia Reis, Psychoanalyst and Durda Sucevic, Psychologist, Zvonka Tomisovic, Research Assistant, Jan Tait, Primary Researcher.

Appendix F: Informed Consent Form

This document represents consent for participation in a research study entitled:

The Osteopathic Treatment of Adults who experienced War as Children

The research is to be performed by Jan Tait (primary researcher), a graduate of the Canadian College of Osteopathy and serves as a requirement for the degree “Doctorate of Osteopathic Manual Practice”.

The research will be assisted by RESEARCH ASSISTANT assigned by Velda Lulic DO(MP).

I hereby consent:

1. To receive osteopathic assessment and treatment consisting of physical evaluation and manual treatment of many parts of the body including, but not limited to, the head, spine, abdominal and thoracic organs, pelvis and extremities.

2. To complete one written history questionnaire, two written quality of life tests, and perform two computer administered reaction time based tests.

3. To not receive any other forms of manipulative treatment starting one month prior through completion of the experimental protocol.

4. That all information provided on questionnaires or verbal history is true and accurate.

5. That I will be available for 1 preliminary testing session, 5 to 6 treatments and 1 final testing session each 1 1/2 to 2 hours in length.

6. To inform the research director (Jan Tait) and the RESEARCH ASSISTANT should any criteria for admission to the study change while serving as a study subject.

I, _____, understand that my participation in this research study is completely voluntary and I consent willingly to participate on the following pre-arranged dates_____.

Signature_____

Witness_____

APPENDIX G: SUBJECT INFORMATION

SUBJECT INFORMATION

The Osteopathic treatment of adults who experienced war as children

Jan Tait (thesis candidate), Zvonka Tomasovic (research assistant)

- The following information will be kept by the research assistant in order insure the invisibility of Objective Testing scores.
- WHOQOL-bref and each Stroop test will be labeled using the individual's study participant number. Their name will not appear on the objective testing material. This information will only be viewed by Zvonka Tomasovic.

Name: _____

Study Participant Number: _____

Address: _____

Phone

Home: _____

Mobile: _____

Work: _____

e-mail: _____

Pre-Treatment test date #1 _____

Pre-Treatment test date #2 _____

Post Treatment test date #1 _____

Post Treatment test date #2 _____

APPENDIX H: MEDICAL QUESTIONNAIRE

Medical Questionnaire

Please note: Information provided will assist the researcher in providing safe and effective treatment. All information will be kept strictly confidential and will be used only for purposed required for this clinical study.

Name_____ Date_____

Address_____ City_____

Province_____ Postal Code_____

Home Phone_____ Cell Phone_____ Work Phone_____

Email_____

Occupation_____ Gender_____

Age_____ Date of Birth_____

Height_____ Weight_____

Left or Right Handedness_____

Emergency Contact Person_____ Phone #_____

_____

1. How Would you describe your current state of health? (Check one)

Excellent_____ Good_____ Fair_____ Poor_____

2. List all medical diagnoses that have been assigned to you by a medical doctor:_____

_____

_____

_____

3. List all medications you are currently taking (including dosage):_____

_____

_____

4. List all surgeries (include approximate dates):_____

_____

_____

5. List all motor vehicle accidents (include approximate dates):_____

_____

_____

6. List all fractured bones, sprains, & major falls:_____

_____

_____

7. List all Concussions, Loss of Consciousness, Closed Head Injuries, and Falls/ Injuries to the Tailbone:_____

_____

_____

8. Are you currently receiving psychotherapy or psychiatric counseling?:_____

_____

_____

9. Are there any major stressors in your life currently? (work, home, relationships):

_____

_____

10. Please circle all that apply to you:

Low Blood pressure	Cancer	Circulatory Condition	Depression
High Blood pressure	Digestive problems	Drug Addiction	Eating Disorder
Epilepsy	Fibromyalgia	Glaucoma	Heart Disease
Mental Illness	Migraine	Headache	Neurologic Disease (MS, Parkinson's etc)
Orthodontics (present)	Pregnant (currently)	Stroke History	Spine Pain (Chronic)
Brain Injury	History of Concussion	Diabetes	Respiratory issues
Anxiety	Arthritis	Alcoholism	Alzheimer's Disease

11. Is there anything else you would like to share that has not already been mentioned?

_____

_____

APPENDIX I: STROOP PROCEDURES

PM Instructions for Opening and Recording Stroop test

1. Turn on Dell PC
2. Double click SuperLab 4.0 icon
3. Click 'File'
4. Go to 'My SuperLab Experiments' folder then to 'Main Experiments' folder
5. Click 'Thesis Croatian Stroop Master Version (autobackup)' and 'Open'

Read 'Instructions for Patients' to thesis Participant.

PRACTICE TEST (Fixation '+', with 10 events – 6 Neutral and 4 Interference)

6. Click 'B2 Practice Test1' in 'Blocks' window
7. Click 'Practice Test' in 'Trials' window
8. Click green arrow 'Run' (second button from end)
9. 'Run Experiment' will appear.
10. Unclick 'Save collected data.'
11. Click 'Run selected blocks only'
12. Participant has already been given their instructions. Have participant place fingers on the button press box. Ask them, "Are you ready?" When they respond that they are ready Click 'Run'
13. Test will take less than 1 minute to perform.

FORMAL TEST

1. Click 'B1 Three Part Stroop' under Blocks window.
2. Click '3 part Stroop Test' under Trials window
3. Click green arrow 'Run'
4. 'Run Experiment' will appear. Type Participant's code number.
5. Click 'Save collected data' (arrow will appear in box)
6. Click 'Run selected blocks only' (arrow will appear in box)
7. Click 'Run'. 'Save the Collected Data File as:' will appear. Type Participant Code number in 'File name' window.
8. Data will be saved in Zagreb Data Folder.
9. Click File Folder Name until it appears in 'Save in' window.

WARNING: Clicking SAVE will start the test. Therefore prepare the participant to begin.

10. Participant has already been given their instructions. Have participant place fingers on the button press box. Ask them if they are ready. When they respond that they are ready Click 'SAVE'
11. Test will have two 'fixation pauses' ('+') and take 8 minutes to perform.

Closing 'Thesis Croatian Stroop Master version (autobackup)

1. Close Program. Close 'Thesis Croatian Stroop Master version (autobackup)' first.
2. 'Do you want to save changes to document' will appear. Click 'Yes'
3. Close 'SuperLab 4.0' program.

APPENDIX J: STROOP TEST INSTRUCTIONS FOR PATIENTS

Instructions for Patients – Stroop Test

6. Obtain informed consent following the established institutional guidelines.

Psycophysical Procedures

7. Tell subjects that sets of one to four identical words will appear on the screen, and instruct them to report via button press, the number of words in each set, regardless of what the words are.

8. Instruct subjects that the keypad buttons represent responses one, two, three and four, from left to right, and that they should use the index and middle fingers of the left and right hands to respond. (place them on the buttons before starting)

9. **Explicitly instruct the subjects**: **i)** that the sets of words will change every 1.5 seconds. **ii)** to "Answer as quickly as possible, but since getting the correct answer is important, do not sacrifice accuracy for speed." **iii)** "do not 'blur your vision' in an attempt to make the task easier – keep the words in sharp focus."

10. After instructions are reviewed, and just prior to formal testing, have subjects complete a 1-min computerized practice test. (6 neutral trials and 4 interference trials will be shown). Reviewing the responses here ensures that the subject understands the task and can perform correctly without requiring excessive practice.

Formal Testing for the Three Part Stroop

4. Formal testing will begin with 30 seconds of fixation on a '+' sign. The participant should remain looking at the '+' sign with fingers on the key pad and wait for the test to begin.

5. The formal testing version will have 16 neutral trials followed by 16 interference trials in each section. There will be three sections (parts). A five second fixation pause (+) occurs between each section. The subject should remain looking at the '+' sign with fingers on the keys and wait for the next test to resume.

6. The test will be 8 minutes long and will consist of three sections.

APPENDIX K: OSTEOAPTHIC TREATMENT PROTOCOL

Subject Number_____ Date_____

1. Cranial / Dural

SEGMENT	LESION	DIRECT	INDIRECT	COMPRESS/DECOMP	SPECIAL TECHNIQUE
Spheno Basilar	Torsion (L/R)				
	SB/Rot (L/R)				
	Superior Strain				
	Inferior Strain				
	Lateral Strain (L/R)				
	SBS Interosseous				
Occipito Mastoid	Right				
	Left				
TMJ	Right				
	Left				
Sacrum	L5/S1				
	Intraosseous				
	Sacro-Coccyx				
	SB/ Compacted				
	SacroIliac				
C0	Squama				

C0	Basilar Parts (intraosseous)				
C0C1	R / L / Bilat				
C0C1 on C2	Pseudo- rotation				

Appendix K: Osteopathic Treatment Protocol

2. Osteoarticular Structures - Spine

Cervical Segmants	Direct MET	Direct OA	Functional Technique	Compaction/ Decompaction	2nd degree Lesions
C1					
C2					
C3					
C4					
C5					
C6					
C7					
Thoracic Segments	Direct MET	Direct OA	Functional Technique	Compaction/ Decompaction	2nd degree Lesions
T1					
T2					
T3					
T4					
T5					
T6					
T7					
T8					
T9					

T10					
T11					
T12					

Appendix K: Osteopathic Treatment Protocol

Lumbar Segments	Direct MET	Direct OA	Functional Technique	Compress/ Decompres-sion	2nd degree Lesion
L1					
L2					
L3					
L4					
L5					
VISCERA					
Viscera Tested	Decompaction From	Ptosis	Translation	Specific Correction	Surgery Scars
Uterus Prostate					
Mesentery					
Kidneys					
Liver					

Stomach					
Páncreas					
Heart					

Appendix L: CE0 Methodology - Lesion Types

Treatment methodology for this research is based upon the Osteopathic principles of practice taught by the College d'Etudes Osteopathiques de Montreal developed by Philippe Druelle D.O..

The terminology below describes bio-mechanical states of health and vitality. These conditions are prioritized in order to direct effective treatment. Lesions types are listed from most severe to least severe. Treat methodology begins by treating the most significant to the least significant lesion.

In order of significance:

- Systemic Vitality
- Compactions, Intra Osseous lesions: There is no motion with no vitality expression
- Scars and adhesions sufficiently present to prevent proper axis use
- Non physiological without respect to axis: force vectors and sheers of structures
- Non physiological with respect to axis: paradoxes or atypical expressions but still respecting some axis.
- Physiological lesions: anatomy gets blocked in one of the movements it's normally allowed to have.
- Restrictions: reduced amplitude of motion without blockage

(College d'Etudes Osteopathiques de Montreal, Lesion Priority orignited by Philippe Druele DO, received - Autoregulation course, Instructor: Genevieve Forget D.O.)

APPENDIX M: CENTRAL CHAIN

CENTRAL CHAIN

Concept developed by Philippe Druelle DO (1983)

- Vertex
- Third Ventricle (thalamus)
- Sphenobasilar Symphysis (pituitary)
- Parango-basilar fascia (attachments of the tongue)
- Middle Cervical fascia (thyroid, oesophagus, trachea)
- Pericardium – Heart
- Phrenic Centre – Thoracic diaphragm (anterior leaf)
- Crossing formed by Falx of the Liver, Lesser curvature of the Stomach and Head of the Pancreas
- Root of the Mesentery
- Isthmus of Uterus (female) or Denonvillier's Fascia (men)
- Central Tendon of the Perineum

(College d'Etudes Osteopathiques de Montreal, Autoregulation course 2009, Instructor: Genevieve Forget D.O.)

Appendix N: Encephalon Evaluation Form

Subject Number_____ Date_____

Inclusion Justification:

___ Good global vitality expressed in the Primary Respiratory Mechanism.

___ Centralized straight sinus.

___ Patent spinal dura upon longitudinal traction.

___ Unimpeded fluid drive: occipitomastoid to contralateral orbit via sella turcica.

___ Integrity of central chain.

Pre-Treatment Encephalon Findings:

Evaluation Key: 0 = No Motion
1 = Restricted Motion
2 = Normal Motion
3 = Exceptional Motion

1. Hemisphere Motility:

Motility Parameter	Right Side	Left Side
A/P Roll		
Lateral Spiral		
Global Expansion		

2. Ventricular Motility:

Motility Parameter	R. Lateral Ventricle	L. Lateral Ventricle	3rd Ventricle	4th Ventricle
A/P Roll				
Lateral Expansion				
Longitudinal Expansion				

3. Cardinal Encephalon Motion Fulcrums:

Motion Fulcrum	Anatomical Location of Fulcrum
A/P Fulcrum	
Longitudinal Fulcrum	
Transverse Fulcrum	

4. Global Encephalon Motion Fulcrum:

Evaluation Key: 0 = Chaotic reference, fulcrum is located at a tissue fixation
1 = Stable reference, fulcrum is far from central.
2 = Good reference, fulcrum is near central.
3 = Excellent reference, fulcrum is at thalamus.

Reference Quality	Anatomical Location

5. Presence of Endocranial Spasms:

Key = (T)Traumatic, (E)Emotional, (TG)Trans-Generational

Cortical Level		Left Lateral	Left Medial	Right Medial	Right Lateral
Pre-Frontal					
Frontal					
Parietal					
Occipital					
Cerebellum					

L. Temporal		Medial	Lateral	Tip	Root
R. Temporal					

Presence of Endocranial Spasms (cont'd):

Sub Cortical Level		Left Anterior	Left Posterior	Right Anterior	Right Posterior
Insula					
Basal Ganglia					
Limbic Structures					
Thalamus					
Hypo-thalamus					
Pons					
Medulla					

Appendix 0: Endocranial Treatment Justification Tests

Justification for the completion of Treatment Phase A and the beginning of Treatment Phase B of this study requires that each subject demonstrate the following:

Good global vitality expressed in the Primary Respiratory Mechanism.

This criterion simply demonstrates that the general milieu of the craniosacral mechanism is healthy, allowing for a moderately high level of vitality to be expressed. This ensures a proper terrain for accessing the endocranial contents. The subject needs to impress upon the researcher that their mechanism could demonstrate reasonable amplitude, symmetry, and vitality during palpation.

Centralized straight sinus.

Functioning as the primary fulcrum for the reciprocal tension membranes, the straight sinus needs to be centered to best perform this function. It's centering provides for maximized membrane flexibility to support the tissular motion of the endocranial contents.

Patent spinal dura upon longitudinal traction.

The criteria ensures that the 'core link' (dural membranes) from cranium to coccyx is capable of unimpeded translation, demonstrating no major vertebral strains or spinal cord tethering to interfere with proper CNS mobility/motility.

Unimpeded fluid drive: occipitomastoid to contralateral orbit via sella turcica.

This criterion is promoted by Philippe Druelle, DO as the definitive criterion for the cranial container's preparedness for direct endocranial treatment. The mobility of this vector is thought to b the functional expression of the osseous and membranous craniums' capacity to tolerate the major parenchymal and fluid mobility often generated by the endocranial approach.

Integrity of central chain.

This criteria provides a reasonable physiologic terrain for the viscera occupying the central chain. Such a terrain provides good compensatory relief for the whole of the soma, ensuring the proper integrity of the central axis of the body.

*Inclusion Justification Tests (Bergstein, 2009)

APPENDIX P: CNS ASSESSMENT AND TREATMENT PROTOCOL

CNS Assessment and Treatment Protocol

Established by Genevieve Forget D.O. based on developments of Philippe Druelle D.O.

Part One: Assess Three Terrains (general scan)

A. Container: Osseous / Membranous cranio-sacral unit

- Continuity of dural bag – cranial to caudal with Sutherland's fulcrum within the straight sinus availability.

B. Content I: General inherent motility of CNS (Encephalon Coiling / Global Spinal Cord with sub volume interactions)

- Cord vs. brain stem
- Brain stem vs. cerebellum
- Brain stem vs. cerebrum

B. Content II: Three Bands (fasciculi)

- Cephalad / Caudal
- Anterior / Posterior
- Transverse
- Note interaction with resulting fulcrum at thalamus

B. Content III: Brain Three Layers

- Cortical: note state of cortex and interaction with the lateral ventricles
- Limbic: note state of limbic and interactions with the lateral ventricles and third ventricle
- Archaic: note state of archaic structures and interactions with the third ventricle and forth ventricle

C. Ventricles: Integrity of the Ventricular Network

- Lateral ventricles: Note state and communication of ventricles via foramens Monro
- Third ventricle: note stat and communication via Sylvius duct
- Fourth ventricle: note state and communication via ependymal canal

Part Two: used for Treatment Phase A

Clean Up: Musculo-skeletal, Osseous / Membranous, Cranio-sacral unit, Central Chain / Visceral

Part Three: used for Treatment Phase B

Preliminary preparation work of the CNS (cord and encephalon according to findings)

Part Four

- Specific assessment of the remaining densities using the three layers (cortical, limbic archaic) and spasms differential diagnosis.

- Treat Spasm using Philippe Druelle D.O. protocol. (if applicable)

Part Five

Integrate to 'idling' / 'cat purring' / independence of the mechanism

APPENDIX Q: ENDOCRANIAL AND GLOBAL SUBGROUP INCLUSION CRITERIA

Global Osteopathic and Endocranial Treatment Subgroup

*Post-treatment research phase patient notes must include records of a minimum of 3 aspects of global motility within the CNS to be included in the Global Osteopathic and Endocranial treatment group.

Global CNS motility is defined as independent physiological motion of cranial content – ventricles and encephalon terrain.

Global motility might be any of the following:

1. Ventricular motility (lateral, third and fourth ventricles)
2. Hemisphere motility
3. Lobe motility
4. Fissure dissociation
5. 'Three layers' motility (cortical, limbic, archaic [which includes brain stem])
6. Global Encephalon Motion (coiling) around resultant axis. (with component dimensions: A/P, cardinal, longitudinal)
7. Endocranial spasm treatment (traumatic or emotional)

Global Osteopathic Subgroup Group Inclusion Criteria

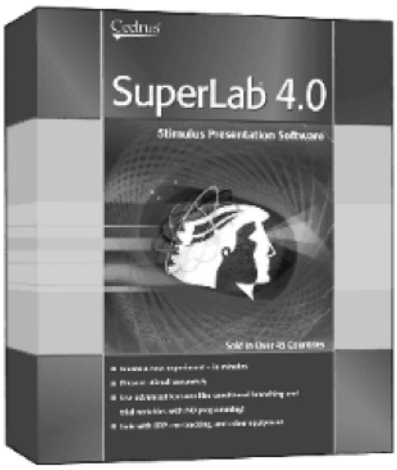
- Subjects who did not meet the requirements for treatment using the endocranial concept based on the 'Endocranial Treatment Justification Tests' (Appendix >>>) were included in the Global Sub-group.

APPENDIX R: THE STROOP TEST SOFTWARE AND RESPONSE PAD

SuperLab Stimulus Presentation Software by Cedrus

SuperLab 4.0 is the stimulus presentation software for Mac OS X (10.4 or later) and Windows XP/2000. In development for almost five years, the new SuperLab 4.0 introduces a host of new features, including:

- Stimulus lists
- Support for JPEG, GIF, PNG, and TIFF files
- Built-in support for RSVP and self-paced reading
- Improved support for fMRI and EEG/ERP
- Trial variables
- Conditional branching (if/then/else)
- Multiple input devices in the same experiment



The new version 4.0 is a 100% rewrite of SuperLab and was built from the ground up as a Unicode application that handles Japanese, Chinese, and other international fonts just as easily as it handles English fonts.

SuperLab 4.0 remains, without any doubt, the easiest way to build an experiment while eliminating nearly all the limitations found in earlier versions.

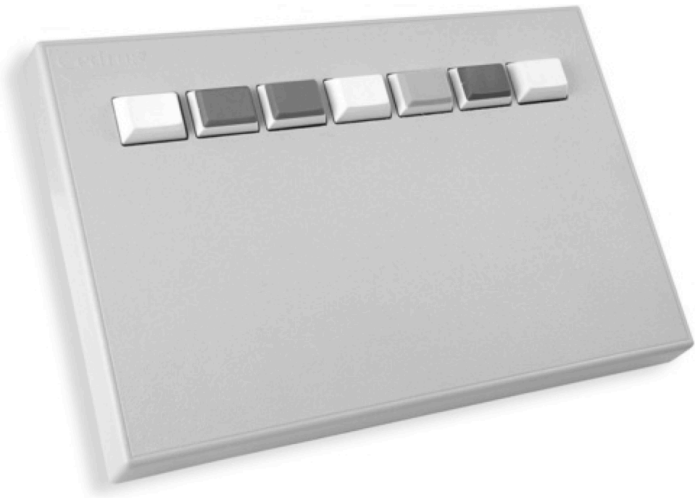
Upgrade Information

If you are not eligible for a free upgrade, the cost of upgrading is 50% off the published prices regardless of whether it's a single license or multiple licenses.

Using a pre-4.0 version? Support pages can still be found here.

The RB-730 Model

The RB-730 provides seven keys laid out in a straight line. The keys are slightly wider than the typical keyboard key and feature removable key tops. The following photo shows an RB-730 pad with the colored tops (included free) installed. The pad ships also with seven clear key tops so you can insert any legend or color paper.



When you buy an RB-730, the following items are included:

- RB-730 response pad
- Wrist pad (see picture on the right)
- Seven white key tops
- Seven clear key tops
- One red key top
- One green key top
- One yellow key top
- One blue key top

APPENDIX S: STROOP TEST DESIGN CORRESPONDENCE

Dr. Lisa Shin - Personal Correspondence in giving this researcher advice regarding Stroop Test design.

Lisa M. Shin, PhD
Associate Professor
Department of Psychology
Tufts University
490 Boston Avenue
Medford, MA 02155

First Design advice – Personal correspondence, February 12th 2009

In response to the initial inquiry from this researcher Dr. Shin wrote: "Sounds like you want to just get a behavioral test (not in imaging) to index treatment response. I'd use emotional and nonemotional versions of the stroop (or MSIT) to assess rACC and dACC function respectively. See attached methods articles that may be helpful."

Second Design advice – Personal Correspondence, February 8th 2010

This researcher asked: "I've been following the test design structure of your work and Whalen's ecStroop Did your reasons have something do to with fMRI data collection?"

Also this researcher asked, "You present your neutral and negative words in alternating 30 sec. blocks. You also present an equal number of neutral to negative words. I'm curious to know why you chose a predictable format."

Lisa Shin responded: "Stroop effects are bigger when you block conditions rather than intermixing them. We wanted to capitalize on this fact by blocking word types together."

Third Design advice – Personal Correspondence, February 8th 2010

This researcher wrote: "I was fortunate enough to receive a consult with a retired research psychologist in Zagreb (who did lie detector studies 40 years ago), she advised me to randomize the neutral and negative words. She also recommended using 80% more neutral words than negative to highlight possible contrasts in reaction time."

Dr. Shin advised against intermixing the neutral and negative words and against randomizing words.

Lisa Shin wrote: "I would always try to match the number of words per condition and don't really

understand the rationale for using 80% more words in one condition rather than another. If you have two different emotional word conditions then it would make sense to have two separate sets of neutral words, one matched to each emotional condition."

This researcher responded: "I have two different word conditions - war related words and present day stress words. I intend to make two separate tests with two separate sets of neutral words to accompany them. Once again I'll continue to follow your design and match the number of words per condition." This researcher also wrote, "My test will be almost 8 minutes in length. Durda Sucevic (Zagreb research psychologist) a longer test was best. I notice in one of Bush's studies he stated healthy people improve their Stroop test skills after 4 minutes. I'm hoping a longer test will demonstrate the presence of stress." Lisa Shin responded: "8 minutes is a long time. If you give an 8 min Stroop, you can always examine just the first half (4min) if you end up needing to (to avoid the problem of practice effects.

Dr. Lisa Shin Personal Correspondence in attempting to evaluate Stroop test results for this research.

Personal Correspondence, February 27, 2012

In sharing Stroop results Dr. Shin wrote: "If the two patterns between the groups that you note are not significantly different, then I'm not sure you can make much out of the difference between them." "We've also never done imaging across these time points so I can't really claim to know what is underlying or mediating these behavioral changes at each time point."

Personal Correspondence, February 29, 2012

Lisa Shin added the following: **"**I'm not really sure how to interpret this, to be honest, especially since most findings were not significant. The only findings that are worth thinking about are those that were significant. I don't understand what those group differences mean if both groups are the similar at the final endpoint?"

APPENDIX T: STROOP TEST DESIGN COMPONENTS

Three Part Stroop Design Chart

3 Parts / 3 Domains

1 Domain has 6 Blocks

1 Block has 16 words / trials

1 Domain has 96 words / trials (6x16=96)

Three Part Stroop has:

3 Domains,

18 Blocks,

288 Trials in total

Timing

1 trial is 1.5 seconds

1 Block with 16 trials is 24 seconds

1 Domain with 6 Blocks and 96 trials is 2 min 40 sec

Total 3 part Stroop test time is 7 minutes, 20 seconds

4 Fixation pauses are presented

1 Fixation pause (+) at the start, 1 at the finish lasting 30 seconds each

1 between each test (2) – lasting 5 seconds each

Total test time with Fixation Pauses = 8 minutes

APPENDIX U: WHOQOL-BREF AGREEMENT

User Agreement for WHOQOL Bref and related materials

This agreement is between the World Health Organization ("WHO") and Jan Tait (CEO thesis candidate). WHO hereby grants User a nonexclusive, royalty free license to use the World Health Organization Quality of Life Questionnaire and/or related materials (hereafter referred to as "WHOQOL Bref") in User's study outlined below. The term of this User Agreement shall be for a period of 1 year.

The approved study for this User Agreement is:

Study Title	The Osteopathic treatment of adults who experienced war as children
Principal Investigator	Jan Tait
Sample characteristics	Young adults who had direct exposure to war as children, when 3 to 11 years old, in Croatia between 1991 - 1995
Sample size	25
Treatment Intervention	Osteopathic assessment and treatment
Total number of assessments	4 times
Assessment time points	2 times, one month apart, before 6 Osteopathic treatments. 2 times, one month apart after 6 Osteopathic treatments
WHOQOL Bref version	WHOQOL Bref copyright 2004
Other measures	Counting Stroop test Emotional Counting Stroop test

This User Agreement is based upon the following conditions:

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b. common methods used by two or more Users;

c. the data reported from two or more Users ;

d. the comparisons made between the data reported from the Users;

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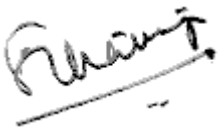


WHO:

Dr. Somnath Chatterji

Measurement and Health Information Systems (MHI)

World Health Organization

Avenue Appia

Geneva 27

CH 1211 Switzerland

Date:

USER:

By: _Jan Tait_____
Title: _The Osteopathic treatment of adults who experienced war as children
Institution: _The College d'Etudes Osteopathiques, Montreal, Canada
Address: _Jan Tait_____
_290 Longspell Rd, RR 2_____
_Canning, Nova Scotia, B0P 1H0, CANADA_____
Date: _October 18, 2010_____

THE WORLD HEALTH ORGANIZATION QUALITY OF LIFE (WHOQOL) -BREF

APPENDIX V: WHOQOL-BREF PDF

The World Health Organization Quality of Life (WHOQOL)-BREF

WHOQOL-BREF

The following questions ask how you feel about your quality of life, health, or other areas of your life. I will read out each question to you, along with the response options. **Please choose the answer that appears most appropriate.** If you are unsure about which response to give to a question, the first response you think of is often the best one.

Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life **in the last four weeks.**

		Very poor	Poor	Neither poor nor good	Good	Very good
1.	How would you rate your quality of life?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
2.	How satisfied are you with your health?	1	2	3	4	5

The following questions ask about **how much** you have experienced certain things in the last four weeks.

		Not at all	A little	A moderate amount	Very much	An extreme amount
3.	To what extent do you feel that physical pain prevents you from doing what you need to do?	5	4	3	2	1
4.	How much do you need any medical treatment to function in your daily life?	5	4	3	2	1
5.	How much do you enjoy life?	1	2	3	4	5
6.	To what extent do you feel your life to be meaningful?	1	2	3	4	5

		Not at all	A little	A moderate amount	Very much	Extremely
7.	How well are you able to concentrate?	1	2	3	4	5
8.	How safe do you feel in your daily life?	1	2	3	4	5
9.	How healthy is your physical environment?	1	2	3	4	5

The following questions ask about how completely you experience or were able to do certain things in the last four weeks.

		Not at all	A little	Moderately	Mostly	Completely
10.	Do you have enough energy for everyday life?	1	2	3	4	5
11.	Are you able to accept your bodily appearance?	1	2	3	4	5
12.	Have you enough money to meet your needs?	1	2	3	4	5
13.	How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
14.	To what extent do you have the opportunity for leisure activities?	1	2	3	4	5

		Very poor	Poor	Neither poor nor good	Good	Very good
15.	How well are you able to get around?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
16.	How satisfied are you with your sleep?	1	2	3	4	5
17.	How satisfied are you with your ability to perform your daily living activities?	1	2	3	4	5
18.	How satisfied are you with your capacity for work?	1	2	3	4	5
19.	How satisfied are you with yourself?	1	2	3	4	5

20.	How satisfied are you with your personal relationships?	1	2	3	4	5
21.	How satisfied are you with your sex life?	1	2	3	4	5
22.	How satisfied are you with the support you get from your friends?	1	2	3	4	5
23.	How satisfied are you with the conditions of your living place?	1	2	3	4	5
24.	How satisfied are you with your access to health services?	1	2	3	4	5
25.	How satisfied are you with your transport?	1	2	3	4	5

The following question refers to how often you have felt or experienced certain things in the last four weeks.

		Never	Seldom	Quite often	Very often	Always
26.	How often do you have negative feelings such as blue mood, despair, anxiety, depression?	5	4	3	2	1

Do you have any comments about the assessment?

_____

_____

[The following table should be completed after the interview is finished]

		Equations for computing domain scores	Raw score	Transformed scores*	
				4-20	0-100
27.	**Domain 1**	(6-Q3) + (6-Q4) + Q10 + Q15 + Q16 + Q17 + Q18 ☐ + ☐ + ☐ + ☐ + ☐ + ☐ + ☐	a. =	b:	c:
28.	**Domain 2**	Q5 + Q6 + Q7 + Q11 + Q19 + (6-Q26) ☐ + ☐ + ☐ + ☐ + ☐ + ☐	a. =	b:	c:
29.	**Domain 3**	Q20 + Q21 + Q22 ☐ + ☐ + ☐	a. =	b:	c:
30.	**Domain 4**	Q8 + Q9 + Q12 + Q13 + Q14 + Q23 + Q24 + Q25 ☐ + ☐ + ☐ + ☐ + ☐ + ☐ + ☐ + ☐	a. =	b:	c:

* See Procedures Manual, pages 13-15

APPENDIX W: SF-36-ENGLISH VERSION PDF

SF36 Health Survey

INSTRUCTIONS: This set of questions asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer every question by marking the answer as indicated. If you are unsure about how to answer a question please give the best answer you can.

1. In general, would you say your health is: (Please tick **one** box.)
   - Excellent ☐
   - Very Good ☐
   - Good ☐
   - Fair ☐
   - Poor ☐

2. Compared to one year ago, how would you rate your health in general now? (Please tick **one** box.)
   - Much better than one year ago ☐
   - Somewhat better now than one year ago ☐
   - About the same as one year ago ☐
   - Somewhat worse now than one year ago ☐
   - Much worse now than one year ago ☐

3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much? **(Please circle one number on each line.)**

	Activities	**Yes, Limited A Lot**	**Yes, Limited A Little**	**Not Limited At All**
3(a)	**Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	1	2	3
3(b)	**Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
3(c)	Lifting or carrying groceries	1	2	3
3(d)	Climbing **several** flights of stairs	1	2	3
3(e)	Climbing **one** flight of stairs	1	2	3
3(f)	Bending, kneeling, or stooping	1	2	3
3(g)	Waling **more than a mile**	1	2	3
3(h)	Walking **several blocks**	1	2	3
3(i)	Walking **one block**	1	2	3
3(j)	Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	(Please circle one number on each line.)	**Yes**	**No**
4(a)	Cut down on the **amount of time** you spent on work or other activities	1	2
4(b)	Accomplished less than you would like	1	2
4(c)	Were **limited** in the **kind** of work or other activities	1	2
4(d)	Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (e.g. feeling depressed or anxious)?

	(Please circle one number on each line.)	**Yes**	**No**
5(a)	Cut down on the **amount of time** you spent on work or other activities	1	2
5(b)	Accomplished less than you would like	1	2
5(c)	Didn't do work or other activities as **carefully** as usual	1	2

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups? (Please tick **one** box.)

- Not at all ☐
- Slightly ☐
- Moderately ☐
- Quite a bit ☐
- Extremely ☐

7. How much physical pain have you had during the past 4 weeks? (Please tick **one** box.)

- None ☐
- Very mild ☐
- Mild ☐
- Moderate ☐
- Severe ☐
- Very Severe ☐

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)? (Please tick **one** box.)

- Not at all ☐
- A little bit ☐
- Moderately ☐
- Quite a bit ☐
- Extremely ☐

9. These questions are about how you feel and how things have been with you during the past 4 weeks. Please give the one answer that is closest to the way you have been feeling for each item.

	(Please circle one number on each line.)	**All of the Time**	**Most of the Time**	**A Good Bit of the Time**	**Some of the Time**	**A Little of the Time**	**None of the Time**
9(a)	Did you feel full of life?	1	2	3	4	5	6
9(b)	Have you been a very nervous person?	1	2	3	4	5	6
9(c)	Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
9(d)	Have you felt calm and peaceful?	1	2	3	4	5	6
9(e)	Did you have a lot of energy?	1	2	3	4	5	6
9(f)	Have you felt downhearted and blue?	1	2	3	4	5	6
9(g)	Did you feel worn out?	1	2	3	4	5	6
9(h)	Have you been a happy person?	1	2	3	4	5	6
9(i)	Did you feel tired?	1	2	3	4	5	6

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives etc.) (Please tick **one** box.)

- All of the time ☐
- Most of the time ☐
- Some of the time ☐
- A little of the time ☐
- None of the time ☐

11. How TRUE or FALSE is each of the following statements for you?

	(Please circle one number on each line.)	**Definitely True**	**Mostly True**	**Don't Know**	**Mostly False**	**Definitely False**
11(a)	I seem to get sick a little easier than other people	1	2	3	4	5
11(b)	I am as healthy as anybody I know	1	2	3	4	5
11(c)	I expect my health to get worse	1	2	3	4	5
11(d)	My health is excellent	1	2	3	4	5

Thank You!

APPENDIX X: SUBGROUP INCLUSION SCREENING AND TREATMENT FINDINGS

ENDOCRANIAL SUBGROUP CRITERIA SCORES out of 7 (Appendix J)

Endocranial Subgroup 14 Subjects (56%)	Inclusion Score
01	5
05	7
06	4
07	3
11	5
13	7
16	5
17	5
18	5
20	5
21	6
22	5
23	4
24	4

ENDOCRANIAL SUBGROUP INCLUSION RESULTS (needs 3 out of 7 possible criteria)
N=14, percentage based on total of subgroup

Ventricular motility (lateral, third and fourth ventricles)	14 subjects 100%
Hemisphere motility (+ corpus callosum)	9 subjects 64%
Lobe motility	12 subjects 86%
Fissure dissociation	5 subjects 37%
'Three layers' motility (cortical, limbic, archaic)	10 subjects 71%
Global Encephalon Motion (coiling) around Cardinal Axes (A/P, cardinal, longitudinal)	9 subjects 64%
Endocranial spasm treatment (traumatic or emotional)	11 subjects 79%

ENDOCRANIAL SUBGROUP SPASM TREATMENTS (by total subjects)

No Spasm Treated	4
Traumatic Spasm Treated	4
Emotional Spasm Treated	4
Traumatic and Emotional Spasm Treated	2

***Spasms Treated: 10 Subjects (40%)**

GLOBAL SUBGROUP ENDOCRANIAL JUSTIFICATION TEST RESULTS
N=11

Good global vitality – expressed in the PRM	2 subjects
Centralized straight sinus (Sutherland's Fulcrum)	9 subjects
Patent spinal dura upon longitudinal traction (Core Link)	10 subjects
Unimpeded fluid drive: om to contralateral orbit	
Central Chain integrity	5 subjects

GLOBAL SUBGROUP ENDOCRANIAL INCLUSION CRITERIA RESULTS

Ventricular motility (lateral, third and fourth ventricles)	4^{th} – 19, 4^{th} and lateral – 10, 4^{th} V – 03, 4^{th} V – 12, lateral – 26, lateral - 14
Hemisphere motility	4 subjects
Lobe motility	2 subjects
Fissure dissociation	1 subject
'Three layers' motility (cortical, limbic, archaic)	
Global Encephalon Motion (coiling) around Cardinal Axes (A/P, cardinal, longitudinal)	1 subjects
Endocranial spasm treatment (traumatic or emotional)	

WHOLE GROUP FINDINGS – Endocranial Sphere (25 subjects)

PRIMARY RESPIRATORY MECHANISM – Presence at onset of Treatment (by total)

PRM	8 (32%)
No PRM	17 (68%)

PRIMARY RESPIRATORY MECHANISM – Presence at onset of Treatment (by subject)

PRM	8/25 (32%) Whole Group 42% Endo 18% Global
No PRM	17/25 (68%) Whole Group 57% Endo 82% Global

Of the total group of 25 17 had no PRM. Subjects were almost split evenly (50/50) between endocranial subjects who began with no PRM and global subjects who began with no PRM (8/17 endo, 9/17 global). Nonetheless, subjects with no initial PRM comprised 57% (8/14) of the total endocranial group. Subjects with no initial PRM comprised 82% (9/11) of the Global group.

Distinct Encephalon Findings – by total (15 Subjects – 60%)

Brain Stem / Diencephalon	10 50% Endo, 50% Global
Retracted Encephalon	6 50% Endo, 50% Global
Global Encephalon Vibration	1 Global
Radiating Thalamus	2 Endo, Global

- 5 in this group had initial PRM and were in endocranial group
- 2 in this group had no initial PRM and were in endocranial group
- 8 in this group had no initial PRM and were in global group

Distinct Encephalon Findings – by subject (15 Subjects – 60%; 30% Endo, 30% Global)

Brain Stem / Diencephalon	10 subjects 50% Endo, 50% Global
Retracted Encephalon	6 subjects 50% Endo, 50% Global
Global Encephalon Vibration	1 subject Global
Radiating Thalamus	2 subjects Endo, Global

Note: some subjects had more than one finding

APPENDIX Y: SF-36 HEALTH SURVEY SUBGROUP RESULTS

***Hypothesis**

Global osteopathic and endocranial assessment and treatment will improve objective SF-36 scores in adult subjects who experienced war related trauma in childhood.

***Independent Variable**

Assessment and treatment of the cranial and endocranial sphere will serve as the independent variables. (Between group analysis is done to indicate the independent variable.)

Domain One (SF-36): Physical Functioning (PF)

Independent Group Analysis – Wilcoxon Signed Ranks Test (PF)

The Wilcoxon is a non-parametric single sample analysis.

- *Endocranial group changed significantly across time between pre and post scores. (p =.015)
- Global group did not change significantly. (p =.35)

***Hypothesis Questions based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?
   *Yes.
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

Yes. The Endocranial treatment group changed significantly over time whereas the Global treatment group did not.

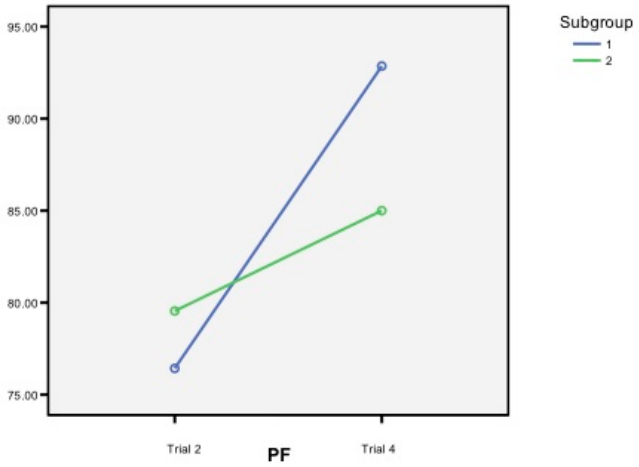
ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

(Increased score = positive outcome.)

Physical Functioning (PF) Plots



Time effect F= 5.9, p < .02

Group effect F = .25, p = .62

Interaction (group* Time) F = 1.48, p = .23

Between Group Analysis – Physical Functioning (PF)

1. Are there significant differences in scores over measurement times?

*Yes. Both groups change similarly over time. (p <.02)

2. Do overall group means differ?

No significant difference in overall means between groups was detected.

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time.

Trends: The Endocranial treatment group increased more than the Global treatment group.

A larger sample is needed

Domain Two (SF-36): Role Physical (RP)

Independent Group Analysis – Wilcoxon Signed Ranks Test (RP)

Appendix (??)

The Wilcoxon is a non-parametric single sample analysis.

- Endocranial treatment group changed significantly across time between pre and post scores. (p=.05)
- Global treatment group changed moderately across time between pre and post scores. (p =.065)

***Hypothesis Question based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?

   *Yes

2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

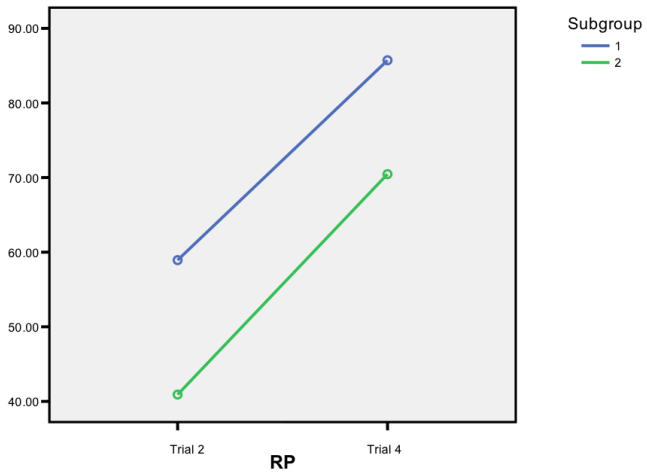
No

ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

Role Physical (RP) Plots



Time effect F = 8.3, p = .008

Group effect F= 2.18, p = .15

Interaction (group* Time) F = .02, p = .89

Between Group Analysis – Role Physical (RP)

1. Are there significant differences in scores over measurement times?

Yes. Both groups change similarly over time. (p<.008)

2. Do overall group means differ?

No significant differences in overall means were detected.

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across.

Trends: Both treatment groups change over time and increase scores similarly.

Domain Three (SF-36): Role Emotional (RE)

Independent Group Analysis – Wilcoxon Signed Ranks Test (RE)

The Wilcoxon is a non-parametric single sample analysis.

- Endocranial treatment group did not change significantly across time between pre and post scores. (p =.286)
- Global treatment group did not change significantly across time between pre and post scores. (p =.518)

Hypothesis Question based on Independent Variables:

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?

   No.
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

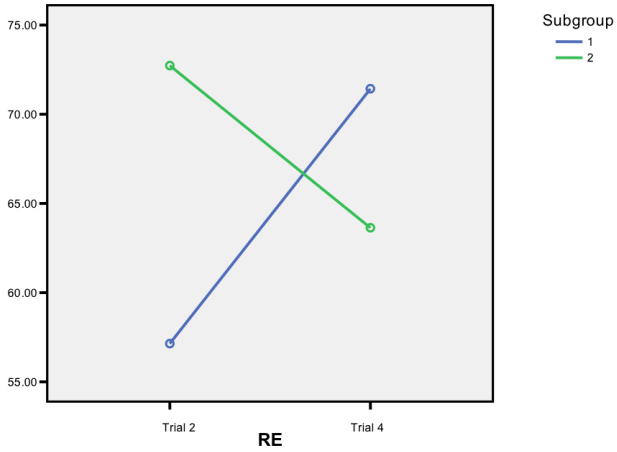
No, however a trend showing a difference in behaviour occurred. Scores for the Endocranial group increased while the Global group decreased.

ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

Role Emotional (RE) Plots



Time effect F = .069, p = .79

Group effect F = .09, p = .76

Interaction (group* Time) F = 1.4, p = .25

Between Group Analysis – Role Emotional (RE)

1. Are there significant differences in scores over measurement times?

No significant changes were found.

2. Do overall group means differ?

No significant differences in overall means were detected.

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time.

Trends: Though no statistically significant differences between groups were found, distinctly different behaviours occurred. The Endocranial treatment group increased and Global treatment group decreased, suggesting a trend, a larger sample needed.

Domain Four (SF-36): Social Functioning (SF)

Independent Group Analysis – Wilcoxon Signed Ranks Test (SF)

- Endocranial treatment group changed significantly across time between pre and post scores. ($p<.054$)
- Global group did not change significantly. ($p <.151$)

***Hypothesis Question based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?
   *Yes.
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

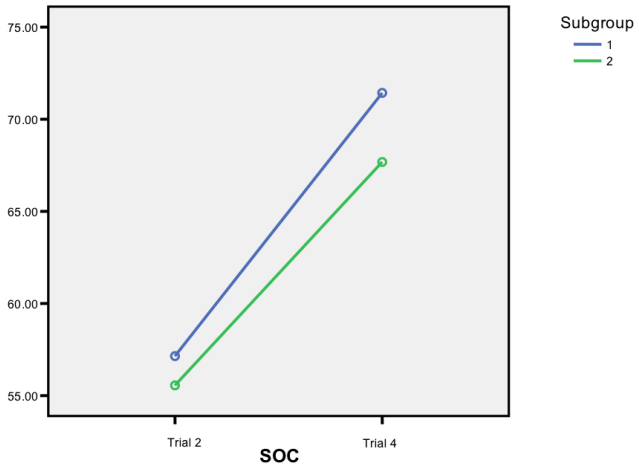
No, however the Global Osteopathic treatment group did not change significantly in Wilcoxon analysis where as the Endocranial Treatment group did.

ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

Social Functioning (SF) Plots



Time effect F= 6.57, p = .02

Group effect F = .04, p = .83

Interaction (group* Time) F = .14, p = .71

Between Group Analysis – Social Functioning (SF)

1. Are there significant differences in scores over measurement times?

Yes. Both groups change similarly over time. (p<.02)

2. Do overall group means differ?

No significant difference in overall means were detected.

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time.

Trends: Both groups changed over time and increase scores similarly.

Domain Five (SF-36): Mental Health (MH)

Independent Group Analysis – Wilcoxon Signed Ranks Test (MH)

- Endocranial treatment group changed significantly across time between pre and post scores. ($p<.032$)
- Global treatment group did not change significantly. ($p=.324$)

***Hypothesis Question based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?
   *Yes.
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

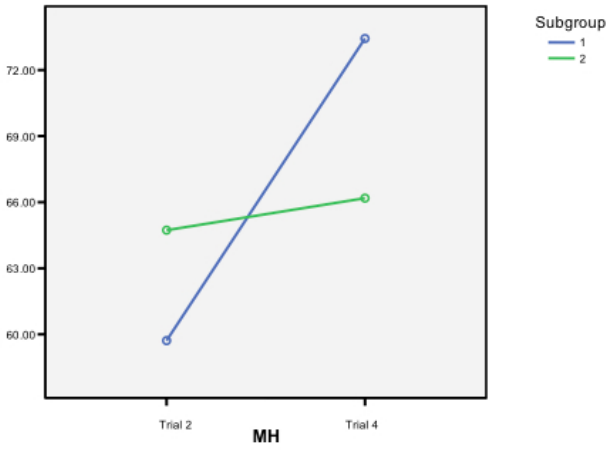
Yes.

ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

Mental Health (MH) Plots



Time effect F = 4.16, p = .05

Group effect F = .04, p = .85

Interaction (group* Time) F= 2.71, p = .11

Between Group Analysis – Mental Health (MH)

1. Are there significant differences in scores over measurement times?

Yes. Both groups change similarly over time. (p<.05)

2. Do overall group means differ?

No significant differences in overall means were detected.

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time. (p =.11)

*Note: “It is currently becoming accepted in the field of psychological testing that p<.10 indicates significance.” (Dianne Looker, social statistician/professor, Acadia University Wolfville NS; professional consult, Feb. 21, 2012)

Trends: Endocranial group increased while global group remained stable, larger sample needed.

Domain Six (SF-36): Energy/Vitality (EV)

Independent Group Analysis – Wilcoxon Signed Ranks Test (EV)

- Global treatment group changed moderately across time between pre and post scores. ($p<.058$)
- Endocranial treatment group did not change significantly across time between pre and post scores. ($p = .146$)

***Hypothesis Question based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?

   No.

2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

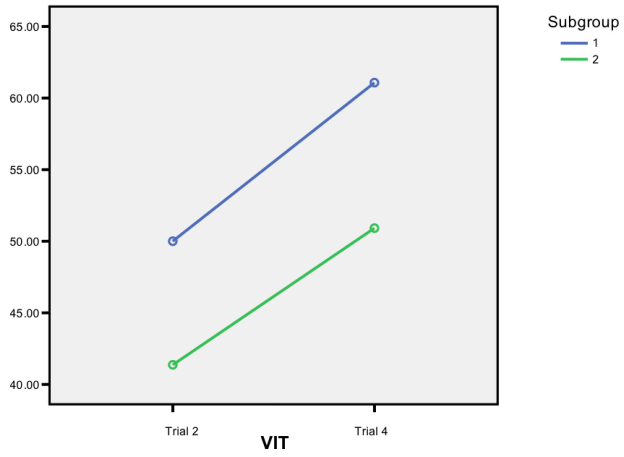
Yes. The Endocranial Treatment Group did not increase Energy/Vitality Scores significantly whereas the Global Treatment Group did.

ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

Energy/Vitality (EV) Plots



Time effect F= 4.9, p = .04

Group effect F = 1.44, p = .24

Interaction (group* Time) F = .03, p = .87

Between Group Analysis – Energy/Vitality (EV)

1. Are there significant differences in scores over measurement times?

Yes. Both groups change similarly over time. (p<.04)

2. Do overall group means differ?

No significant differences in overall means were detected.

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time.

Trends: Both groups change over time and increase scores similarly.

Domain Seven (SF-36): Body Pain (BP)

Independent Group Analysis – Wilcoxon Signed Ranks Test (BP)

- Global treatment group changed moderately across time between pre and post scores. (p = .088)

- Endocranial treatment did not changed significantly across time between pre and post scores. (p = .200)

***Hypothesis Question based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?
   No.
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

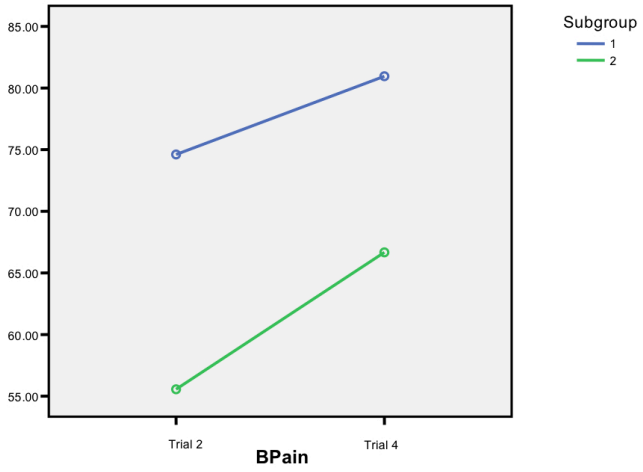
No, however the Global Osteopathic Treatment group had a marginal improvement in Body Pain scores.

ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

Body Pain (BP) Plots



Time effect F = 6.3, p = .02

Group effect F = 3.42, p = .08

Interaction (group* Time) F = .47, p = .50

Between Group Analysis – Body Pain (BP)

1. Are there significant differences in scores over measurement times?
   Yes. Both groups change similarly over time. (p<.02)

2. Do overall group means differ?

Marginal differences in overall means were detected. (p =.08)

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time.

Trends: Both groups increase scores similarly. The Group Effect of p =.08 in this instance indicates a trend toward difference prior to and after Osteopathic treatment. This pre-existing trend toward difference is indicated by lack of significant change in the Wilcoxon Signed Rank test.

Domain Eight: General Health Perception (GH)

Independent Group Analysis – Wilcoxon Signed Ranks Test (GH)

- Endocranial treatment group changed significantly across time between pre and post scores. ($p<.010$)
- Global treatment group changed significantly across time between pre and post scores. ($p<.004$)

***Hypothesis Question based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective SF-36 Health Survey scores in adult subjects who experienced war related trauma in childhood?
   *Yes.
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

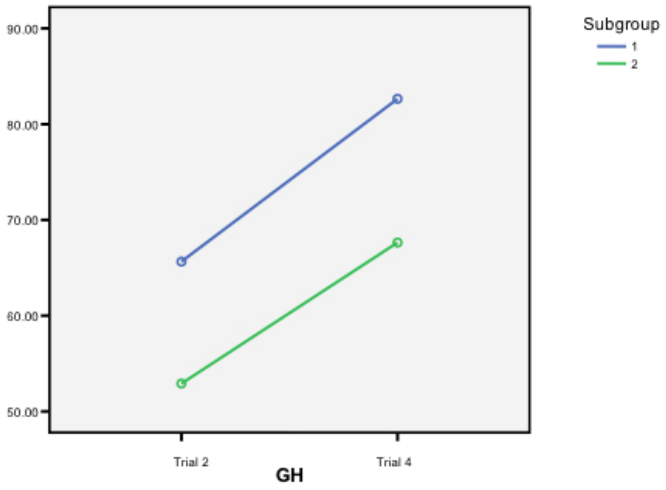
No. Though a significant group effect was found ($p = .04$) the Endocranial Treatment group had a higher GH score prior to treatment and maintained that significant difference after treatment.

ANOVA – between group analysis

Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

General Health Perception (GH) Plots



Time effect F = 23.14, p = .000

Group effect F = 4.88, p = .04

Interaction (group* Time) F = .12, p = .73

Between Group Analysis – General Health Perception (GH)

1. Are there significant differences in scores over measurement times?
   Yes. Both groups change similarly over time. (p<.000)

2. Do overall group means differ?
   Yes, significant difference in overall mean scores were detected (p<.04)

3. Is there an interaction between group and time?
   There is no significant interaction between treatment groups across time.

Trends: Groups changed over time but both groups improved scores similarly.

APPENDIX Z: SF-36 HEALTH SURVEY WHOLE GROUP RESULTS

Independent Group Analysis – Wilcoxon Signed Ranks Test

This is a simple non-parametric single sample analysis.

Endocranial and Global Osteopathic Treatment Group

(14 subjects)

1. In across time between pre and post scores the Endocranial Treatment group had significant increases in four scores (PF, RP, MH, GH) and a marginal increase in one (SF).

Test Statistics[b,c]

	Physical Functioning (PF)	Role Physical (RP)	Role Emotional (RE)	Social Functioning (SF)	Mental Health (MH)
Z	-2.443[a]	-1.956[a]	-1.066[a]	-1.929[a]	-2.142[a]
Asymp. Sig. (2-tailed)	.015	.050	.286	.054	.032

Test Statistics[b,c]

	Energy/Vitality (EV)	Body Pain (P)	General Health Perception (GH)	Transit
Z	-1.454[a]	-1.282[a]	-2.585[a]	-1.705[a]
Asymp. Sig. (2-tailed)	.146	.200	.010	.088

Global Osteopathic Treatment Group (11 subjects)

2. In across time between pre and post scores the Global sub-group had significant increase in one score (GH) and marginally significant increases in three scores (RP, EV, BP).

Test Statistics[c,d]

	Physical Functioning (PF)	Role Physical (RP)	Role Emotional (RE)	Social Functioning (SF)	Mental Health (MH)
Z	-.923[a]	-1.845[a]	-.647[b]	-1.437[a]	-.986[a]
Asymp. Sig. (2-tailed)	.356	.065	.518	.151	.324

Test Statistics[c,d]

	Energy/Vitality (EV)	Body Pain (P)	General Health Perception (GH)	Transit
Z	-1.895[a]	-1.706[a]	-2.852[a]	-1.543[a]
Asymp. Sig. (2-tailed)	.058	.088	.004	.123

Whole Group Results (25 subjects)

3. In across time between pre and post treatment scores the entire treatment group had significant increases in seven out of eight domains (all except RE).

Test Statistics

	Physical Functioning (PF)	Role Physical (RP)	Role Emotional (RE)	Social Functioning (SF)	Mental Health (MH)
Z	-2.495	-2.567	-.350	-2.443	-2.330
Asymp. Sig. (2-tailed)	.013	.010	.726	.015	.020

Test Statistics

	Energy/Vitality (EV)	Body Pain (P)	General Health Perception (GH)	Transit
Z	-2.208	-2.097	-3.836	
Asymp. Sig. (2-tailed)	.027	..036	.000	

APPENDIX AA: WHOQOL-BREF SUBGROUP RESULTS

WORLD HEALTH QUALITY OF LIFE-bref (WHQOL-bref) RESULTS ANALYSIS AND INTERPRETATION

***Hypothesis**

*Endocranial and global Osteopathic assessment and treatment will improve objective WHQOL-bref scores in adult subjects who experienced war related trauma in childhood.

***Independent Variable**

Assessment and treatment of the cranial and endocranial sphere will serve as the independent variables. (Between group analysis is done to indicate the independent variable.)

Physical Domain (WHOQOL-bref)

Endocranial and Global Osteopathic Treatment Independent Group Analysis

Wilcoxon Signed Ranks Test between Trials

This is a simple non-parametric single sample analysis.

	Physical2 – Physical1	Physical3 – Physical1	Physical4 – Physical1	Physical3 - Physical2	Physical4 - Physical2	Physical4 - Physical3
Z	-.079(a)	-2.943(b)	-2.611(b)	-3.016(b)	-2.357(b)	-1.602(a)
Asymp. Sig. (2-tailed)	.937	.003	.009	.003	.018	.109

Physical scores increased, after treatment, in Trial 3 and Trial 4 over pre-treatment Trial 1 and Trial 2. Trial 4 was similar to Trial 3 scores (both post treatment scores).

Friedman Test across Multiple Trials

This is a non-parametric test used for multiple across time trials.

- There is a significant difference in physical scores across time measurements. Four combined Trials p = .001

Global Osteopathic Treatment Independent Group Analysis

Wilcoxon Signed Ranks Test between Trials

	Physical2 – Physical1	Physical3 – Physical1	Physical4 – Physical1	Physical3 - Physical2	Physical4 - Physical2	Physical4 - Physical3
Z	-1.017(a)	-1.742(b)	-1.797(b)	-2.201(b)	-2.532(b)	-.741(a)
Asymp. Sig. (2-tailed)	.309	.082	.072	.028	.011	.458

Physical scores increased, post treatment, at Trial 3 and 4 over pre-treatment Trial 2. Trials 3 and 4 were similar. Trials 3 and 4 marginally increased over Trial 1.

Friedman Test across Multiple Trials

- There is a significant difference in physical scores across time measurements. Four combined Trials p = .013

***Hypothesis Questions based on Independent Variable:**

3. Did global osteopathic and endocranial assessment and treatment improve objective WHQOL-bref scores in adult subjects who experienced war related trauma in childhood?

   *Yes.

4. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

No. Both groups changed significantly over time.

Repeated Measures ANOVA – Between Group Analysis

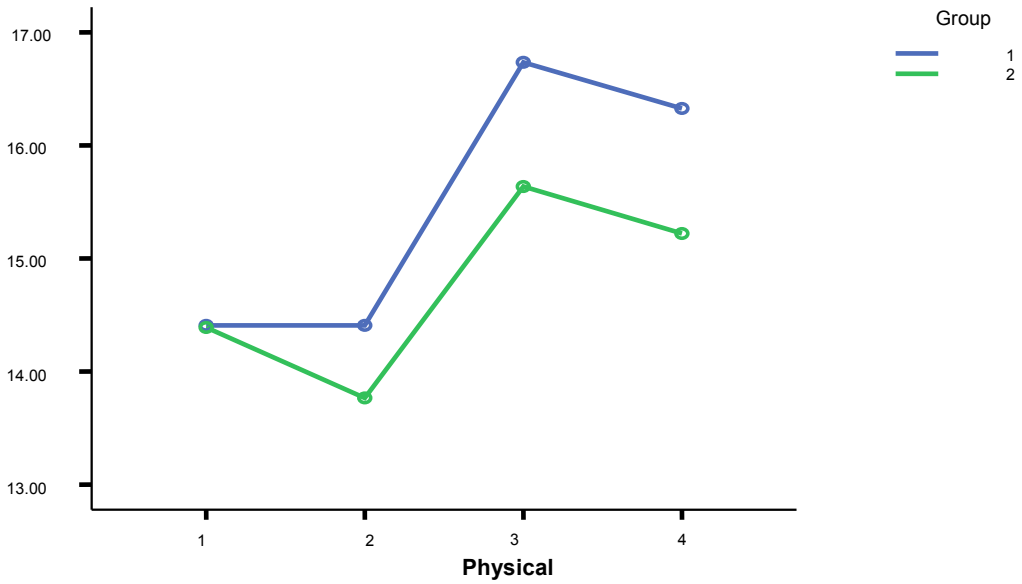
Subgroup 1: Endocranial and Global Osteopathic Treatment Group

Subgroup 2: Global Osteopathic Treatment Group

This is an analysis of variance that compares different means / components between groups.

- Compares Global versus Endocranial treatment groups on physical scales over each measurement time 1- 4

Physical Plots



Time effect F= 5.8, p = .005

Group effect F = .48, p = .49

Interaction (group* Time) F = .66, p = .59

Between Group Analysis – Physical

4. Are there significant differences in scores over measurement times?

*Yes there was a difference in scores over time. Both treatment groups behaved similarly. (p = .005)

5. Do overall group means differ?

No significant differences in overall means between treatment groups were detected. Groups behaved similarly. (p = .49)

6. Is there an interaction between group and time?

There was no interaction between measurement times, group behaved similarly. (p = .59)

Trends: They begin at the same point.. yet the Endocranial group improves even prior to treatment. Are we seeing the effects of optimism and 'worry' in two different groups?

Psychological Domain (WHOQOL-bref)

Endocranial and Global Osteopathic Treatment Independent Group Analysis

Wilcoxon Signed Ranks Test

N=14	Psychological2 Psychological1	Psychological3 Psychological1	Psychological4 Psychological1	Psychological3 Psychological2	Psychological4 Psychological2	Psychological4 Psychological3
Z	-.052(a)	-2.446(b)	-2.150(b)	-2.099(b)	-1.502(b)	-.638(a)
Asymp. Sig. (2-tailed)	.958	.014	.032	.036	.133	.524

Psychological scores increased, after treatment, at Trial 3 over pre-treatment Trial 1 and Trial 2. Trial 3 and 4 scores did not different.

Friedman Test across Multiple Trials

- There is a significant difference in psychological scores across time measurements. Friedman Test: 4 combined Trials p = .010

Global Osteopathic Treatment Independent Group Analysis

Friedman Test across Multiple Trials

- There are no differences in psychological scores over measurement times. Four combined Trials p = .690

***Hypothesis Questions based on Independent Variables:**

3. Did endocranial and global osteopathic assessment and treatment improve objective WHQOL-bref scores in adult subjects who experienced war related trauma in childhood?

   *Yes.

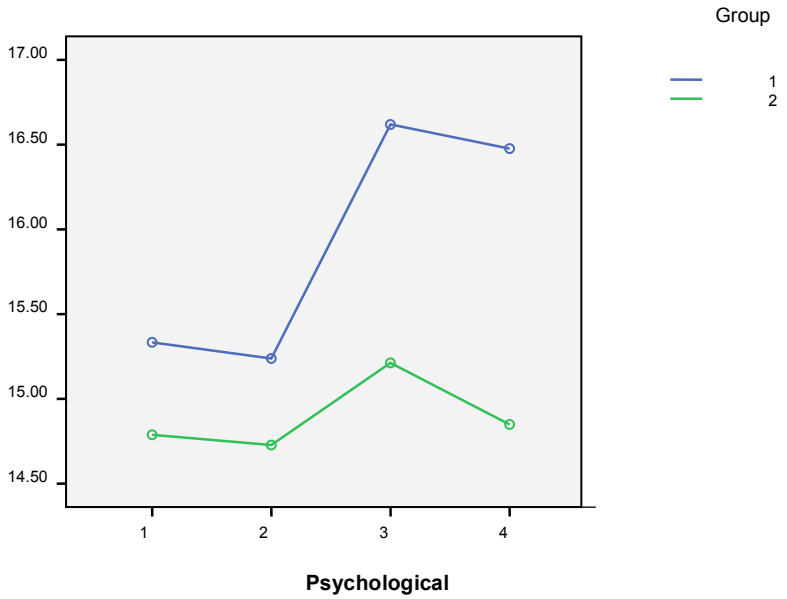
4. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

Yes. Though groups behaved similarly the Endocranial group showed significant improvement by comparison.

Repeated Measures ANOVA – Between Group Analysis

- Comparing Global versus Endocranial groups on psychological scales over each measurement time 1- 4

Psychological Plots



Time effect F= 3.15, p = .047

Group effect F = 1.08, p = .31

Interaction (group* Time) F = .77, p = .52

Between group Analysis – Psychological

1. Are there significant differences in scores over measurement times?

*Yes. There was a difference in scores over time. (p = .047)

2. Do overall group means differ?

There is no difference between groups and groups behave similarly over time. (p = .31)

3. Is there an interaction between group and time?

There was no interaction between measurement times and group – groups behaved similarly. (p = .52)

TREND: Not enough power to detect significant increase in endocranial group but certainly a marked trend here. Larger sample needed.

Social Domain (WHOQOL-bref)

Endocranial and Global Osteopathic Treatment Independent Group Analysis

Wilcoxon Signed Ranks Test

- There are no differences in between time measures

Friedman Test across Multiple Trials

- There are no differences in social scores across time measurements. Friedman Test: 4 combined Trials p = .961

Global Osteopathic Treatment Independent Group Analysis

Friedman Test across Multiple Trials

- There are no differences in psychological scores across time measurements. Friedman Test: 4 combined Trials p = .819

***Hypothesis Questions based on Independent Variables:**

1. Did a combination of global osteopathic and **endocranial** assessment and treatment improve objective WHQOL-bref scores in adult subjects who experienced war related trauma in childhood?

   No.

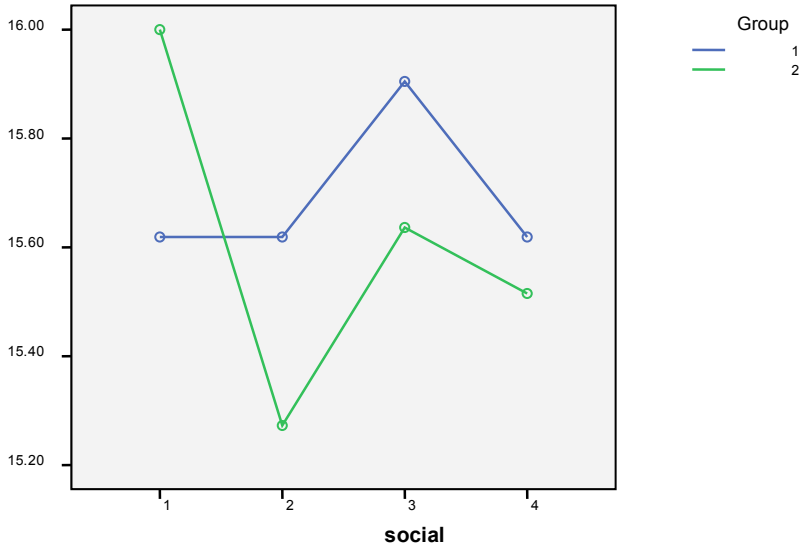
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?

No.

Repeated measures ANOVA – between group analysis

Comparing Global and Endocranial groups on social scales over each measurement time 1- 4

Social Plots



Time effect F = .79, p = .51

Group effect F = .006, p = .94

Interaction (group* Time) F= .45, p = .72

Between group Analysis – Social

1. Are there significant differences in scores over measurement times?

There was no difference over time measures. (p = .51)

2. Do overall group means differ?

No differences in overall means between groups were detected. (p = .94)

3. Is there an interaction between group and time?

There is no significant interaction between treatment groups across time. (p = .72)

TREND: Global Osteopathic treatment group expresses 'a fluke' in time 2 by declining prior to treatment. Both groups behave similarly.

Environment Scores (WHOQOL-bref)

Endocranial and Global Osteopathic Treatment Independent Group Analysis

Wilcoxon Signed Ranks Test

N=14	Environment2 – Environment1	Environment3 Environment1	Environment4 Environment1	Environment3 Environment2	Environment4 Environment2	Environment4 Environment3
Z	-1.395(a)	-2.406(a)	-1.778(a)	-1.315(a)	-1.123(a)	-1.313(b)
Asymp. Sig. (2-tailed)	.163	.016	.075	.189	.261	.189

Post Treatment Trial 3 scores increased over Trial 1. Trial 4 does not differ from Trial 3.

Friedman Test across Multiple Trials

- There are marginal differences in environment scores across time measurements. Four combined Trials p = .082

Global Osteopathic Treatment Independent Group Analysis

Friedman Test across Multiple Trials

- There are no differences in environment scores across time measuremts. Four combined Trials p = .733

***Hypothesis Questions based on Independent Variables:**

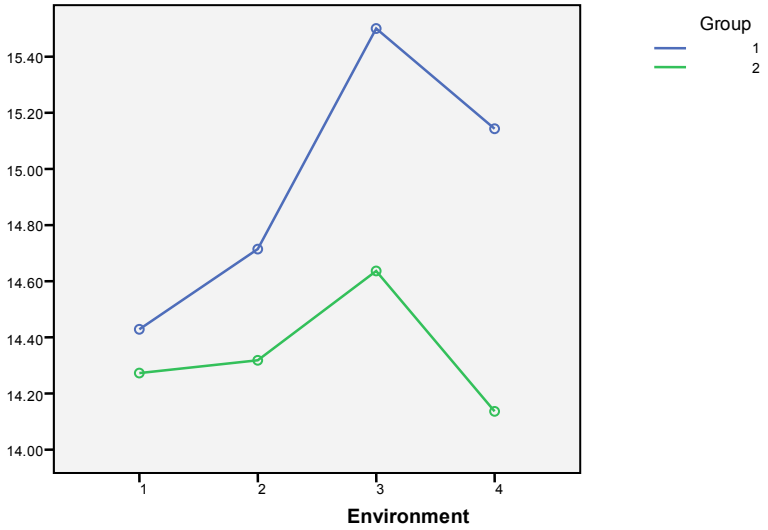
1. Did a combination of global osteopathic and endocranial assessment and treatment improve objective WHQOL-bref scores in adult subjects who experienced war related trauma in childhood?
   No, however there was marginal improvement found worth clinical consideration.
2. Did the effects of Endocranial Osteopathic treatment differ from Global Osteopathic treatment?
   Yes, marginally.

Repeated Measures ANOVA – Between Group Analysis

Comparing Global and Endocranial groups on environment scales over each measurement time

1- 4

Environment Plots



Time effect F = 2.54, p = .06

Group effect F= .42, p = .52

Interaction (group* Time) F = 1.06, p = .36.

Between group Analysis – Environment

1. Are there significant differences in scores over measurement times?

No significant difference over time, though marginal difference was found. Could (should) be considered clinically relevant. (p = .06)

2. Do overall group means differ?

No differences in overall means between groups were detected. (p = .52)

3. Is there an interaction between group and time?

There is no interaction between groups over time, they both behave similarly. (p = .36)

APPENDIX BB: WOQOL-BREF WHOLE GROUP RESULTS

Total Sample n = 25

FRIEDMAN MATCHED RANKS

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Physical	25	14.4000	2.87613	8.57	20.00
Physical2	25	14.1257	3.41075	7.43	20.00
Physical3	25	16.2514	2.55060	11.43	20.00
Physical4	25	15.8400	2.34170	11.43	20.00

Ranks

	Mean Rank
Physical	1.94
Physical2	1.76
Physical3	3.34
Physical4	2.96

N	25
Chi-Square	29.509
Df	3
Asymp. Sig.	.000

There is a significant difference in Physical scores between measurement times

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Psychological	25	15.0933	2.47117	11.33	20.00
Psychological2	25	15.0133	3.18631	8.00	20.00
Psychological3	25	16.0000	2.52396	12.00	20.00
Psychological4	25	15.7600	2.37175	12.00	20.00

Ranks

	Mean Rank
Psychological	2.16
Psychological2	2.18
Psychological3	3.02
Psychological4	2.64

N	25
Chi-Square	9.338
Df	3
Asymp. Sig.	.025

There is a significant difference in Psychological scores between measurement times

Wilcoxon Signed Ranks Test

Total Sample

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Physical	25	14.4000	2.87613	8.57	20.00
Physical2	25	14.1257	3.41075	7.43	20.00
Physical3	25	16.2514	2.55060	11.43	20.00
Physical4	25	15.8400	2.34170	11.43	20.00

Ranks

N=25	Physical2 – Physical1	Physical3 – Physical1	Physical4 – Physical1	Physical3 - Physical2	Physical4 - Physical2	Physical4 - Physical3
Z	-.773(a)	-3.368(b)	-3.205(b)	-3.715(b)	-3.376(b)	-1.833(a)
Asymp. Sig. (2-tailed)	.440	.001	.001	.000	.001	.067

For Physical scores over time

Scores increased Time 3 over time 1 and 2, similar scores at time 4 as time 3- could be considered marginally lower time 4 (p=.07)

Psychological

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Psychological	25	15.0933	2.47117	11.33	20.00
Psychological2	25	15.0133	3.18631	8.00	20.00
Psychological3	25	16.0000	2.52396	12.00	20.00
Psychological4	25	15.7600	2.37175	12.00	20.00

N=25	Psychological2 – Psychological1	Psychological3 – Psychological1	Psychological4 – Psychological1	Psychological3 - Psychological2	Psychological4 - Psychological2	Psychological4 - Psychological3
Z	-.164(a)	-2.539(b)	-1.744(b)	-2.190(b)	-1.340(b)	-1.567(a)
Asymp. Sig. (2-tailed)	.870	.011	.081	.028	.180	.117

Psychological Scores increase time 3 over time 1 and time 2. Time 4 similar to time 3

Appendix CC: WHQOL-bref Whole Group Results: Quality of Life and General Health

From WHOQOL-BREF: Two separate items on general health assessment and quality of life:

Between Trial 1 and Trial 4

Q1: How would you rate your quality of life?

N=25	Mean	Standard Deviation	Percentile 25	Median	Percentile 75	Z*	P
Q1_1st	3.64	.70	3.00	4.00	4.00	-1.886	.059
Q1_4th	3.96	.79	4.00	4.00	4.00		

* Wilcoxon Signed Ranks Test

There was no statistically significant difference in self-assessed quality of life before and after treatment. Although average quality of life is higher after the treatment this difference is not statistically significant. But results show a trend.

Q2: How satisfied are you with your health?

N=25	Mean	Standard Deviation	Percentile 25	Median	Percentile 75	Z*	P
Q2_1st	3.44	.96	3.00	4.00	4.00	-1.977	.048
Q2_4th	3.84	.85	3.00	4.00	4.00		

* Wilcoxon Signed Ranks Test

There was statistically significant difference in satisfaction with health before and after treatment. Average satisfaction with health is higher after the treatment.

APPENDIX DD: ENDO AND GLOBAL RT COMPARISONS:

Counting Stroop Interference and Neutral results

***Below is Reaction Time Data for part 2 of the Three Part Stroop.**

The Counting Test showed the most variance between groups and so was chosen. It is also the Stroop test this researcher would recommend using in future research. This list has been included for use in comparing results with future research.

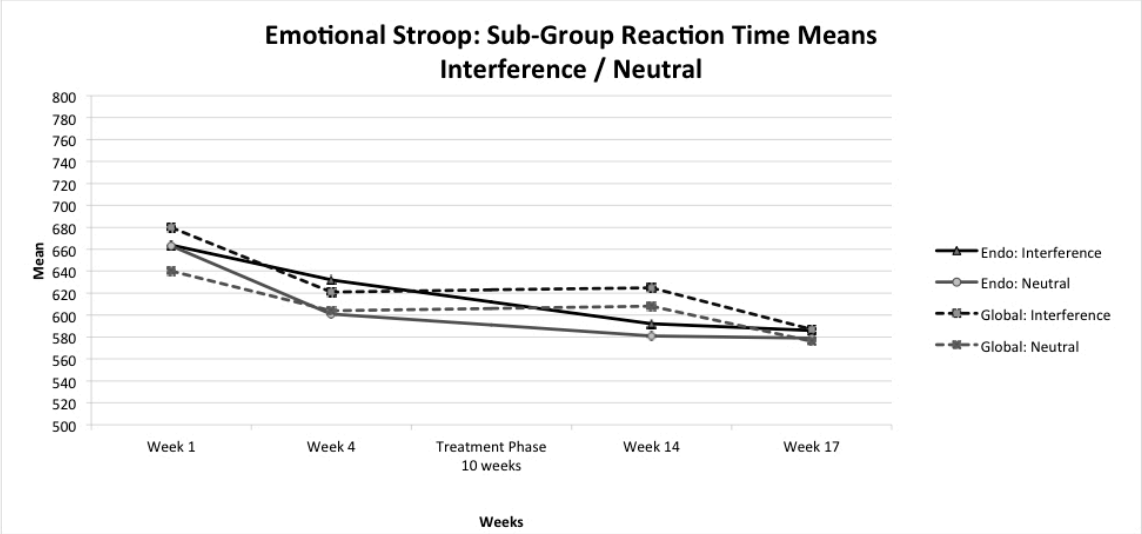
Values represent the difference between Interference and Neutral means for each individual sub-group.

Counting Stroop Test	Endo	Global	Endo	Global	Endo	Global	Endo	Global
Neutral and Interference dimensions	Means	Means	SD	SD	F value	F value	P value	P value
Neutral – trial 1	658.8	648.1	81.3	60.6				
Interference – trial 1	751.5	734.4	84.1	84.8	9	8	.006	.013
Neutral – trial 2	613.9	611.6	54.3	43.9				
Interference – trial 2	679.7	701.5	91.9	77.5	5	11	.029	.003
Neutral – trial 3	592.2	621.1	56.3	72.8				
Interference – trial 3	661.5	699.9	70.7	105.9	8	4	.008	.056
Neutral – trial 4	590.2	596.4	55.6	85.5				
Interference – trial 4	648.2	643.1	82.7	88.8	5	2	.038	.223

*Means in milliseconds.

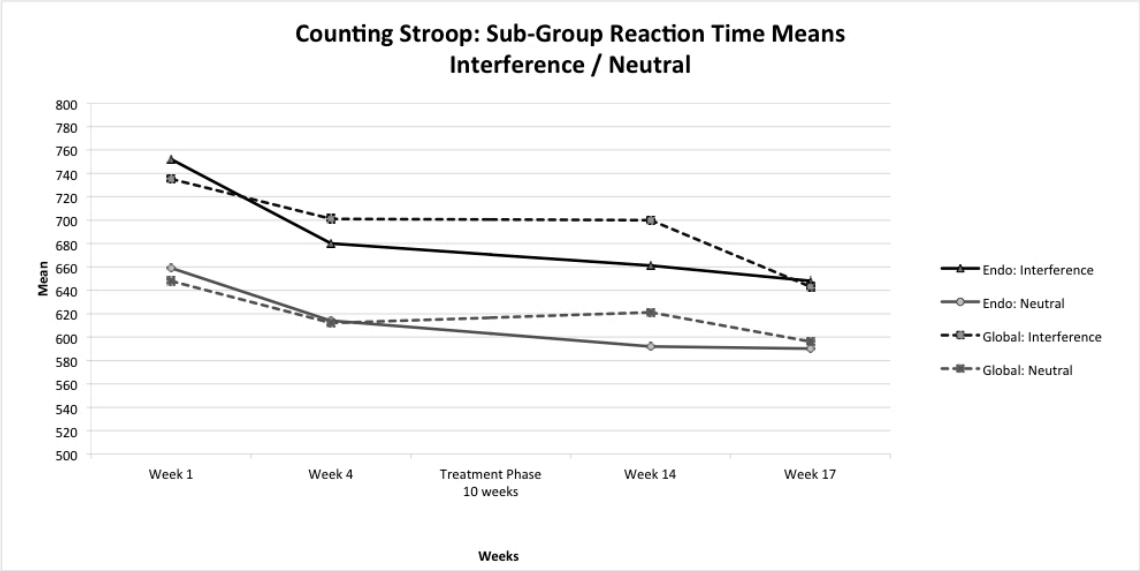
APPENDIX EE: THREE PART STROOP REACTION TIMES BY SUBGROUP, INTERFERENCE AND NEUTRAL

EMOTIONAL STROOP: Interference and Neutral Mean Reaction times and Standard Deviation by Sub-group



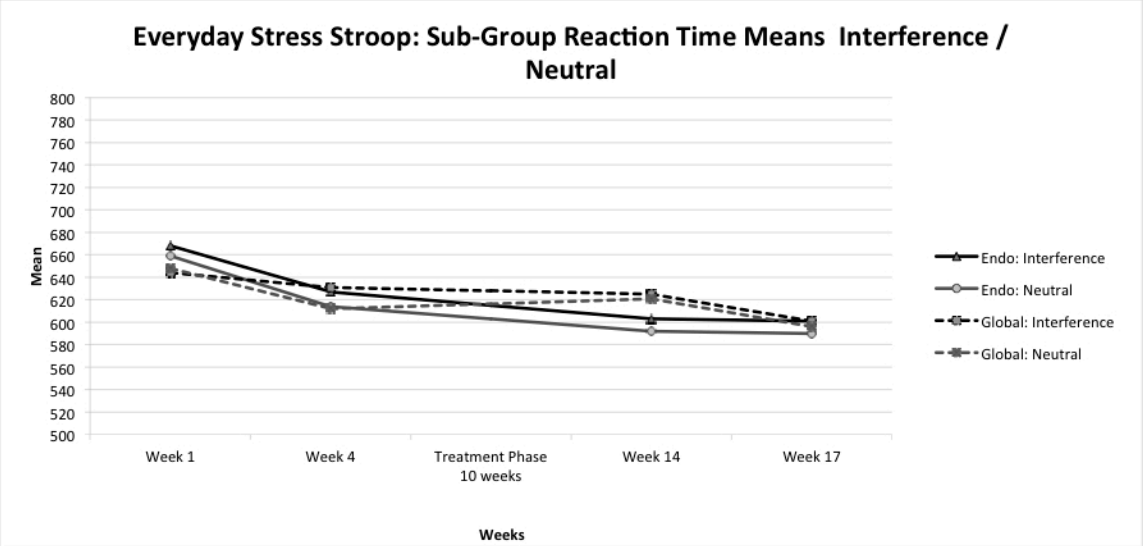
EMOTIONAL	**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**	
Part 1	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Global Interference	680	68	621	49	625	81	587	87
Global Neutral	640	55	604	45	608	60	576	73
Endo Interference	664	91	632	76	592	65	586	66
Endo Neutral	633	86	601	53	581	52	579	57

COUNTING STROOP: Interference and Neutral Mean Reaction times and Standard Deviation by subgroup



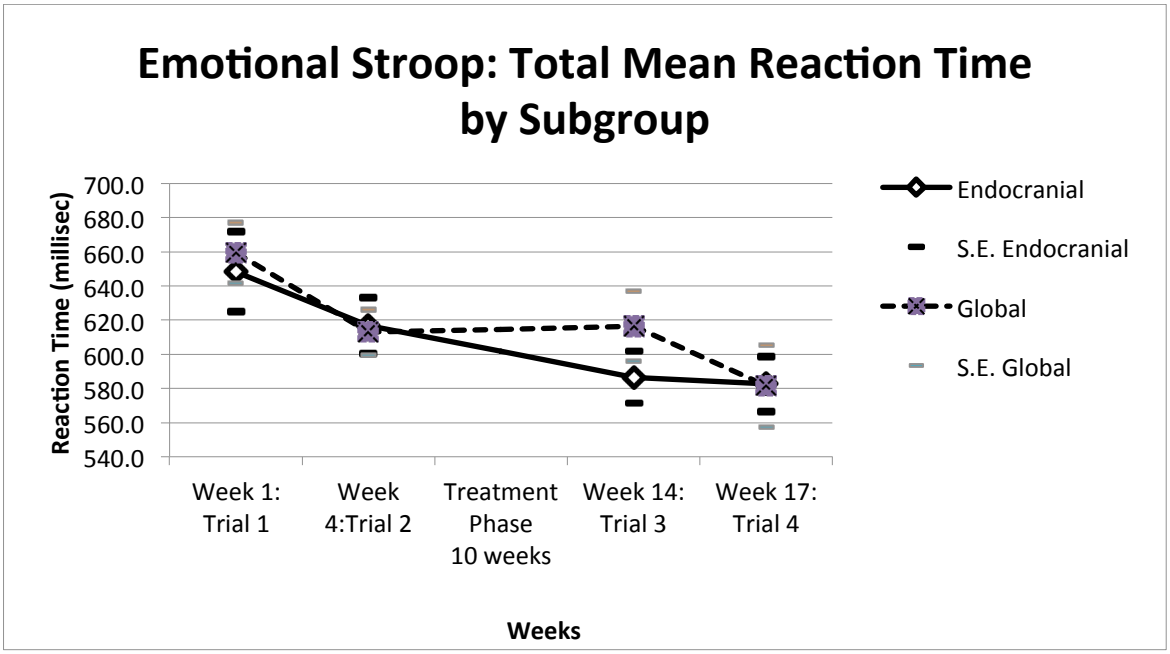
COUNTING	**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**	
Part 2	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Global Interference	735	85	701	78	700	106	643	89
Global Neutral	648	61	612	44	621	73	596	85
Endo Interference	752	84	680	92	661	71	648	83
Endo Neutral	659	81	614	54	592	56	590	56

EVERYDAY STROOP: Interference and Neutral Mean Reaction times and Standard Deviation by Sub-group



EVERYDAY	**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**	
Part 3	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Global Interference	644	54	631	59	625	79	601	47
Global Neutral	648	61	612	44	621	73	596	85
Endo Interference	668	100	627	85	603	65	601	52
Endo Neutral	659	81	614	54	592	56	590	56

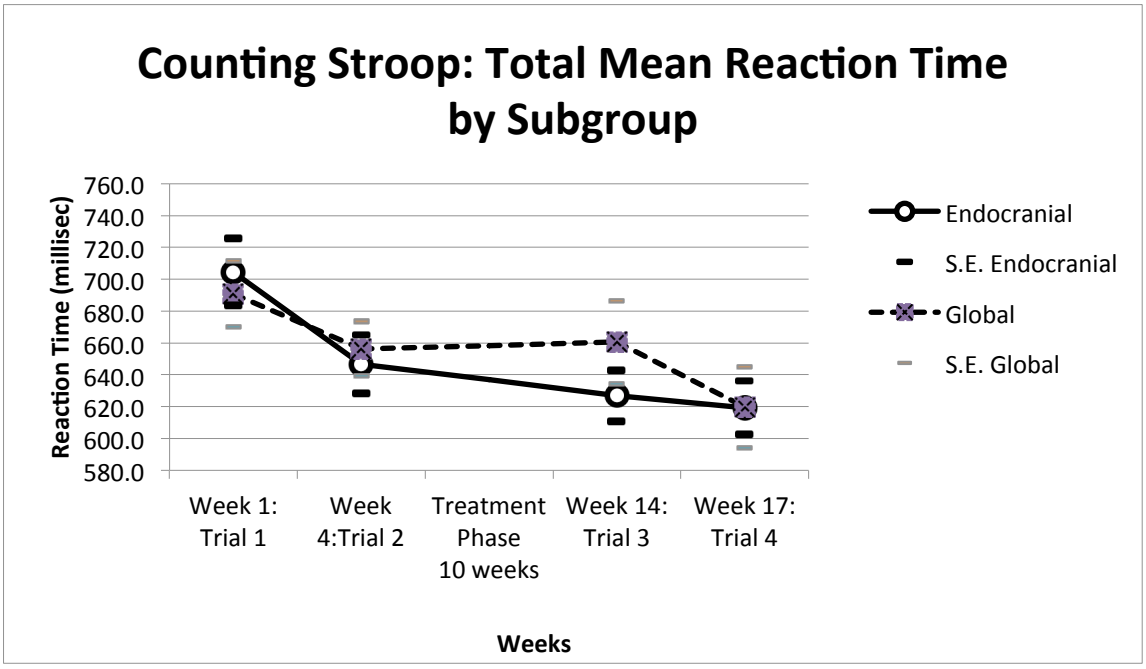
APPENDIX FF: THREE PART STROOP REACTION TIMES BY SUBGROUP



Part 1

EMOTIONAL	**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**	
Part 1	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Global	660	18	613	13	616	21	581	24
Endocranial	648	23	617	17	587	15	583	16

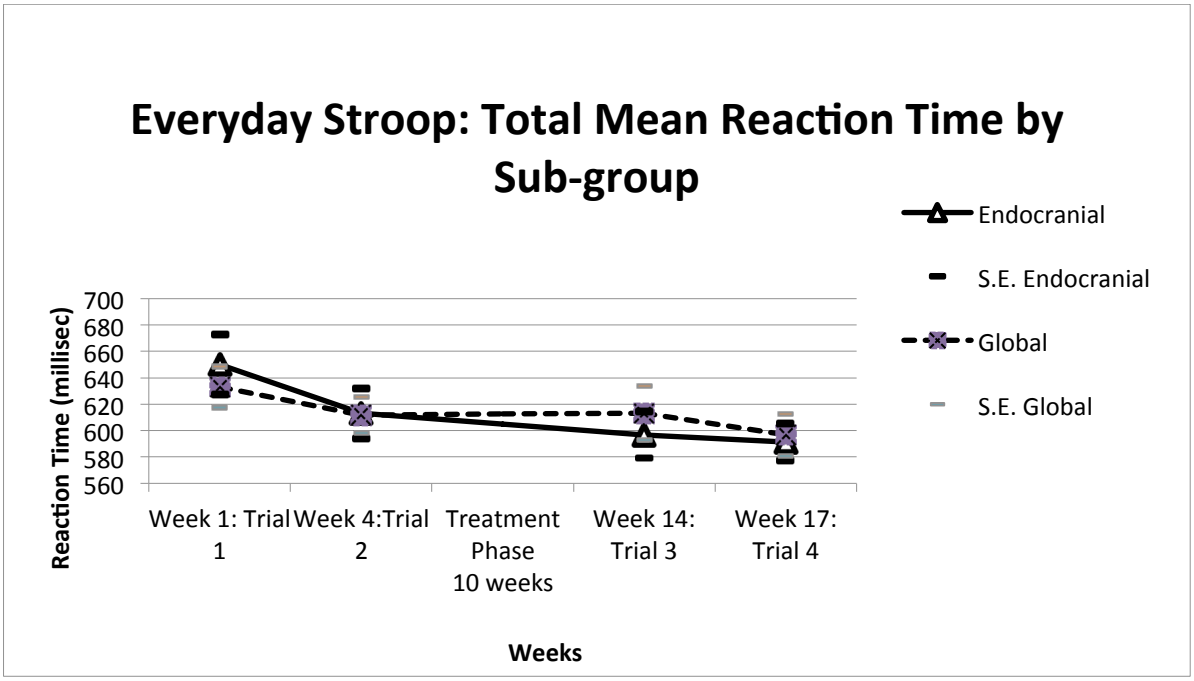
(mean in milliseconds)



Part 2

COUNTING	**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**	
Part 1	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Global	691	21	656	17	661	26	620	25
Endocranial	705	21	647	18	627	16	619	17

(mean in milliseconds)



Part 3

EVERYDAY	**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**	
Part 1	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Global	633	15	611	14	613	21	597	16
Endocranial	650	23	613	19	597	18	591	14

(mean in milliseconds)

APPENDIX GG: STATISTICIAN VERIFICATION LETTER

Dr. Beth Bruce
RE:DESIGN
Research & Evaluation Consultant
42 Twilight Lane
Dartmouth, NS
B2X 2R9
beth@redesign-evaluation.com

Collège d'Études Ostéopathiques - Halifax
7400, St-Laurent bouvelard, #211
Montreal (Quebec) H2R 2Y1

June 1, 2012

RE: Data Analyses

To whom it may concern,

I am pleased to provide approval of the statistical analyses of this thesis. I can confirm that I completed the data analyses for this study conducted by Jan Tait and that she is permitted to use the analyses.

If I may provide any further details, I would be pleased to do so.

Sincerely,

Beth Bruce

Beth Bruce, RN, BScN, MN, PhD