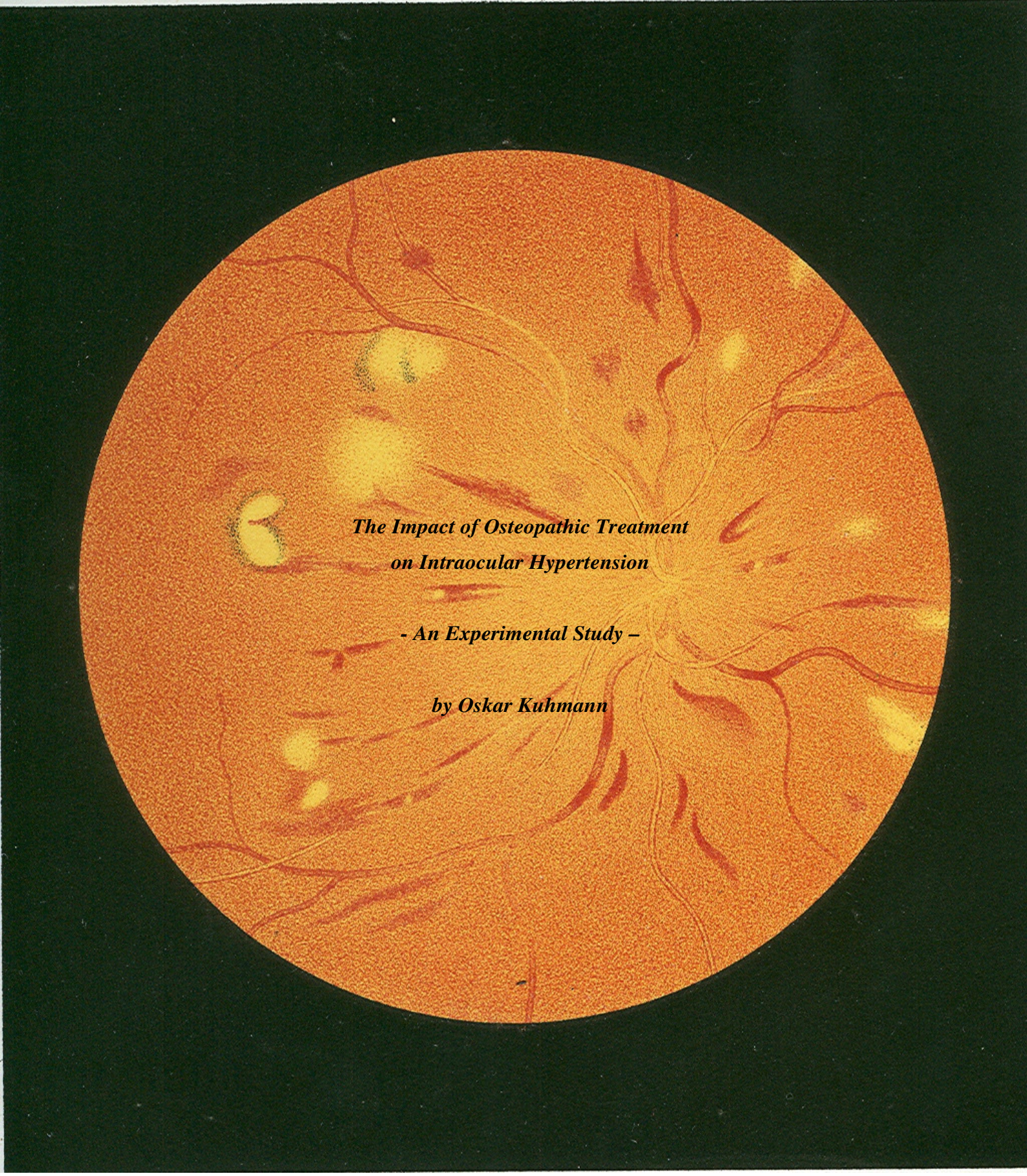

The Impact of Osteopathic Treatment on Intraocular Hypertension

- An Experimental Study –

by Oskar Kuhmann

AHistorical lithography Dr. Jaeger „ Pathologie des Auges“(pathology of the eye) 1855, Vienna, from the Imperial Royal Court and State Printing Office. Fundus of a 53-year old woman suffering from ophthalmolgia.

THE IMPACT OF OSTEOPATHIC TREATMENT ON INTRAOCULAR HYPERTENSION – AN EXPERIMENTAL STUDY –

M A S T E R T H E S I S

For the Degree of
Master of Science in Osteopathy

by OSKAR KUHMANN

Gochsheim, December 2007

Under the guidance of Kathie Musil and Peter Sommerfeld
Translated by Birgit-Schinner-Schäfer

Acknowledgement

With these words I would like to thank my tutors for this study. I also express my gratitude to the team of the Vienna School of Osteopathy, Ms Kathie Musil and Mr Peter Sommerfeld, for the scientific counselling, and to Dr. Gebhard Woitseschläger for the statistics. Furthermore, I would like to thank Dr Hubert Maier, Gerolzhofen, for his support and cooperation in this study. Many thanks to the patients and contributors, who spent their time for the treatment by me and who had the measurements carried out at the ophthalmologist's. Sincere thanks for the uncomplicated translation by Ms Birgit Schinner-Schäfer.

Dedication

Thank you, Andrew Tailor Still, for this legacy. Osteopathy gives me a new raison d`être and strength. I dedicate this work to my daughter, Franziska, and to my wife, Gabriele, who offered me the strength, understanding, energy and mental support. Above all to my daughter, Franziska, who had to spend a lot of time without me due to this work. It has not always been easy for her. Many thanks to my parents, Traugott and Aurelia, for the financial support.

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1. ABSTRACT

THE IMPACT OF OSTEOPATHIC TREATMENT ON INTRAOCULAR HYPERTENISON – AN EXPERIMENTAL STUDY

by Oskar Kuhmann

Target: Target of the study is the question of whether osteopathic treatments can positively influence intraocular hypertension

Study design: Experimental study with within subject design

Patients and methods: Thirteen patients fulfilling the inclusion criteria were included in the study. The average of three measurements in retrospect was taken as an initial basic value. The prospective measurements were carried out 48 hours, 4-5 and 8-9 weeks after the last treatment, at the same time of the day.

The patients received three treatments at intervals of one week. The treatment methods were not only techniques possibly influencing the ocular pressure but also parietal and visceral techniques.

Targets: The primary target is the reduction of the increased intraocular pressure and the secondary target is influencing the side effects such as headaches, neck and eye pains.

Findings: Forty-eight hours and 4-5 weeks after the last treatment a clear tendency showed that the osteopathic treatment has an impact on intraocular hypertension. Four to five weeks afterwards, at the second reading, the pressure values were lower again and after 8-9 weeks the average values nearly approached the initial value. As to side effects, a slight but not significant improvement could be achieved.

The average age was 53.8 years and the distribution to gender was 11 female and 2

male participants. The most frequent anamnesis diseases were thyroid diseases, heart diseases and diabetes. In patients suffering from thyroid diseases the ocular pressure values were better to influence than in the other patients.

Resume: Summarising, it can be stated that the osteopathic treatments have an impact on intraocular hypertension for a certain period of time. Through this the therapy of conventional medicine could be assisted and limited.

It would be desirable to conduct a study in cooperation with a university hospital with a large number of patients with a control group covering a longer period of time.

Affidavit

Hereby I declare that the following master thesis has been written only by the undersigned and without assistance from third parties.

All text passages which were literally or analogously taken from publications or unedited work of others are indicated as those. All sources and aids I used for this work are indicated. This work with the same contents has not been submitted to other examination boards.

…….

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Date Signature

PREFACE

I have been concerning myself with bone ailments for almost thirty years. Even as a young physiotherapist I was continually asking and always looked for plausible answers. Whenever I received an answer, there was a new question. I always chased my answers.

Eventually - I had already reached an adequate age for a therapist - I came across osteopathy, which could answer many of my questions and which gave me a satisfactory work success. Now I have found an occupation which gives me everything, which I love and which I can also live.

Once, when I was in the fourth year of osteopathic training at the College Sutherland, a female patient was under my treatment because of back problems. During treatment I noticed her much reddened eyes and addressed her on that account. She told me that she had an increased ocular pressure and that the medicaments caused undesirable side effects in her. In my still juvenile enthusiasm I told her that I could perhaps help her. She agreed to a treatment and made an appointment for the following week. She told her ophthalmologist about it and he documented the ocular pressure. He measured the ocular pressure before the treatment and some days after my treatment. After the treatment the pressure was in a borderline normal range. This was the inspiration for this master thesis.

Oskar Kuhmann Gochsheim, January 2007

2. INTRODUCTION

THE IMPACT OF OSTEOPATHIC TREATMENT ON INTRAOCULAR HYPERTENSION – AN EXPERIMENTAL STUDY

The eye is not just any sensory organ, no, for humans it is the door to the world. It is an anatomical masterpiece, a live camera, which can process light stimuli from differing distances as quick as a flash. The two spherical balls are able to adjust to the most different light conditions. The view can ramble between 20 centimetres of a newspaper to 40 kilometres of an Alp panorama and is able to differentiate between 600.000 colour shades at the same time (**Hansen 2007**). This is possible if the eye is healthy and under normal conditions. Clouding of the lens as well as damages in the retina and in the optic nerve can considerably restrict these functions.

The intraocular hypertension (IOP) is a prevalent clinical picture in the present industrial countries. This is a pathologically elevated intraocular pressure, which the affected patient cannot notice and feel himself – the disease proceeds slowly. This elevated pressure within the chamber of the eye entails high risks. The risk of damaging the optic nerve papilla with a progressive restriction of the visual field and a subsequent loss of sight is very high. This case is called glaucoma. The cost which the national health insurers have to pay annually for medicamentous and surgical treatment runs into billions of euros (**Pfeiffer 2005**). The ocular hypertension has already a long history. Even Aristotle could feel an increased ocular pressure by the palpation of the eyeball. In the 20th century the term "green star" became established as a synonym for glaucoma and ocular hypertension. Up to the 1970ies, glaucoma and ocular hypertension were always put on the same level (**Pfeiffer 2005**).

The term “glaucoma” originally coined by Aristotle comes from the Greek word „glaucos“ meaning “blue, sea-coloured, shiny” and is derived from the grey-blue change in colour of the iris in case of chronic inflammations.
In the 16th century this changed into “green, sea-coloured”, because in Northern France the Atlantic Ocean seems to be more greenish than bluish. In Germany, the term “star” is an expression for the clouding of the lens (**de Gruyter 1998**).
The first specialist hospital for ophthalmology, which opened in 1812 in Vienna, was enrichment for ophthalmology. Dr. Albrecht von Graefe (1828 – 1870) was a great specialist in ophthalmology and the founder of the surgical ophthalmology. Already then he carried out iridectomies with the aid of cocaine for the local anaesthesia to remove the iris in case of glaucoma (**Porter 2000**)
Thus this quasi experimental study investigates whether primary a decrease of intraocular hypertension is possible and secondary a reduction of side-effects such as headache, neck and eye pains is achievable. A further parameter is the internal diseases and osteopathic dysfunctions found in the anamnesis and whether this correlates to ocular hypertension.
For the therapy in conventional medicine, whether medicamentous or surgical, is only a symptomatic treatment that does not always bring the desired positive results.

3. Definition

Up to the year 1970 the distinction between glaucoma and ocular hypertension had not been drawn. Scientists assumed that in case of glaucoma there was only one cause, ocular hypertension (**Krieglstein 2000**).
There are a number of visual field defects which occur without any intraocular

hypertension. Just as well there are patients suffering from intraocular hypertension for years and being afflicted with no consequences at all. There is also glaucoma with hypertension and a hypertension without glaucoma. The diagnosis of intraocular hypertension was created, which differs from the glaucoma by a perfect visual field (**Pfeiffer 2005**).

Ocular hypertension is defined as follows in accordance with the guidelines No. 15 of the German Ophthalmologic Society (Deutsche Ophthalmologische Gesellschaft (DOG)):

- Showing a value higher than 21 mmHg, measured using a Goldmann's tonometer. . .
- No changes in the optic nerves and visual field that are typical for glaucoma
- Start in adulthood
- Open and inconspicuous iridocorneal angle
- Absence of other reasons for a so-called secondary open angle glaucoma (**@3**)

In other words, the ocular hypertension (IOP) is described as an above-standard elevated intraocular pressure without other indications of disease and the absence of changes which are typical for the glaucoma (**Pfeiffer 2005**).

4. Problem Descriptions

5. Epidemiology and actual costs

The cost for IOP causes enormous annual sums. In Western Europa the loss of workforce, early retirement and financial support lead to higher cost than the medicamentous treatment of IOP does. Therefore prevention and treatment play an exceptional role (**Krieglstein 2003**).

In my research I asked for the updated figures in the year 2006 at the Scientific institute of the Allgemeinen Ortskrankenkassen (1) and at the State Office for Statistics.

According to the present pharmaceutical regulation – report 2006, which analyses the data of the year 2005, in the year 2005 432 mio. daily doses (DDD) of ophthalmic drugs were prescribed and handed out for affected patients at the expense of the compulsory health insurance (GKV). This is the latest information of the scientific institute of the AOK Bonn 2007. According to the Bavarian State Office for Statistics and Data Processing (2007), the following figures were released concerning the green star: In accordance with the IDC-10 key, in 2004 a total of 5424 cases of glaucoma were known. Among these cases 2390 were male patients and 3034 were female patients. Surgical treatment was executed in 2356 patients and 3068 patients were treated with a medicamentous therapy. Only one patient among these 5424 cases of glaucoma died (p 105; 106).

In the Federal Republic of Germany approximately 3.2 million inhabitants over 40 years of age suffering from ocular hypertension are registered. This corresponds to a prevalence of 8 % of the inhabitants over 40 years of age (**Pfeiffer 2005**).

This does not include the cost caused by side effects of these medicaments and by

[1]*Translator's note: German public health insurance company*

drug intolerance. According to Pfeiffer (2005) the question arises whether the prophylactic treatment of IOP is advisable, so that a possible conversion to glaucoma could be prevented.

6.0. Diagnostic Options in Conventional Medicine

Tonometry

In the past, fifty years ago, when special measuring instruments did not exist, the ocular pressure had to be determined by palpation with the fingers. Here, the ophthalmologist put both index fingers onto the eye and pressed alternately on the bulbus to be able to estimate the ocular pressure. Today there are various tonometric devices (Tonos, Greek: tension / metrein, Greek: to measure) to be able to measure ocular pressure.

Here there are two different measuring techniques. There are the non-contact-tonometers and the applanation tonometer. The most usual method to measure ocular pressure is the examination using an applanation tonometer, named for Goldmann, its inventor, the ophthalmologist from Bern, Hans Goldmann (1899 – 1991). Before the examination the cornea has to be anaesthetised by means of eye drops. Then a small sensor is pressed into the curvature of the cornea in an area of 3 mm, it is quasi applanated. The necessary pressure represents the ocular pressure.

The devices are calibrated in a way that the ocular pressure can be read directly. To ensure that an area of identical size is subjected to pressure, Goldmann developed the following principle:

To guarentee that the area which is to be applanated is not too small, the ophthalmologist observes the cornea through a small plastic cylinder. Immediately

before the measurement a fluorescent dye is instilled into the eye so that the ophthalmologist is sure because of the bue light that the plastic cylinder has an optimal contact area on the cornea. After the examination the visual field is slightly blurry, but this disappears within a few minutes.

Non-contact devices measure ocular pressure without contact to the cornea by means of a jet of air. This jet of air flattens the cornea and a special optic receiver detects the speed and the extension of the applanation. These measures are the basis for determining the ocular pressure.

The advantage of this method lies in the fact that an anesthetic is not necessary and that this examination can be carried out without the risk of injuring the cornea or infection. However, it is not as accurate as applanation tonometry and requires several measurements (**Leydhecker 1990**).

The Slit-Lamp Examination

The slit lamp is a rotatable microscope with which the peripheral parts of the fundus can be observed through the pupilla. The ophthalmologist can assess the cornea, the conjunctiva, the sclera, the iris, the anterior chamber and the lens. By means of a special converging lens the vitreous body, the retina and the optic nerve head can be observed. For ocular hypertension the assessment of the optic nerve head is vital for differentiating a normal optic nerve papilla and an excavation typical for glaucoma (**Leydhecker 1990**).

Gonioscopy

Gonioscopy is an examination of the iridocorneal angle (gonios Greek: knee/ skopein Greek: to look). The iridocorneal angle is always assessed if the reason for a pressure elevation has to be found.

This serves for the differential diagnostics between angle-closure glaucoma, where the iridocorneal angle is closed or open-angle glaucoma, where the iridocorneal angle is open. This examination is executed under local anesthesia (**Leidhecker 1990**).

Perimetry

The examination of the visual field by means of a Goldmann perimetry examination plays a considerable role in diagnosing glaucoma. Here the visual function of the patient is tested. A visual-field defect can entail dangerous consequences for the patient. In case of a defect in nerve fascicles, where one or several nerve fascicles break down, the visual ability can be changed in a way which is characteristic for glaucoma. These examination options mentioned above are the most important and most common diagnostic methods. Certainly there are even more diagnosis options such as capillary microscopy and colour duplex sonography (**Flammer 2000**).

6.1. Therapy Options in Conventional Medicine

An increased ocular pressure can lead to nerve cell destruction (**Pfeiffer 2005**).

The conversion rate at an increased IOP of 21 -25 mmHg is between 3 and 10 %, which result in a damage at the optic nerve head. General forms of therapy are the medicamentous therapy, laser therapy and surgical therapy.

Glaucoma damage is not treatable; a damage at the optic nerve head is still irreversible according to the current state of medicine (**@4**).

6.2. Medicamentous Therapy

The target of medicamentous therapy is the protection of the optic nerve. The medicinal neuroprotection is carried out in three stages. First, the lowering and stablilising of ocular pressure, second, the stabilising and improvement of ocular blood circulation, and third, of nerve cells by neuroprotection. There are different substance categories, which reduce aqueous humour production, and/or lead to alleviating the outflow. The following substance categories are used in medicamentous therapy (**Mutschler 1998**).

Cholinergics are drugs which imitate the effect of acetylcholin. These cholinergics take effect at the nerve endings of the parasympathetic nervous system.

This group of substances is the oldest drug in glaucoma treatment (pilocarpin 1876). The effect is an improved outflow of aqueous humour. It produces a contraction of parasympathetic innervated inner ocular muscles.

The ciliary muscles contract, the result is a narrowing of the pupilla and thus an opening of the trabecular network, so that the outflow of aqueous humour is accelerated (**Mutschler 1998**).

The undesirable side-effects are accomodation disorders, above all in the dark, and asthma disposition can be aggravated.

Sympathicomimetics are a substance group which imitates the effects of the sympathicus. The therapeutic benefit is a decrease in aqueous humour production and an increase in trabecular capacity.

The undesirable side-effects are not unobjectionable. Due to the effect of adrenaline the possible consequences can be tachycardia, arrhythmias and blood pressure increases (**Leydhecker 1990**).

Sympathikolytics, among which beta-blockers represent the main group, which

hinder the effects of the sympathicus. Their effects are the reduction of aqueous humour production. Beta-blockers are also used in internal medicine to lower blood pressure. Undesirable side-effects are depression, anxiety disorders and bronchospasms in asthmatics (**Leydhecker 1990**).

Carboanhydrase inhibitors cause an encymatic chemical reaction, that is they have a diuretic effect, thus an effect of lowering ocular pressure and cerebral pressure.

The disadvantage of this group of drugs is paresthesia in the hands, hearing dysfunctions, loss of appetite, taste dysfunctions, nausea and predisposition for kidney stones (**Leydhecker 1990**).

Prostaglandins are hormone substances which can be found in all cells of the human body. In ophthalmology, these prostaglandin analogues lead to a local decrease of ocular pressure. The side-effects of this group of drugs are local, such as redness and inflammation of the conjunctiva, increased sensitivity to pain and temperatures, iris pigmentation, an increase in the length growth and a darkening of the eyelashes.

Summarising, it can be stated that the different groups of drugs influence the aqueous humour dynamics in different ways. According to Krieglstein there is a rough guide for the relative pressure drop.

Monotherapy – administering only one drug – results in a pressure drop of approximately 25%, a combitherapy leads to a 35% pressure decrease, and the maximal medicamentous therapy brings about a 40 % decrease (**Leydhecker 1990**).

6.3. Laser Therapy and Pressure-Lowering Operations

Laser surgery and pressure-lowering operations are only used in case of glaucoma damages. Laser surgery is indicated in various types of glaucoma. Here the trabecular network in the iridocorneal angle is influenced to achieve an improved outflow of aqueous humour.

In pressure-lowering operations the ophthalmologist tries to create a new outflow canal for the aqueous humour.
Of course, every surgical intervention holds its risks and undesirable side-effects, such as the post-operative inflammatory reactions, haemorrhages, and above all a reclosure of the artificial aqueous humour canal by scar tissue (**Flammer 2000**).

6.4. Alternative Medicine

In this paragraph I would like to describe the alternative options of treatment, the osteopathic treatment.

6.4.1. Holistic treatment

The holistic medicine aims at harmonising body, mind and soul and at rebalancing them. Some of the most therapies include a balanced diet, exercise therapy, meditation, biofeedback and relaxation training.

6.4.2. Food and Drink

However, there are some studies on the uptake of caffeine for a short period of time and a slightly increased ocular pressure for one to three hours.
Other studies do not notice a noteworthy impact of caffeine consumption on increased ocular pressure. Patients having an increased ocular pressure are advised to restrict their caffeine consumption.
Another study has shown that patients suffering from ocular hypertension who drank a quarter litre of water within twenty minutes showed increased ocular pressure measurements. Thus, affected patients should drink small amounts of water during the day.

An ideal diet and an adequate taking of minerals and vitamins are essential for the eye, such as vitamin C, E, A (in form of beta-carotin), selenium, zink and copper (@4).

6.4.3. Exercise Therapy

Regular controlled exercises positively influence not only the increased ocular pressure, but also the risk factors such as diabetes and high blood pressure.

In a recent study affected patients were treated with specific exercises. These patients cycled four times a week for forty minutes. The result was a measurable improvement of the ocular pressure. After the cycling workout was finished, the low ocular pressure rose again (@4).

7.0. Anatomy

This chapter describes all osseous, vascular, membranate and neural structures of the eye.

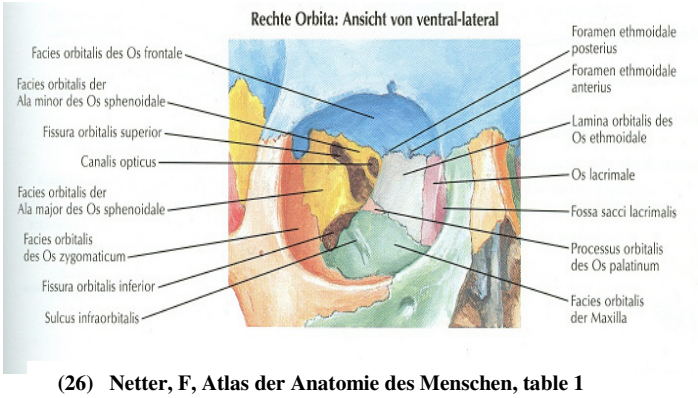
7.1. The Orbit

The orbit is a pear-shaped pyramid, which is open at the front. Its diameter is 4 – 5 cm and its volume is approximately 30 ml, of which the eyeball represents one fifth. The other structures are adipose body, muscles, nerves, vessels and connective tissue septa (Liem 2003).

7.2.2. Osseous Relation of the Orbit

The orbit consists of seven different bones, which belong to the viscerocranium, the facial skull, and to the desmocranium, the roof of the skull. The bones of the

viscerocranium contain a great part of the sensory organs, and those of the desmocranium serve for protecting the nervous system. In the orbit the different bones from both the viscerocranium and the neurocranium meet (**Cloet 1999/Liem2003**).
The eye pit consists of the frontal bone with the orbital part, the lacrimal bone, the ethmoid bone with its orbital lamina and the sphenoid bone with the great wing of the sphenoid bone. These four bones belong to the desmocranium. The zygomatic bone, the maxillary bone with its orbital surface and the palate bone with the orbital process belong to the viscerocranium and form the eye pit together with the desmocranium (**Liem 2001**). The orbit is relatively flexible because of its numerous cranial sutures. The orbit possesses several important passage locations for neural and vascular structures (**Liem 2001**). In this connexion the sphenoid bone plays an essential role. The optic canal in the sphenoid bone is an important passage location. Here, at the top of the orbital pyramid, there is the passage location for the optic nerve and the ophthalmic artery.
The superior orbital fissure represents the passage location for the different cerebral nerves II, IV; VI and particularly of the ophthalmic vein. An important passage location for the inferior ophthalmic vein is the inferior orbital foramen. Both fissures can represent a barrier for the ophthalmic veins. Neighbouring structures of the orbit lie superior, the frontal lobe of the cortex, in the front cranial fossa the frontal sinus, medially the ethmoidal sinuses and downwards the maxillary sinus (**18**). The orbit is coated with the periost and with the connected periorbit. This is a funnel-formed connective tissue tunic, which merges into the dura mater at the openings to the skull interior. This periorbita contains substantial fatty tissue, which, on the one hand, protects the bulbus and on the other hand, offers the orbital fasciae a tunic for the eye muscles (**Pfeiffer 2005**).



(26) Netter, F, Atlas der Anatomie des Menschen, table 1

7.3. Neural Supply

The eye is sensitively and motorically supplied by altogether six cerebral nerves, which, except from the facial nerve, pass through the superior orbital fissure. The six cerebral nerves are the optic nerve, the oculomotor nerve, the trochlear nerve, the branches V1 and V2 of the trigeminal nerve, the abducent nerve and the facial nerve (**Hansen 2007**).

The ciliospinal centre is located at the edge between the neck and the thoracic part of the spinal cord. It belongs to the symphatetic system and from there the width of the pupilla, the position of the bulbus in the eye pit and the opening of the palpebral fissure are influenced (**Schlote 2004**).

The ciliary ganglion is a small ganglion located between the orbital fissure and the eyeball. Here complex neuronal interconnection processes happen. Here the parasympathetic fibres change, the sensitive and sympathetic fibres pass through this ganglion without being changed. The parasymphatetic portion of the ganglion causes the change of the parasymphatetic fibres of the oculomotor nerve to the second postganglionic neuron (@2). The fibres of the oculomotor nerve feed the sphincter muscle of the pupilla (narrowing of pupilla) and the ciliary muscle (accommodation). Furthermore, parasymphatetic fibres, which supply the lacrimal glands, are connected to the infratrochlear nerve.

The sympathetic fibres of the cervical and the thoracic part of the spinal cord are changed in the ganglia of the neck region, the stellate ganglion, the middle cervical ganglion and the superior cervical ganglion to the second postganglionic symphatetic neuron. They pass through the ganglion ciliare and the fibres supply the dilatator pupillae, which is responsible for pupil dilation (@2).

7.4. The Blood Supply of the Eye

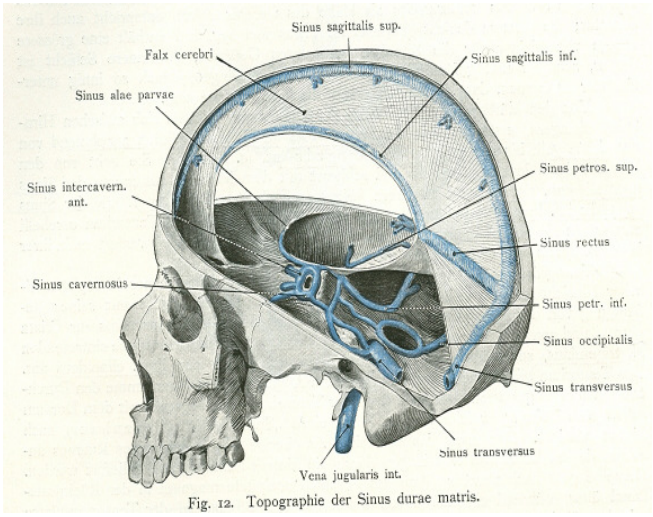
7.4.1. Arterial Supply

The arterial supply of the eye is provided by the ophthalmic artery, which is a branch of the internal carotid artery.

It originates medially from the anterior clinoid process shortly after the cavernous sinus. The ophthalmic artery with the optic nerve runs laterally underneath through the optic canal at the level of the sphenoid bone into the eye pit, where it separates into an orbital and an ocular branch. The orbital branch supplies the orbital structures and the ocular branch supplies the eyeball and the ocular muscles. Through the supraorbital artery there is an anastomosis to the external carotid artery (**Moll 1999**)

7.4.2. Venous Supply

The venous blood from the orbit is carried through the superior and inferior ophthalmic veins, which unite in front of the superior orbital fissure and then flow into the cavernous sinus. The superior ophthalmic vein disposes of the blood from the scleral veins and thus functions as a pressure regulator for the aqueous humour (**Moll 1999**). From there the venous blood flows into the superior petrosal sinus, then into the sigmoid sinus and finally into the internal jugular vein. A further branch leads from the cavernous sinus into the inferior petrosal sinus and from there directly into the jugular vein. Here the main outflow of the venous system is carried out via the jugular foramen, which is osseously formed by the basal part of the occipital bone and the temporal bone (**Cloet 1999**).



Corning, K.H. Lehrbuch der topographischen Anatomie, 1907

7.5. The Oculomotor System

Six ocular muscles, consisting of four muscles running straight and two muscles running obliquely form the oculomotor system. The inferior rectus muscle causes the lowering and outer rotation of the bulbus, the lateral rectus muscle provides for the abduction and the medial rectus muscle for the adduction of the bulbus. The two oblique ocular muscles are the superior oblique muscle and the inferior oblique muscle. The superior oblique muscle is responsible for the lowering, inner rotation and abduction of the bulbus, and the inferior oblique muscle for the raising, outer rotation and abduction.

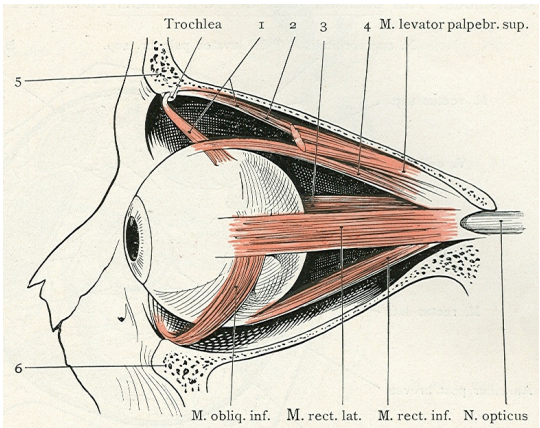


Fig. 61. Augenmuskeln und Bulbus, von der lateralen Seite gesehen.
1, 2 M. obliq. sup. 3 M. rectus medialis. 4 M. rectus sup.
5 Margo supraorbitalis. 6 Margo infraorbitalis.

Corning, K.H. Lehrbuch der topographischen Anatomie, 1907

7.6. The Outer Eye

The outer eye consists of both eyelids, which protect the eye from dust and blinding effects. The outer ocular muscles are responsible for the closure of the eyelid and the drainage of tear fluid. The fatty secret of the sebaceous glands (Meibom) is an essential component of the tear film.

The lacrimal apparatus consists of the lacrimal glands and their lacrimal ducts. The tear film has the function to protect the epithelium, to prevent microorganism growth and it creates a clear optic surface. The conjunctiva offers a protection against intruders. It fills the space between the orbit, the eyelids and the eyeball. (**Pfeiffer 2005**).

7.7. The Tunics of the Eyeball

7.7.1. The Sclera

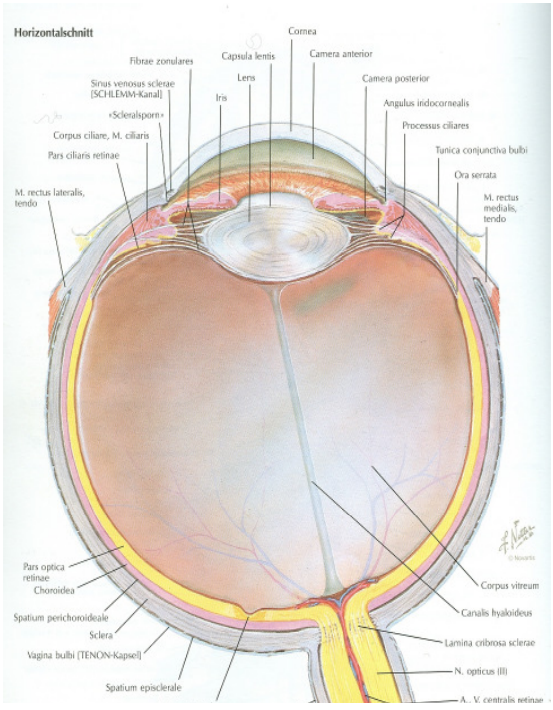
The sclera and the cornea are the two outer tunics of the ocular bulb. The sclerotic coat or sclera is a tough white coating protecting the eye and offering stability for the eyeball. Due to this stability optic imaging conditions are guaranteed. Part of the white sclera can be seen in the front of the eye. A clear fine membrane, called conjunctiva, covers the sclera and protects it from outer influences. The sclera continuously merges into the dura of the optic nerve (**Hoeppner 1996**).

7.7.2. The Cornea

The non-vascular cornea is transparent, not vascularised and forms the front lens. The cornea is moistened at the front by tear fluid and at the back by aqueous humour. It serves as an infection and diffusion barrier and is an important part of the dioptric apparatus.

7.7.3. The Bulbus – Eyeball

The ocular bulb, or eyeball, is the next structure which embeds in the eye pit. The bulbus consists of three chambers from anterior to posterior, that is the anterior chamber between cornea and iris, the posterior chamber between the iris and the vitreous boundary layer and the vitreous space. It is formed by four different layers. The outer layer is made from a compressed boundary layer, which forms baggily around the vitreous body. The central layer of the eyeball is the vascular coat of the eye, the uvea. It's outer



Netter F. Atlas der Anatomie des Menschen, table 82/ 1997

restriction is the sclera and the anterior chamber, the inner restriction is the pigment epithelium (**Schliebler 1999**).

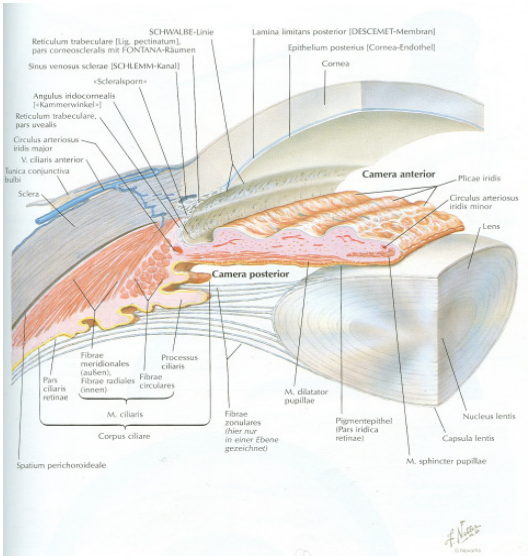
The iris, the ciliary body and the choroidea form the uvea, which is highly vascularised. The choroidea constitutes the posterior section of the uvea. Its tasks are the nourishment of the outer retina, the regulation of the metabolism, the absorption of heat, the reduction of scattered light and it offers a mechanical protection of the retina. The retina and the pigment epithelium are the innermost layer and they line 2/3 of the rear eyeball. The retina consists of several tissues layers. Nerve cells and their projections, glia cells and vessels serve for taking up and processing light stimuli. The pigment epithelium offers a protective and transporting function. It represents a blood-retina-barrier against the choroidea (**Hansen 2007**).

7.7.4. The Ciliary Body

A further element of the eyeball is the ciliary body. The ciliary body, or ciliary apparatus, is a bulge of the vascular coat of the eye and is located in the front section of the bulbus, between the ora serrata and the iris base. In the epithelium of the ciliary body, the inner non-pigmented layer the aqueous humour is produced, which flows into the anterior chamber. Furthermore, the ciliary body influences the outflow of the aqueous humour and enables the accomodation of the lens through three muscles, which are responsible for the close focusing and zonule relaxation. (**Hansen 2007**).

7.7.5. The Iridocorneal Angle – Schlemm's Canal

The cornea and the iris form the iridocorneal angle. The iridocorneal angle is a sharp angle to which the trabecular meshwork is connected. It is a sponge-like filter system, which leads the aqueous humour again into



.Netter; „Atlas der Anatomie des Menschen" table 83 /1997

the blood stream. The Schlemm's canal, which has an inlet to the episcleral venous plexus, is connected to the outside (**de Gruyter 1998**).

7.7.6. The Aqueous Humour

The aqueous humour is produced in the ciliary body of the eye by means of secretion and it flows from the posterior chamber to the anterior chamber, runs through the pupilla and then drains away through two different ways. The conventional way is the outflow via the trabecular meshwork. Eighty percent of aqueous humour flows here through the pores of the meshwork into the Schlemm's canal and then into the episcleral veins. This high amount flows through a pressure-sensitive route so that an increase in pressure is a possible result (**Morrison 1996**).

The second way of the aqueous humour is via the uveoscleral, unconventional outflow. Twenty percent of the aqueous humour is drained this way. The aqueous humour crosses the ciliary body, reaches the suprachoroidal space and is then drained away by the venous network of the ciliary body, choroidea and sclera. Some aqueous humour also flows away via the iris (**Morrison 1996**). The aqueous humour is a clear fluid, similar to the liquor, consisting of electrolytes, sugar, enzymes, hyaluronic acid, proteins and ascorbic acid. The aqueous humour regulates the intraocular pressure, serves for the nourishment of the cornea, provides for keeping the bulbus in shape and offers immunological protection for the cornea (**Hansen 2007**).

The production of aqueous humour in the ciliary body is depending on carboxyl, that means the medicamentous lowering using beta-blockers, sympatholytics and carboxylic anhydrase inhibitors is a form of therapy in the treatment of ocular hypertension. The outflow of aqueous humour, too, can be medically increased by means of prostaglandins, sympathomimetics and parasympathomimetics (**Flammer 2000**).

7.7.7. The Iris

The iris is pigmented and forms the optic hole, the pupilla, and controls the light entering the eye by means of narrowing and widening like in a photo camera (**Schiebler 1990**).

7.7.8 Optic Nerve and Optic Cord

The ganglion cells of the retina converge in the optic nerve head. This is a round, short opening in the sclera, where the approx. 1.2 mio. axons emerge and where they form the optic nerve, the second cranial nerve. This papilla, or optic nerve head, can be seen as a flat, orange disk on the fundus of the eye in an ophthalmoscopy. This papilla is a neuralgic point of the optic nerve. Intraocular hypertension and poor circulation can lead to a dysfunction of the axonal transport (**Flammer 2000**). The optic nerve itself with its longest part winds in the orbit and shows a good mobility. The entire length amounts to 45 mm, of which 2/3 are in the orbit (**Flammer 2000**). The optic nerve is surrounded by all three meninxes, here the pia mater directly adheres to the optic nerve, above lies the arachnoidea, and the dura forms the outer layer (**Hansen 2007**).

7.8. PATHOPHYSIOLOGY OF THE IOP

On a daily average the normal intraocular pressure ranges between 14.5 und 15.5 mmHg (**Pfeiffer 2005**) und is subject to a circadian rhythm of +- 5 mmHg. In the morning the pressure values are at a maximum, during the day they fall and at night the ocular pressure rises again (**@1**). This physiologic ocular pressure bearing on the inner wall of the eye provides for a constant stability of the eyeball and for a consistent curvature of the cornea surface. It regulates the distance between the

cornea, the lens and the retina and is responsible for a steady alignment of the retinal photoreceptors and of the pigment epithelium on the evenly stretched membrane, so that a normal image can be projected (**Liem 2001**). Furthermore, a certain pressure is necessary to guarantee an exchange of nourishment to the lens and to the cornea.

The IOP is influenced by certain factors. On the one hand by the amount of aqueous humour production in the ciliary body, on the other hand by the resistance in the drainage channels, the pressure in the episcleral veins and the pupillary resistance (**Morrison 1996**). However, the elevation of the IOP is not caused by an increased aqueous humour production in the ciliary body, but by a deterioration of the aqueous humour outflow by degeneration or obstruction of the outflow channels (**10**) and by an increase in resistance in the Schlemm's canal and in the episcleral veins. An increased resistance of the ciliary muscle contraction also leads to an elevation of ocular pressure, because the ciliary muscles are connected to the trabecular meshwork. Here, the operating increased muscle contraction hinders the outflow via the meshwork.

The pupillary resistance is an important parameter for the outflow of aqueous humour. Aqueous humour does not flow continuously but intermittently from the posterior chamber into the anterior chamber. A certain pressure is a precondition so that the iris can lift off the lens. Then the aqueous humour can flow away intermittently (**Esser 2002/ Schwarz 2001**).

7.9. Risk Factors and Factors Causing Ocular Hypertension

The following chapter describes the factors causing ocular hypertension in the conventional and osteopathic sector of medicine.

7.9.1. Elevated Intraocular Pressure

An elevated intraocular pressure is one of the most important damage factors in the development of glaucoma. Since 1972 ocular hypertension has been differentiated from the glaucoma. While in case of ocular hypertension there is an elevated ocular pressure of > 21 mmHg, glaucoma is an elevated ocular pressure with glaucoma damage at the optic nerve and a restriction of the visual field. Even at an average pressure elevation of 15 mmHg to 20 mmHg the glaucoma risk is increased by one and a half time (**Pfeiffer 2005**).

7.9.2. Change of the Iridocorneal Angle

The iridocorneal angle is a sharp angle between the cornea and the iris; there the trabecular meshwork is connected. This angle can be altered, so that the aqueous humour outflow finds an additional barrier, which is the main reason for an elevated ocular pressure according to present research findings (**Pfeiffer 2005**).

7.9.3. Age

Age influences the ocular pressure. Not only an increased number of risk factors, but also the loss of nerve fibres and the sclerosing of drainage vessels lead to an age-dependent elevation of ocular pressure due to these degenerative changes (**Pfeiffer 2005**).

7.9.4. Hereditary Factors

In 1998, Wolfs et. al. writes in a study that the risk of developing ocular hypertension is twice higher if one parent is affected. With siblings the risk is four times higher (**Pfeiffer2005/Wolf 1998**). In my study, too, four pairs of siblings and one mother-daughter combination were among the 13 test persons.

7.9.5. Myopia

In 1999, in a study Mitchel et.al. ascertained a relationship between patients suffering from myopia and glaucoma. In case of ocular hypertension there is only a marginal relationship according to Mitchel (**Pfeiffer 2005/ Mitchel 1999**). In my study, among the 13 test persons there were 10 persons suffering from myopia. Five of them suffered from serious myopia.

7.9.6. Steroids

Administering steroids leads to an elevation of intraocular pressure. According to a study of 1999 by Clark and Wordinger, steroids cause a reduced outflow of aqueous humour. They influence the metabolism of the extracellular matrix, the cytosceleton and the trabecular meshwork (**Pfeiffer 2005**).

8.0. Development of Ocular Hypertension from the Osteopathic Point of View

8.1. Osseous Dysfunctions

Osseous dysfunctions such as movement disorders of the synchondrosis sphenobarsilaris (SSB) or a shifting of the sphenoidal body can lead to a narrowing of the superior and inferior orbital fissure, resulting in a congestion of the superior and inferior ophthalmic veins (**Liem 2003**). According to Liem the result is an increased tension on the jugular foramen, which can lead to a disturbance of the jugular vein and thus to a venous congestion up to the ophthalmic veins, resulting in a restriction of aqueous humour outflow.

8.2. Muscular Dysfunctions

An imbalance in the tone of the ocular muscles can cause a movement dysfunction at the sphenoid bone, at the maxilla and at the ocular muscle nerves. Travel describes the development of ocular hypertension in case of a dysbalance of the occipital muscle (**Liem 2001/ Travell 1983**).

The ocular muscles regulate the tension of the bulbus and the cornea. An elevation of pressure resulting from a dysbalance in the anterior chamber of the eye can be a reason for ocular hypertension.

8.3. Membranous Dysfunction

A membranously increased contraction of the tentorium of the cerebellum and diaphragma sellae lead to a change in position of the sphenoidal body and thus to a obstruction in outflow at the venous cavernous sinus. In addition, the venous sinuses are imbedded in the leaves of the dura and thus are dural structures. Here, an increased tension results in a constriction, an elevated pressure in the valveless blood conduit (**Liem 2003**).

8.4. Orthosymphatetic and Parasympathetic Dysfunctions

The ciliospinal centre of Budge C7 to Th 12 is the centre for adjusting the pupilla and the lens curvature (**Hoeppner 1996**).

According to Dr. Cipolla, already in 1907 Luisa Burns found in a study a relationship between eye ailments and the osteopathic lesions of the cervical spine (**@1**). Stilman, Ried and Ruddy later defined more in detail the dysfunctions of the upper thoracic spine and lower cervical spine in connection with elevated ocular pressure (**4/@1**). An increased sympatheticotonia can also lead to a spasm of vessels and thus influence the ocular pressure (**Cipolla 1975**).

9.0. Scientific Works

This chapter reports of other scientific osteopathic studies on increased ocular pressure. In a pilot study on increased ocular pressure in primary chronic open angle glaucoma, a study by Esser (2002) treated 24 patients three times at intervals of one week using seven predefined techniques. The measurements were executed after a 10-minute recovery in recumbency using a non-contact tonometer.

Esser himself conducted the measurements. In this study the ocular pressure reduction was, according to Esser, "statistically highly significant" by approximately 1 to 2 mmHg. In this study only pressure-reducing techniques were applied and holistic osteopathic treatments were not used. Even the short-term measurements – after a ten-minute recovery – with a non-contact tonometer are not very meaningful. The non-contact tonometer is not an approved measuring technique in line with the gold standard. However, the result of the study is significant (**Esser 2002**).

In another study by Bilgeri (2006) 20 Patients suffering from primary chronic open angle glaucoma were included in the study. The patients were divided into two groups, one experimental group, which received three osteopathic treatments, and one control group without treatment.

The patients of the experimental group were measured using an applanation tonometer and were treated in the second, third and fourth week. The second measurement was carried out in the fifth week, again at the same time of the day.

According to Bilgeri the primary parameters, that is ocular pressure, were slightly better. However, the secondary parameters such as eye pain, neck pain and headaches occurred considerably fewer in the experimental group (**Bilgeri 2006**).

In this blinded study only a small group of 10 patients belonged to the experimental

group and ten patients from the control group whereof three patients are dropped out. The results from the control group of this study have less statistical significance.

A further osteopathic study on ocular pressure was published by Hürlimann, Wanner and Böhler (2002). Twenty-four normal patients were tested in two blind and two osteopathic treatments. Before and after the treatment the ocular pressure was measured by means of a Goldmann tonometer. During treatment 3 defined osteopathic techniques were used. As a result, a significant decrease in ocular pressure could not be achieved. A decrease of 2 mmHg was recorded, which represented a normal decrease due to relaxation (@7).

Medicamentous therapy can also have positive impacts on ocular pressure. According to a study of 2002, which was published in the United press international, 1636 patients between 40 and 80 years suffering from ocular hypertension were included in the study over five years. Fifty percent of the patients received eye drops; the other half of the group was without medication. The scientists found that 50 percent of the treated patients did not develop an open-angle glaucoma (@6).

10.0. MATERIALS AND METHODS

The original study design was a randomised blinded pilot study. The patient recruitment was executed via circular letters to the ophthalmologists situated in the region around Volkach and Gerolzhofen. I encountered partly persistent resistance and no willingness to cooperate on the part of the contacted ophthalmologists, because osteopathy is still a much unknown specialist field in the opinion of the conventional medical scientists here in our region. On my enquiry, the

ophthalmologists informed me that an interest in such a „hocus pocus“did not exist at all, and they were not willing to cooperate in the study because of the amount of time necessary to measure the patients. It was very difficult to recruit the patients for this study. Thus only one ophthalmologist remained who were ready to carry out the measuring of the patients. In the end, I gained my patients by means of several placards in pharmacies, at the ophthalmologist's practices and in opticians' shops, so that I could conduct all measurements at the same ophthalmologist's practice. 25 patients are to be poised to get a treatment by this study. The ophthalmologist chooses 13 patients for the study.

The changed, present study design is quasi an experimental study with "within subject design". This small group of patients consisting of 13 participants was randomly chosen by the ophthalmologist and assigned to me for the study. Since patient recruitment, as mentioned above, was extremely difficult in our region, I had to do without a control group and had to obtain control values by means of several measurement repetitions.

In the study 13 patients fulfilling the inclusion criteria participated. The initial value was the average value of the last three measurements about nine month ago. Patients with an increased ocular pressure have to attend an ophthalmologist every three months as a prophylacticum in order to have their ocular pressure determined to avoid long-term consequences. The patients were treated three times at an interval of one week, always at the same time of the day. Treatment days were Saturdays, because then less stress and disturbances caused by normal practice work were to be expected. I chose these short treatment intervals so that the influenced structures received a new stimulation after a short adaptation period.

After this three-week treatment period, exactly 48 hours after the third and last

treatment the first measurement was carried out at the same time of the day as the treatment happened. This 48-hour interval to the treatment has two reasons. First, I wanted to wait a certain time to observe whether initial deterioration and compensation of the structures would occur. Second, in 1950 a study of Misischea showed, however, that immediately after osteopathic treatment ocular pressure considerably increased by some points (**Liem 2003**). Also A. T. Still's words „find the lesion, adjust it and let it alone" were taken into consideration to give the system time to normalise itself. Therefore the second measurement was read four or five weeks after the last treatment, also at the same time of the day and the last and third measurement was after 8-9 week after the third treatment.

10.1. Inclusion Criteria

- Increased ocular pressure > 19 mmHg und < 30 mmHg diagnosed at least 6 months ago by the ophthalmologist.
- During the study the medication of ophthalmics was not changed.
- The consent that the measurements could be used for the study.
- The willingness to be treated three times and to carry out the measurements in line with the requirements
- No modification in the iridocorneal angle, scotoma and changes typical for glaucoma.

The grounds of my inclusion criteria are based on the following hypothesis: ocular pressure values under 19 mmHg would not show any significant reduction under treatment. With values exceeding 30 mmHg the risk of optic nerve damage is very high and requires medicamentous conventional therapy (**Pfeiffer 2005**).

The nine-month diagnosis of increased ocular pressure before treatment is to

exclude temporary hypertension, which can distort the study result. In case patients are under medication with ophthalmics, the same medicaments were to be administered during the period of the study so that there were no changes in ocular pressure caused by medicaments and thus a distortion of the results was excluded. Types of glaucoma and changes typical for glaucoma such as a changed iridocorneal angle, scotoma and visual field restriction, too, would not result in an objective answer to the question of my thesis. An enormously important point is the compliance of the patients. Since it was only a small group of patients, their cooperation was highly important for the success of the study.

10.2. Exclusion Criteria

- Intraocular pressure > 30 mmHg
- Contraindication for osteopathic treatment
- Every type of glaucoma
- Surgical interventions in eyes and skull
- Systemic diseases, apoplexy, skull-brain injuries, treatment with anticoagulants

The following points deliver the reasons for my exclusion criteria:

Patients suffering from surgical interventions in eye and skull, from systemic diseases named under point five, from apoplexy, from skull-brain injuries, and patients who have to take anticoagulants were excluded from the study, because here one the one hand the patient could be jeopardised, and on the other hand the vascular system after surgical interventions can be influenced by scar fibrosis in a way that the study would not lead to a significant result.

10.3. Methods

10.3.1. Targets of the Study

The primary target of this study is the examination whether osteopathic treatments can reduce intraocular pressure to a value lower than the limiting value of 21 mmHg, as well as whether the pressure behaviour leads to a lower pressure in the middle- term about 8-9 weeks after the treatments.

The secondary target parameter is analysing the behaviour of side-effects such as headaches, neck pain, eye pain, vertigo and visual disturbances.

The tertiary target parameter is figuring out whether the found internal diseases and myopia have an impact on the increased intraocular pressure.

10.3.2. Conducting of the Study

At the beginning of the study I examined each patient osteopathically, in the parietal, visceral and cranial field. I documented the examination results and analysed them statistically. The first treatment required 90 minutes; the other treatments took approximately 60 minutes. The treatments were carried out in the parietal, visceral and cranial fields. The intraocular pressure was measured by means of the Goldmann applanation tonometer at the ophthalmologist's 48 hours after the third and last treatment.

10.3.3. Method of Measurement

The applanation tonometer of the Haag Streit company, Bern, was calibrated and worked in line with the Gold standard. The three prospective measurements were executed exactly at the same time of the day, in order to minimize the effects of circadian variability. After a short recovery of ten minutes the measurement was

carried out using the applanation tonometer. Three prospective readings were recorded 48 hours, 4 – 5 weeks and 8 – 9 weeks after the last treatment as measurement repetition.
These measurements were executed by an ophthalmologist experienced in this field. Three retrospective values, which had been recorded during a period of up to nine months previously, were taken from the patients' files and used as initial basic values.

10.4.0. Osteopathic Treatments

Apart from the found parietal, visceral and cranial dysfunctions, unless these were compensation mechanisms, the treatment mainly aimed at the fascial system in the cranial field, to influence the vascular drainage system and the mobility of the skull bones. Above all the treatment of the reciprocal tension membrane and the venous drainage system were important elements of the treatment.

10.4.1. Description of Applied Osteopathic Techniques

In the next passage the most customary techniques are described which were applied in this study.

- The loosening of the superior thoracic aperture STA (Image 1) and as a fluctuation technique (Image 2), to stimulate the venolymphatic drainage from the head area. Due to the fascial connections, the cervico-thoracic diaphragm affects the mobility of the individual skull bones and the venolymphatic reflux, especially of the internal jugular vein and the arterial influx via the internal carotid artery (**Liem 2003**).

- The manipulation of C8 and T2 if necessary, to innervate the ciliospinal centre and the superior cervical ganglion. This technique was applied whenever there was a clear indication for manipulation. Thereby I tried to achieve neurovegetative stimulation (Image11).

- The mobilisation of the OAA complex and the cranial base was to lead to a general easing of the system by means of a stimulation of the vagus nerve. The relaxation of the jugular foramen was to entail an improved flow in the jugular vein, which runs here through this cranial fissure. Eighty-five to ninety-five percent of intracranial blood drains off through the internal jugular vein. The platybasia technique is an effective technique to achieve this target (**Cloet 1999/ Liem 2003**) (Image 3).

- The treatment of sphenobasilar synchondrosis SBS is to improve the cranial-rhythmic impulse CRI. The majority of patients had a reduced CRI because of the tension on the SBS. The CRI, too, has also an impact on the venous drainage system (**Cloet 1999**).

- Treatment of the intracranial membrane to influence the venous sinus. Since the dural leaves are involved in the formation of the venous sinus, the reciprocal tension relationship of the dura affect the venous outflow.

- Using the „frontal lift“is to effect a decompression of the cranial base and a relaxation of the cerebral falx with the superior and inferior sagittal sinus lying within (**Liem 2003**).

- Tensions and dysfunctions of the pterygopalatine ganglion influence the tension of the cranial base, lacrimation, eye disorders and eye pain. Since in this study some participants had occlusion anomalies this technique was very useful to normalise the tension of the cranial base and the upper cervical spine (Image 4).

- The mobilisation of the orbit and superior orbital fissure for the venous drainage system of the eyes (Image 5). The superior orbital fissure is a considerable barrier for the venous drainage of the eyes. A highly effective technique for the release of the superior orbital fissure, above all for the flow of the superior ophthalmic vein, is the „Cant Hook"technique (Image 6) (**Cloet 1999**).

- The treatment of the lacrimal bone in relation to the frontal bone using a lift is the attempt to separate the two bones to guarantee here an improved outflow as well (**Cloet 1999**) (Image 7).

- The treatment of the bulbus to enhance the blood circulation and to relax the ocular muscles as a direct technique for intraocular hypertension. The listening technique (Image 8) is an attempt to achieve a relaxation of the bulbus.

- The glaucoma technique according to Ruddy exerts a positive influence (Image 9). This technique is applied to improve the fluctuation of the aqueous humour (**Liem 2003**).

- The last technique for normalising the homeostasis and for calming to innervate the parasympathetic system at the end of treatment is the compression of the fourth ventricle CV4 (Image 10) (**Cloet 1999**).

10.4.2. Images

Image 1: Loosening of the superior thoracic aperture

Image 2: Fluctuation ATS

Image 3: „Platy basia“

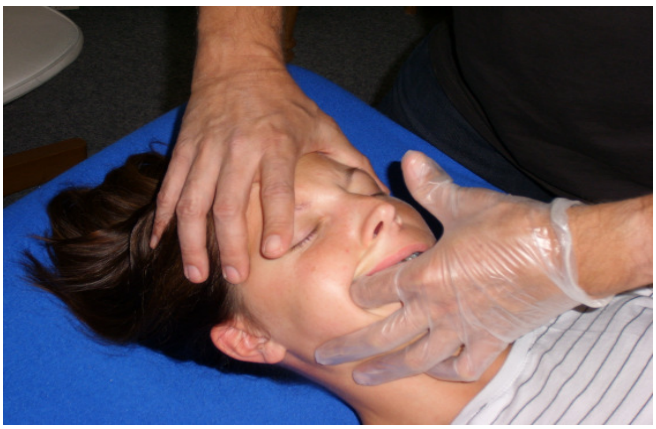


Image 4: Proc. pterygopalatina

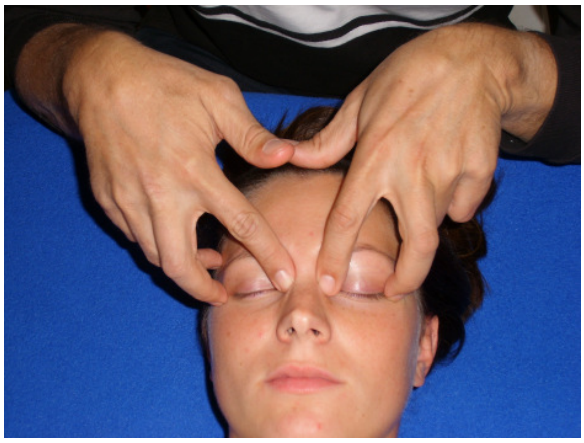


Image 5: Mobilisation of orbit

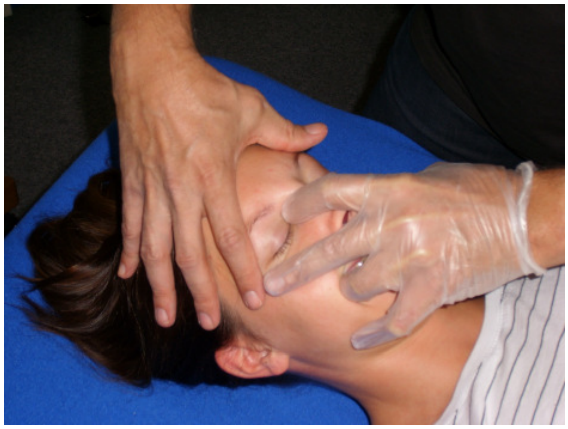


Image 6: „Cant hook“

Image 7: Mobilisation of the lacrimal bone using frontal lift

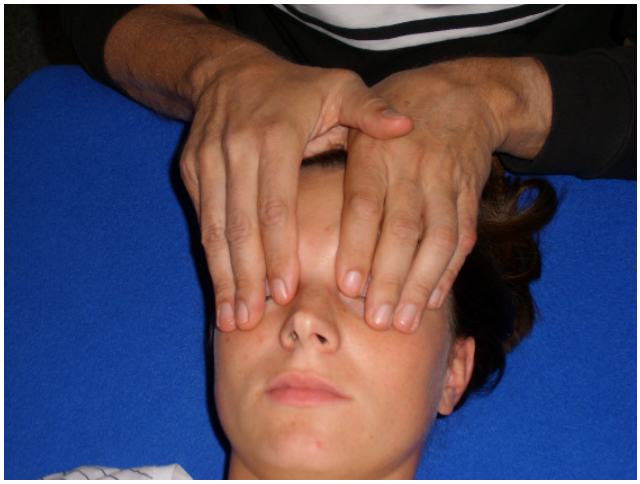


Image 8: “Listening”

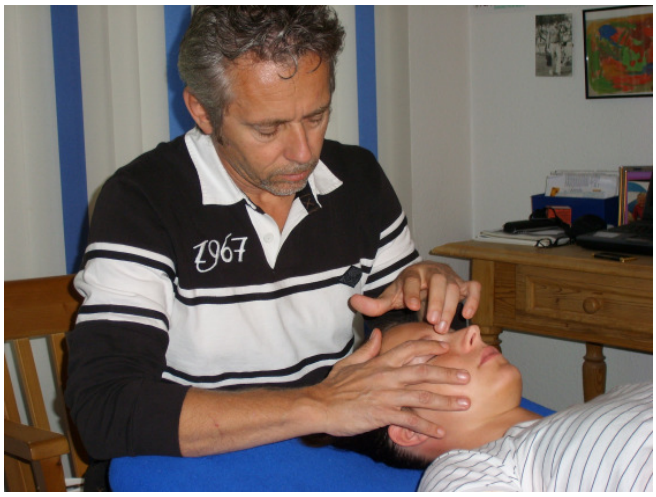


Image 9: Glaucoma technique acc. to Ruddy

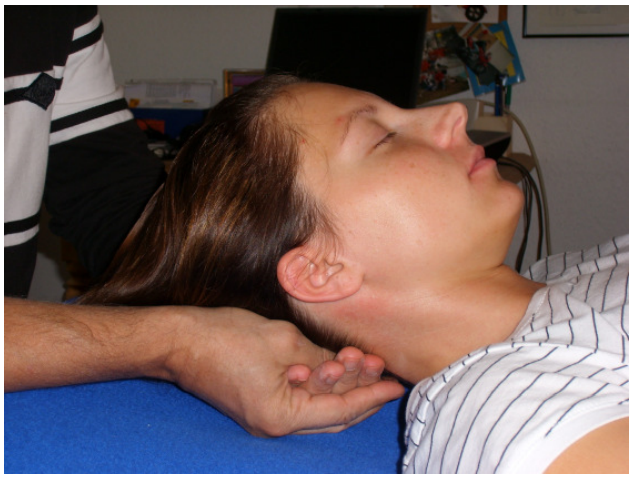


Image 10: “CV 4 ”

Image 11: Mobilisation Th 2

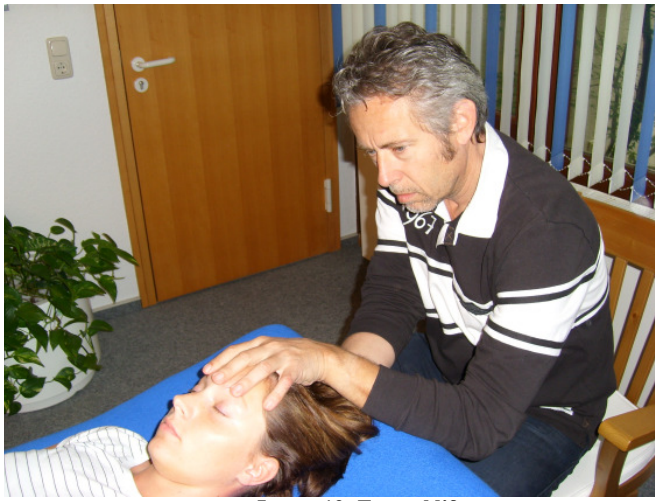


Image 12: Frontal lift

11.0. Statistical Evaluation

11.1. Data analysis

First of all, missing values and the numbers of individual answers were explored for each variable. Missing data are once each the duration of increased intraocular pressure (ID3), the estimation of the extent of side effects (ID 13) and the first measurements of intraocular pressure (IOP) after osteopathic treatment of the patient with ID 7.

11.2. Data exploration

In advance of the statistical tests, tests for normality (Kolmogorov-Smirnov-tests) were performed. The data of the intraocular pressure measurements and their mean values are normal distributed. In contrary, most of the variables of the questionnaire and the medical data sheet deviate from normal distribution. Exceptions are the age of the patients, the years patients suffer from increased IOP, myopia, and the pain intensity of the accompanying symptoms head ache and neck pain before and after osteopathic treatment.

11.3. Statistical tests

The data of the IOP measurements were evaluated in their entirety as well as individually for each patient.

At first, for a general view about the mean IOP before and after osteopathic treatments, an independent samples t-test (level of significance $\alpha = 0.05$, two-tailed) was performed, including all data of the three measurements before and after osteopathic treatment, respectively. That means, this test was performed under consideration of the total variance of IOP of all patients and thus of its natural range of variation.

In a second step, IOP data before and after osteopathic treatment were compared by paired sample t-tests (level of significance □= 0.05, two-tailed). In this case, the measurements after treatment were considered individually and the measurements before treatment as the mean value of the three individual measurements.

By this test, it is possible to estimate the deviation from the initial mean intraocular pressure in chronological sequence.

By these tests, it became apparent, that there is a re-degradation of the IOP between the second and third measurement (4-5 weeks and 8-9 weeks after the last osteopathic treatment, respectively). Therefore, analogously to the first step, another independent sample t-test was performed after excluding the data of the third measurement. In order to consider the individual natural range of variation of IOP, the steps one and three, that means the independent samples t-tests were repeated with the data of the single patients, with and without the comprehension of the third measurement (post3).

Nonparametric tests (Wilcoxon signed ranks test) were used for comparisons of the severity of symptoms accompanying increased IOP before and after osteopathic treatment (level of significance □= 0.05, two-tailed).

In order to evaluate a possible influence of the severity of myopia, Pearson correlation coefficients were calculated with the variable myopia and the differences of the results of the three IOP measurements after treatment, singly, and the mean value of the results of the three measurements before.

During data analysis, it became evident, that there might be a difference in the therapeutic outcome between patients with and without diseases of the thyroid gland. This hypothesis was tested by another independent samples t-test, comparing the single differences in IOP of the results of the three measurements after osteopathic treatment and the initial mean IOP for these two groups.

Software used for evaluation was SPSS® 12.0.0.

11.3.1 .Variables and hypotheses

The variables used for the independent samples t-tests already were described in the previous section. The null hypothesis can be expressed as followed:

The two compared variables do not differ in distribution. Thus, population means of both variables should be equal and differences of the population means equal 0.

This hypothesis applies to the paired sample t-tests, too.

For this test, paired variables are the mean values of the three IOP measurements in advance of osteopathic treatment (pre_l and pre_r) and the results of the first, second and third IOP measurement after osteopathic treatment for each eye separately (11.3.1. Table 1).

before treatments		after treatments	
mean value of three IOPs (left eye) before treatments	pre_l	IOP (left eye) 48 hours after 2nd osteopathic treatment	post1_l
		IOP (left eye) 4-5 weeks after 2nd osteopathic treatment	post2_l
		IOP (left eye) 8-9 weeks after 2nd osteopathic treatment	post3_l
mean value of three IOPs (right eye) before treatments	pre_r	IOP (right eye) 48 hours after 2nd osteopathic treatment	post1_r
		IOP (right eye) 4-5 weeks after 2nd osteopathic treatment	post2_r
		IOP (right eye) 8-9 weeks after 2nd osteopathic treatment	post3_r

Table 1: Paired variables of IOP measurements before and after treatment.

Wilcoxon signed ranks test were performed with the paired variables:

before treatments		after treatments	
pain intensity of eye pain	IOP_eye	pain intensity of eye pain 8-9 weeks after 2nd treatment	IOP_Peye
pain intensity of neck pain	IOP_neck	pain intensity of neck pain 8-9 weeks after 2nd treatment	IP_Pneck
pain intensity of head ache	IOP_head	pain intensity of head ache 8-9 weeks after 2nd treatment	IOP_Phead

Table 2: Paired variables of questionnaire data before and after treatment.

12.0. Results

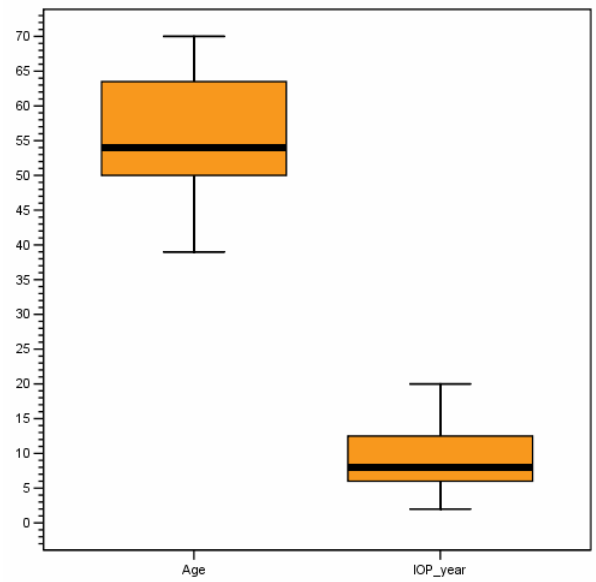
12.1. The Patients

12.2. Results of the Questionnaire

Thirteen patients took part in this study, among them eleven women (84.6%) and two men between 39 and 70 years of age. On average they are 53.4 years old. Standard deviation (SD) is 10.3 years, the median 54 years. The patients have been suffering from increased intraocular pressure (IOP) for 9.4 years on average (SD: 5.3, range: 2-20 years). The according median is eight years.

From the following box and whisker plot (Ill. 1) the distributions of age and of the years patients know about their increased IOP can be read (from top to bottom):

upper end of the whisker: 95% percentile
upper margin of the box: 75% percentile
horizontal line within the box: median
bottom margin of the box: 25% percentile
lower end of the whisker: 5% percentile



Ill. 1: Age and years of having increased IOP.

Ten of the 13 patients (77%) have myopia between 2 and 11.5 dioptres (12.2 Table 3).

Variable	n	total mean (dioptres)	SD	Median	Maximum
myop	10	3.39	3.42	2.5	11.5

Table 3: Dioptres of myopia (The mean value is calculated from the whole sample).

Six of the patients (46.2%) have relatives, with diagnosed increased IOP, three patients take drugs against it and each of the three describes adverse side effects caused by them. The extent of these undesirable effects is scaled with a mean value of 4 (range 3-5) on a 10-point Likert scale (0= no side effect, 1= low extent, 10 = high). The patients describe to have accompanying symptoms due to increased intraocular pressure. The mean value of pain intensity, standard deviation (SD), median and maximum value for the whole sample, calculated from a 10-point scale equal the one introduced above, are summarized in Table 4. The number in brackets (n) is the number of individual patients who describe these symptoms.

before treatement		(n)	total mean	SD	Median	Maximum
eye pain	IOP_eye	(2)	0.85	2.304	0	8
head ache	IOP_head	(8)	2.85	2.512	4	7
neck pain	IOP_neck	(8)	2.69	2.496	3	7
others	IOP_else	(0)	0.00	0.000	0	0

Table 4: Pain intensities of accompanying symptoms. Mean values are calculated from the total sample.

In total, only three of the patients (23.1%) do not have accompanying symptoms. Most frequent are head ache and neck pain, which are described by eight of the 13 patients (61.5% each). Eye pain is described by two of the patients (15.4%).

Internal diseases described by the patients are summarized in Table 5:

Internal diseases	Variable	n	%
Heart disease	els_heart	1	7.7
Hypertension	els_hyp	2	15.4
Diabetes	els_diab	1	7.7
Diseases of the thyroid gland	els_thyr	5	38.5
Diseases of the liver	els_liv	0	0.0

Table 5: Frequencies of internal diseases, described by the patients.

Seven of the patients suffer from additional internal diseases (53.8%).
Diseases of the thyroid gland are most frequent among the patients (38.5%), followed in number by hypertension (15.4%). Heart diseases and diabetes can be observed at two patients (7.7% each).

13.0. Osteopathic Characteristics diagnosed during Check up

13.1 Parietal dysfunctions

Frequencies of parietal dysfunctions diagnosed during osteopathic check up are summarized in Table 6.

Dysfunction	n	%
parietal dysfunction/ cervical spine	9	69.2
parietal dysfunction/ lumbar spine	8	61.5
parietal dysfunction/ ilium	7	53.8
parietal dysfunction/ thoracic spine	5	38.5
parietal dysfunction/ mandibular joint	5	38.5
parietal dysfunction/ lower limbs	1	7.7
parietal dysfunction/ upper limbs	0	0.0

Table 6: Frequencies of parietal dysfunctions (in descending order).

Generally, dysfunctions of all sequences of the spine, except the thoracic spine can be observed at more than 50% of the patients, whereas dysfunctions of the limbs and of the mandibular joint are less frequent. Parietal dysfunctions of the cervical spine were diagnosed most often (69.2%).

13.2. Visceral dysfunctions

Frequencies of visceral dysfunctions diagnosed during osteopathic check up are summarized in Table 7.

Dysfunction	n	%
visceral dysfunction/ small intestine	4	30.8
visceral dysfunction/ stomach	4	30.8
visceral dysfunction/ urogenital tract	3	23.1
visceral dysfunction/ colon	2	15.4
visceral dysfunction/ liver	1	7.7
visceral dysfunction/ pancreas	0	0.0

Table 7: Frequencies of visceral dysfunctions (in descending order).

Compared to the frequency of parietal dysfunctions, less visceral dysfunctions were diagnosed. Structures affected most often are the small intestine and the stomach (30.8% each).

13.3. Cranial dysfunctions

Frequencies of cranial dysfunctions diagnosed during osteopathic check up are summarized in Table 8.

Dysfunction	n	%
cranial dysfunction/ membrane	13	100.0
cranial dysfunction/ CRI	7	53.8
cranial dysfunction/ bone	3	23.1
cranial dysfunction/ fluid	2	15.4

Table 8: Frequencies of cranial dysfunctions (in descending order).

Cranial dysfunctions of the membrane were observed at each of the patients, followed by dysfunctions of the CRI (cranial rhythmic impulse, 53.8%).

13.4. Dysfunctions of the diaphragms

Frequencies of dysfunctions of the diaphragms diagnosed during osteopathic check up are summarized in Table 9.

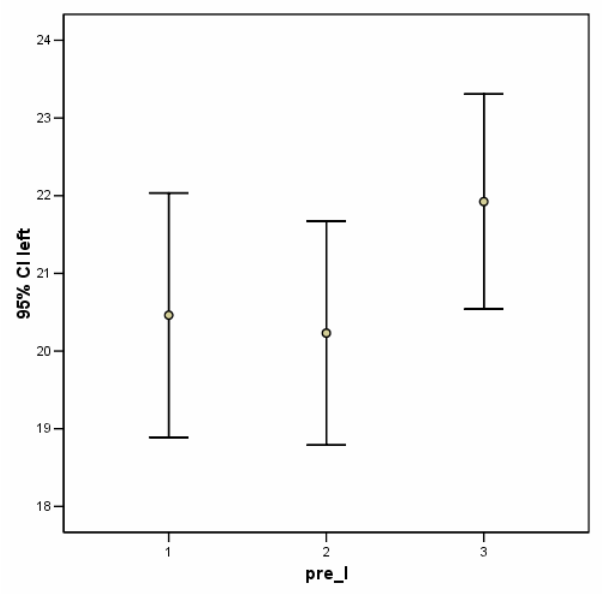
Dysfunction	n	%
dysfunction of diaphragms/ tentorium cerebelli	11	84.6
dysfunction of diaphragms/ thoracocervical aperture	8	61.5
dysfunction of diaphragms/ PPI	6	46.2
dysfunction of diaphragms/ thoracolumbal	5	38.5
dysfunction of diaphragms/ diaphragm of sella turcica	2	15.4

Table 9: Frequencies of dysfunctions of the diaphragms (in descending order).

In 84.6% of the patients, dysfunctions of the tentorium cerebelli were diagnosed and in 61.5% of them dysfunctions of the thoracocervical aperture. The frequencies of other dysfunctions of diaphragms are less than 50%.

14.0. Pressure before Osteopathic Treatment

Descriptive data (mean values, standard deviation (SD), maximum) of the individual data of the three IOP measurements in advance of the osteopathic treatments, as well as the mean value calculated of these three variables are summarized in Table 10 (left eye) and 11 (right eye). An additional overview about the mean values and their 95%-confidence intervals is presented in Ill. 2 and Ill.3.

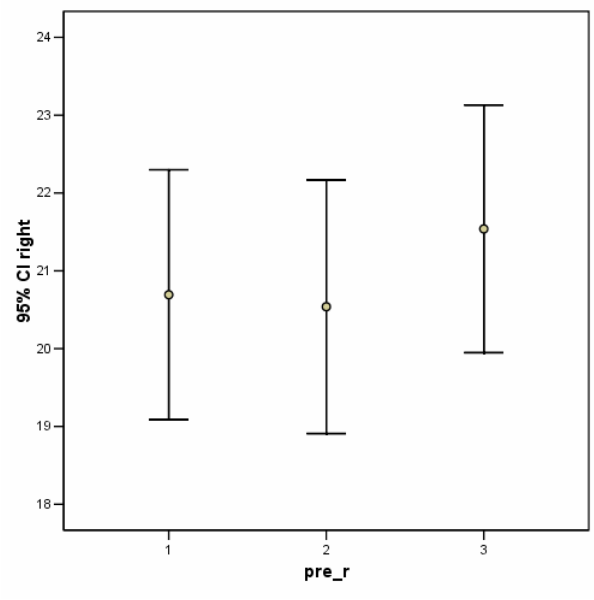


Ill. 2: Mean values and 95%-confidence intervals of the three IOP measurements (left) before osteopathic treatment.

before tr	n	mean value	SD	Maximum
pre1_l	13	20.46	2.60	26
pre2_l	13	20.23	2.39	24
pre3_l	13	21.92	2.29	26
pre_l	39	20.87	2.48	26

Table 10: Results of the three IOP measurements (left eye) before osteopathic treatment and their total mean value (pre_l).

Obviously, the IOP data vary distinctly between the individual dates.



Ill. 3: Mean values and 95%-confidence intervals of the three IOP measurements (right) before osteopathic treatment.

before tr	n	mean value	SD	Maximum
pre1_r	13	20.69	2.66	26
pre2_r	13	20.54	2.70	25
pre3_r	13	21.54	2.63	26
pre_r	39	20.92	2.63	26

Table 11: Results of the three IOP measurements (right eye) before osteopathic treatment and their total mean value (pre_r).

Also in these results, the variation between the individual dates is obvious.

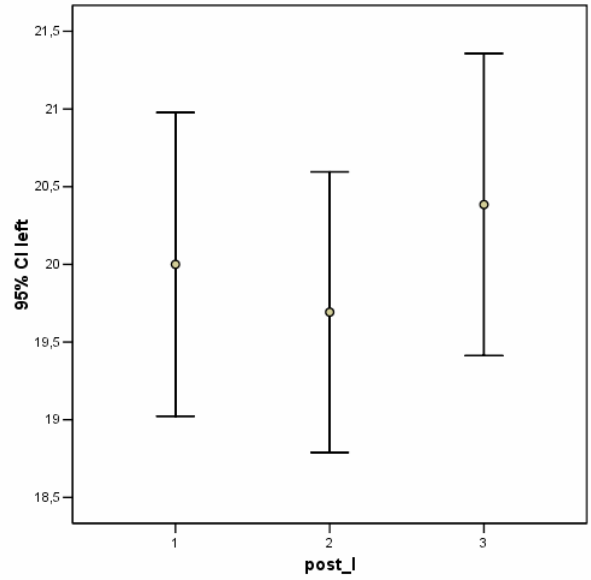
Compared to the intraocular pressure of healthy subjects, 15,5 – 17,5 ± 5 mmHg, the IOP is increased. Thus, these inclusion criteria are fulfilled.

14.1. Changes of Intraocular Pressure by Osteopathic Treatment

14.2. General Overview

14.2.1. Left eye

Mean values, sample number (n), standard deviations (SD) and the standard errors of means of the IOP measurements on the left eye are summarized in Table 12 for the single measurements as well as summarised by the mean value of these results. Additionally, in Ill.4, an overview about the mean values of the three measurements and their 95%-confidence intervals is presented.

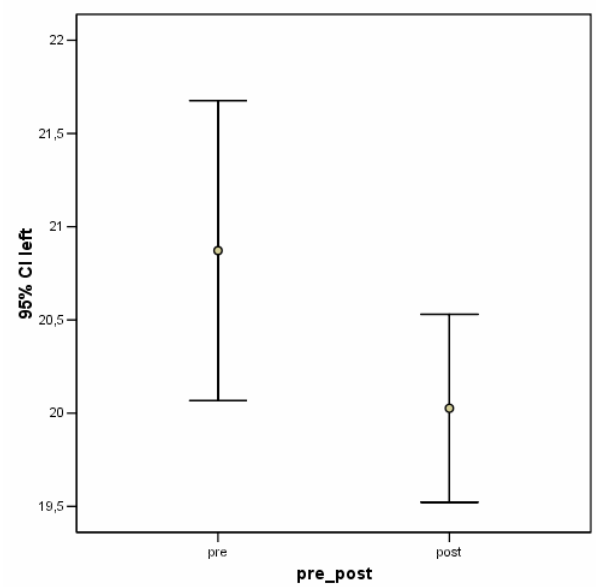


Ill. 4: Mean values and 95%-confidence intervals of the three IOP measurements (left) after osteopathic treatment.

Variable	Mean value	n	SD	SE (mean)
post1_l	20.00	12	1.54	0.44
post2_l	19.69	13	1.49	0.41
post3_l	20.38	13	1.61	0.45
post_l	20.03	38	1.53	0.25

Table 12: Descriptive data of the IOP measurements on the left eye 48 hours after the second treatment (post1_l), 4-5 weeks after the second treatment (post2_l) and 8-9 weeks after the second treatment (post3_l) and their total mean value (post_l).

Mean values as well as standard deviation are lower at each measurement after the osteopathic treatments than before. Nevertheless, a re-increase of the values can be observed at the third measurement compared to the other two measurements.
An independent samples t-test of the complete data for all patients results in not significant but distinct differences of the mean IOP between the measurements before and after osteopathic treatment (t=1. 803, p=0.076). The mean values are 20.87 mmHg (SD: 2.48 mmHg, cf. Ill.4) before, and 20.03 mmHg (SD: 1.53 mm) after therapy. That means, the mean IOP as well as the variance are decreased.



Ill. 5: Mean values and 95%-confidence intervals of all results (left eye) of the three measurements before and the three measurements after osteopathic treatment.

In this connection, it has to be noted, that the three measurements after the osteopathic treatments were collected within a period of 8-9 weeks after the last treatment. Thus, treatment effects might be reduced again, having effects on the mean intraocular pressure.

In order to estimate, when IOP was lowest compared to the initial values, paired samples t-tests were performed with the mean value of the data of the three measurements before treatment and the single data of the three measurements after the therapy period.

Due to one missing IOP measurement (post1_l), only 12 paired samples are considered in the further evaluation.

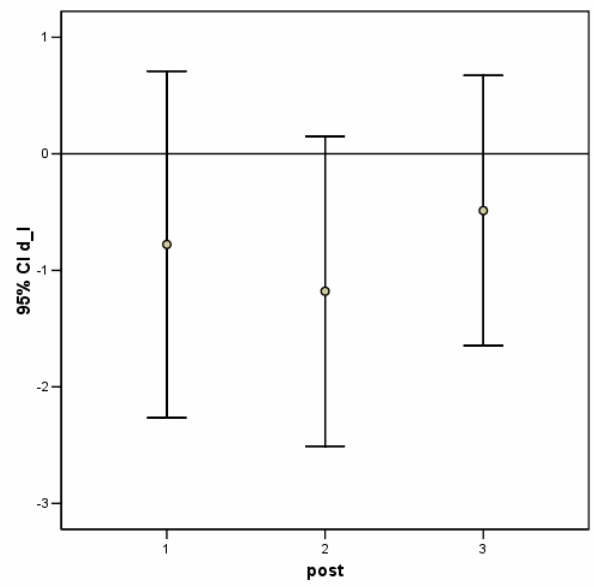
The results of the paired samples t-tests are displayed in Table 13 (left eye). In this table, "mean value" indicates the mean difference between the individual data of the variables shown in the first column of the table. The same accounts for the other statistics.

Paired Differences	Mean value	SD	SE MW	95% CI (Difference)		t	Df	Sig. (2-tailed)
				lower	upper			
post1_l – pre_l	-0.78	2.34	0.68	-2.27	0.71	1.151	11	0.274
post2_l – pre_l	-1.18	2.20	0.61	-2.51	0.15	1.932	12	0.077
post3_l – pre_l	-0.49	1.92	0.53	-1.65	0.67	0.916	12	0.378

Table 13: Results of the paired samples t-test of the results of the IOP measurements (left) before and after osteopathic treatment.

Negative signs of the mean values indicate a decreased intraocular pressure during the measurements after osteopathic treatment compared to the measurements performed before.

A higher and more frequent decrease can be observed during the second measurement after osteopathic treatment than during the first one (Table 14) Additionally, variability of the differences is a little bit lower. Nevertheless, neither of the reductions is significant (level of significance $\alpha = 0.05$). During the third measurement (post3), mean IOP is higher again compared to the both other measurements, but still is lower than the initial mean value (cf. Ill.6).

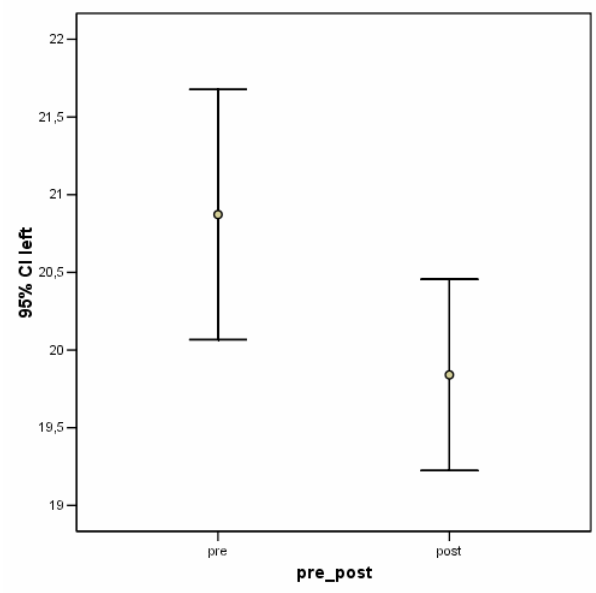


Ill. 6: Mean values and 95%-confidence intervals of the changes of IOP (left eye) measured after the osteopathic treatments compared to the mean value before the treatments (horizontal line y=0).

It can be assumed, that treatment effects decrease again in the course of time.
After exclusion of the data of the last measurement (post3_l), an independent samples t-test of all data before treatments and data of the first two measurements after osteopathic treatments results in significant differences (cf. Table 14 and Ill. 6).

		n	Mean	SD	SE (mean)	t	p
left	before treatment	39	20.87	2.48	0.40	2.08	0.042
	after treatment	25	19.84	1.49	0.30		

Table 14: Descriptive data of the results of the IOP measurements (left eye) before and after osteopathic treatment, as well as results of the independent t-test under consideration of the first two measurements after therapy (post1_l and post2_l, 48 hours and 5-6 weeks after treatment), only.

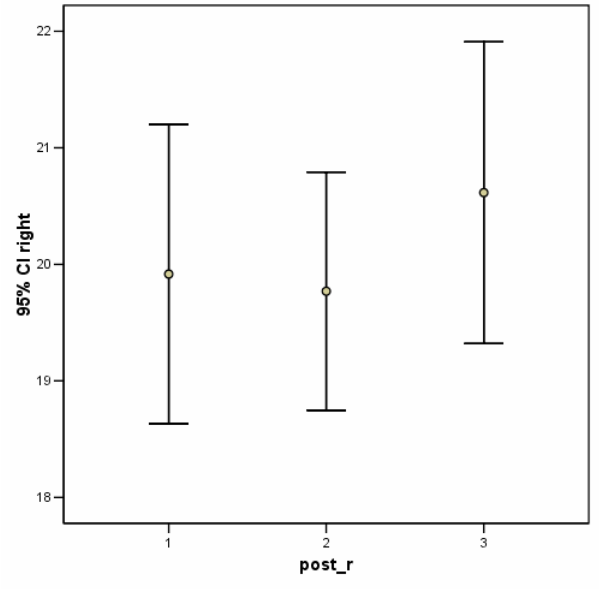


Ill. 7: Mean values and 95%-confidence intervals of all results of the three IOP measurements (left) before (pre) and the first two measurements (post1_l and post2_l), 48 hours and 5-6 weeks after the last treatment (post).

The mean intraocular pressure is significantly lower after osteopathic treatment within the period of 48 hours to 5-6 weeks.

14.2.2Right eye

Mean values, sample number (n), standard deviations (SD) and the standard errors of means of the results of the three IOP measurements on the right eye are summarized in Table 15. Additionally, in Ill. 8, an overview about the mean values of the three measurements and their 95%-confidence intervals is presented.



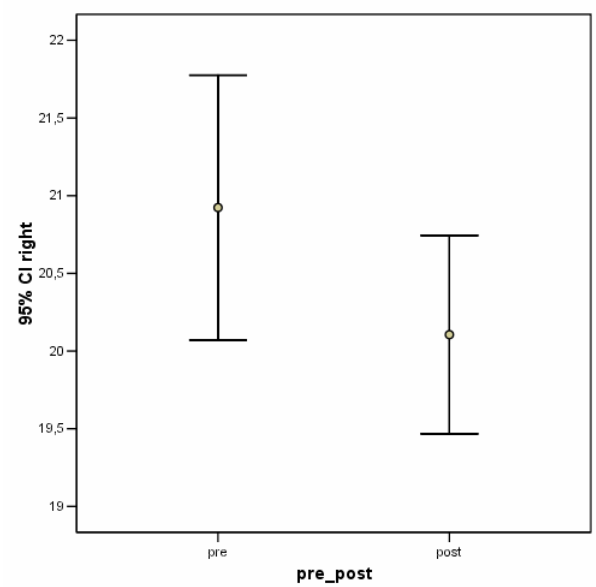
Ill. 8: Mean values and 95%-confidence intervals of the three IOP measurements (right) after osteopathic treatment.

Variable	Mean value	n	SD	SE (mean)
post1_r	19.92	12	2.02	0.58
post2_r	19.77	13	1.69	0.47
post3_r	20.62	13	2.14	0.59
post_r	20.11	38	1.94	0.32

Table 15: Descriptive data of the IOP measurements on the right eye after the osteopathic treatments (mean value of three measurements, post_r), the measurement 48 hours after the second treatment (post1_r) 4-5 weeks and 8-9 weeks after the second treatment (post2_r and post3_r, respectively).

The mean values are lower after the osteopathic treatments than before therapy. Additionally, lower standard deviations can be observed during the first and second measurement, but it re-increases during the third one.

An independent samples t-test of the complete data for all patients results in distinct but not significant differences of the mean IOP between the measurements before and after osteopathic treatment (t=1.549, p=0.126). The mean values are 20.92 mmHg (SD: 2.63 mmHg, cf. Ill. 9) before, and 20.11 mmHg (SD: 1.94 mm) after therapy. That means, the mean IOP as well as the variance are lower after osteopathic treatment.

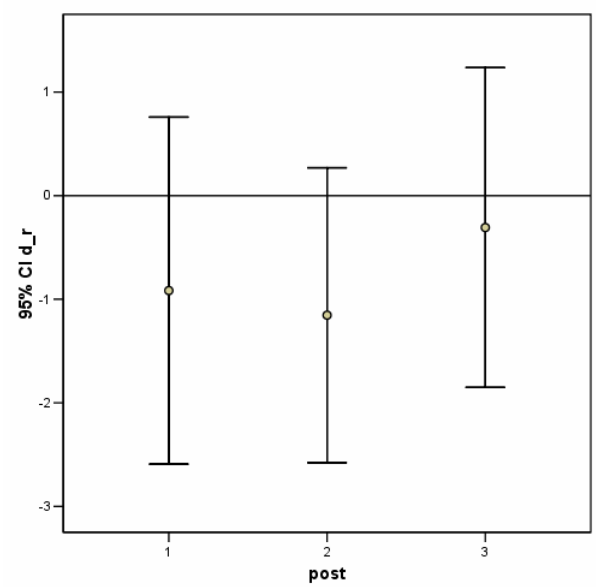


Ill. 9: Mean values and 95%-confidence intervals of all results (right eye) of the three measurements before (pre) and three measurements after osteopathic treatment (post).

Similar to the left eye, treatment effects might be reduced again during the period of 8-9 weeks without accompanying therapy. Therefore, estimation by means of paired samples t-tests was done for the right eye, too, comparing the mean value of the data before osteopathic treatments (pre_r) with the single results of the measurements after osteopathic treatment. By these tests it can be shown, when the intraocular pressure is lowest compared to the average initial state.

Due to one missing IOP measurement (post1_r), only 12 paired samples are considered in the further evaluation.

The results of the paired samples t-tests are displayed in Table 16 (right eye). Again, statistics for the mean differences and not the original values are displayed. The statistic "Mean value" describes the mean difference between the single data of the variables, shown in the first column of this table. The same accounts for the other statistics. An additional overview about the results (mean values and 95%-confidence intervals) is given in Ill. 10.



Ill. 10: Mean values and 95%-confidence intervals of the changes of IOP (right eye) measured after the osteopathic treatments compared to the mean value before the treatments (horizontal line y=0).

Paired Differences	MW	SD	SE (mean)	95% CI (Difference)		t	Df	p (2-tailed)
				lower	upper			
post1_r - pre_r	-0.92	2.64	0.76	-2.59	0.76	1.204	11	0.254
post2_r - pre_r	-1.15	2.36	0.65	-2.58	0.27	1.766	12	0.103
post3_r - pre_r	-0.31	2.56	0.71	-1.85	1.24	0.434	12	0.672

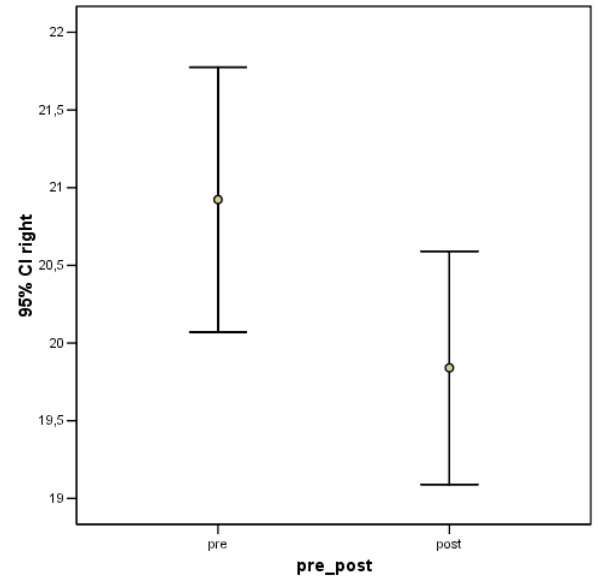
Table 16: Results of the paired samples t-tests of the results of the IOP measurements (right eye) before and after osteopathic treatment.

Also in this case, intraocular pressure is lower during each measurement after osteopathic treatment compared to the measurements performed before.

Again, a higher decrease can be observed during the second measurement after osteopathic treatment than during the first one, values of the third measurement are highest. Variability of the differences is lowest during the second measurement, too. Nevertheless, neither of the IOP reductions is significant (level of significance □= 0.05). Also for the right eye it can be assumed, that treatment effects decrease again in the course of time. After exclusion of the data of the last measurement (post3_r), an independent samples t-test of all data before treatments and data of the first two measurements after osteopathic treatments results in distinct but not significant differences (cf. Table 16 and Ill. 10).

		N	Mean	SD	SE (mean)	t	p
right	before treatment	39	20.92	2.63	0.42	1.80	0.077
	after treatment	25	19.84	1.82	0.36		

Table 17: Descriptive data of the results of the IOP measurements (right eye) before and after osteopathic treatment, as well as results of the independent t-test under consideration of the first two measurements after therapy (post1_r and post2_r, 48 hours and 5-6 weeks after treatment), only.

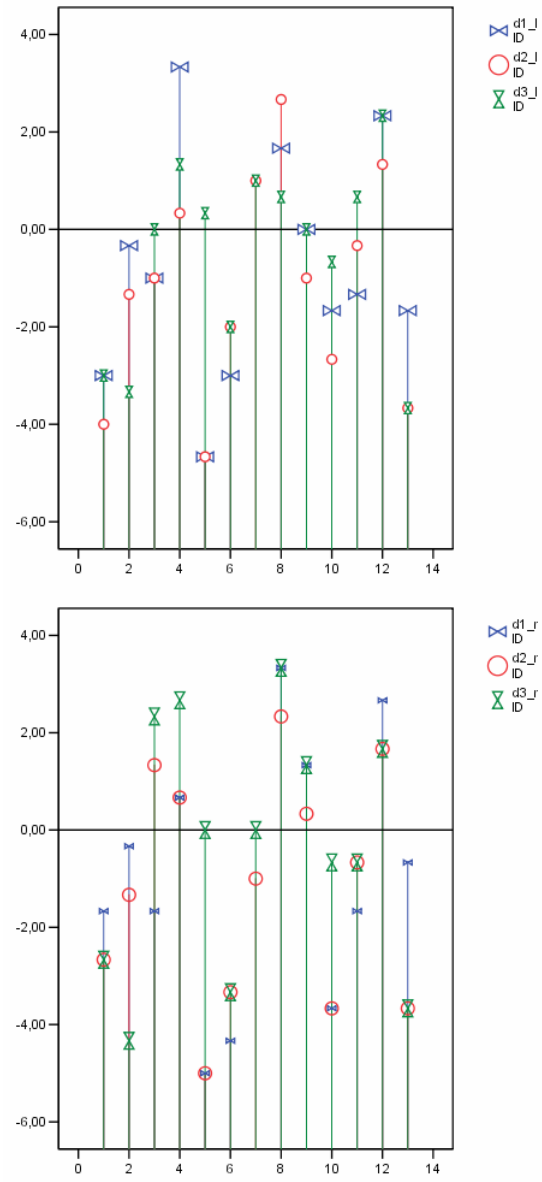


Ill. 11: Mean values and 95%-confidence intervals of all results of the three IOP measurements (right) before (pre) and the first two measurements (post1_r and post2_r), 48 hours and 5-6 weeks after the last treatment (post).

Differences between the results before and after osteopathic treatment are more distinct than under additional consideration of the data of the last measurement, but they are not significant, either.

14.3. Consideration of Individual Changes

The individual changes of IOP are displayed in Ill. 12. The horizontal line at y=0 represents the state before osteopathic treatment (mean value of the data of three measurements pre_l and pre_r, respectively), positive values denote higher intraocular pressure, negative values a reduction of intraocular pressure.



Ill. 12: Differences of IOP between the measurements before (y=0) and after osteopathic treatments (blue: measurement 48 hours after last osteopathic treatment, red: measurement 4-5 weeks after and green: measurement 8-9 weeks after the last osteopathic treatment, left chart: left eye, right chart: right eye).

As can be observed in Ill. 12, intraocular pressure of several patients is subaverage during all measurements after osteopathic treatment. This is the case among five

(38.5%) patients for the IOP of the left eye and among six patients (46.2%) for the IOP of the right eye. Conversely, a higher IOP can be observed at four patients (30.8%) on each eye during all measurements after osteopathic treatment.

The natural variance of the IOP was considered, using independent samples t-tests for each patient individually, comparing the results of the measurements before and after treatment. These tests were performed for each eye, singly and with and without the data of the last measurement. By the exclusion of the data of the last measurement a period of 4-5 weeks after osteopathic treatment is considered, otherwise a period of 8-9 weeks (cf. Table 18).

			post1_, post2_ and post3_ period: 8-9 weeks					post1_ and post2_ period: 4-5 weeks				
ID	Eye	MM	Mean	SD	T	p	Red	Mean	SD	T	p	Red
1	left	pre	24,00	1,73	3,162	0,067	+	24,00	1,73	2,605	0,080	+
		post	20,67	0,58				20,50	0,71			
	right	pre	24,67	1,53	2,475	0,069	+	24,67	1,53	1,809	0,168	+
		post	22,33	0,58				22,50	0,71			
2	left	pre	21,33	1,53	1,336	0,252	+	21,33	1,53	0,696	0,537	+
		post	19,67	1,53				20,50	0,71			
	right	pre	21,33	1,53	1,342	0,251	+	21,33	1,53	0,696	0,537	+
		post	19,33	2,08				20,50	0,71			
3	left	pre	22,00	1,00	1,000	0,374	+	22,00	1,00	1,342	0,272	+
		post	21,33	0,58				21,00	0,00			
	right	pre	21,67	0,58	-0,535	0,621		21,67	0,58	0,139	0,898	+
		post	22,33	2,08				21,50	2,12			
4	left	pre	18,67	2,08	-1,118	0,326		18,67	2,08	-0,959	0,408	
		post	20,33	1,53				20,50	2,12			
	right	pre	18,33	2,31	-0,894	0,422		18,33	2,31	-0,387	0,724	
		post	19,67	1,15				19,00	0,00			
5	left	pre	22,67	3,51	1,143	0,319	+	22,67	3,51	1,783	0,173	+
		post	19,67	2,89				18,00	0,00			
	right	pre	23,00	3,00	1,387	0,238	+	23,00	3,00	2,236	0,111	+

		post	19,67	2,89				18,00	0,00			
6	left	pre	20,00	1,73	2,214	0,134	+	20,00	1,73	1,861	0,160	+
		post	17,67	0,58				17,50	0,71			
	right	pre	21,33	0,58	7,778	**0,001**	+	21,33	0,58	6,734	**0,007**	+
		post	17,67	0,58				17,50	0,71			
7	left	pre	22,00	2,00	-0,671	0,550		22,00	2,00	-0,433	0,707	
		post	23,00	0,00				23,00	.			
	right	pre	22,00	3,00	0,221	0,840	+	22,00	3,00	0,289	0,800	+
		post	21,50	0,71				21,00	.			
8	left	pre	19,33	2,08	-1,250	0,279		19,33	2,08	-1,358	0,268	
		post	21,00	1,00				21,50	0,71			
	right	pre	19,67	3,51	-1,460	0,218		19,67	3,51	-1,072	0,362	
		post	22,67	0,58				22,50	0,71			
9	left	pre	20,00	1,00	0,500	0,643	+	20,00	1,00	0,600	0,591	+
		post	19,67	0,58				19,50	0,71			
	right	pre	18,67	1,15	-1,342	0,251		18,67	1,15	-0,889	0,440	
		post	19,67	0,58				19,50	0,71			

			post1_, post2_ and post3_ period: 8-9 weeks					post1_ and post2_ period: 4-5 weeks				
ID	Eye	MM	Mean	SD	t	p	Red	Mean	SD	T	p	Red
10	left	pre	21,67	3,06	0,898	0,420	+	21,67	3,06	0,939	0,417	+
		post	20,00	1,00				19,50	0,71			
	right	pre	21,67	2,08	1,706	0,163	+	21,67	2,08	2,363	0,099	+
		post	19,00	1,73				18,00	0,00			
11	left	pre	19,33	2,08	0,250	0,815	+	19,33	2,08	0,522	0,638	+
		post	19,00	1,00				18,50	0,71			
	right	pre	19,67	1,53	1,061	0,349	+	19,67	1,53	0,974	0,402	+
		post	18,67	0,58				18,50	0,71			
12	left	pre	17,67	2,52	-1,342	0,251		17,67	2,52	-0,959	0,408	
		post	19,67	0,58				19,50	0,71			
	right	pre	17,33	2,08	-1,604	0,184		17,33	2,08	-1,358	0,268	
		post	19,33	0,58				19,50	0,71			
13	left	pre	22,67	0,58	4,025	**0,016**	+	22,67	0,58	3,098	0,053	+

		post	19,67	1,15				20,00	1,41			
	right	pre	22,67	0,58	2,530	0,065	+	22,67	0,58	1,809	0,168	+
		post	20,00	1,73				20,50	2,12			

Table 18: Mean values and standard deviations of the results of the IOP measurements before and after osteopathic treatments, as well as results of the independent samples t-tests for each individual patient. Data describing the initial state are the results of the three measurements before treatment (pre_1, pre_2 und pre_3), data for the period after treatment are summarised for two periods (8-9 weeks and 4-5 weeks after the last osteopathic treatment).

Under consideration of the period of 8-9 weeks (three measurements) reduced average IOP values can be observed at both eyes of seven patients (53.8%) after osteopathic treatment (cf. Table 19 Red). IOP of two further patients (15.4%) is lower on the left eye, only, IOP of one patient is lower on the right eye, only (7.7%). Improvements of the IOP of two patients (15.7%) are significant, one distinct (but not significant) improvement can be observed at one additional patient (7.7%). Under consideration of two measurements, only, that means, the results of the period of 4-5 weeks after osteopathic treatment (measurements post1 and post2), there are eight patients (61.5%) with improvements on both eyes. Additionally, an improved IOP of only one eye can be observed at two further patients (15.4%).

The fact, that p-values are sometimes higher in the calculations without the data of the last measurements (and thus indicating lower significance of the differences), in spite of more distinct differences between the mean values is caused by the higher variance of the data.

In this connection, it has to be stressed, that these tests can be only estimations due to the small data sets. Nevertheless, these results are cited for the sake of completeness. The state 48 hours after the last osteopathic treatment can be compared with the initial state only in a descriptive way (mean value of the three measurements before therapy, without consideration of the variability of IOP (cf. Table 18).

1st measurement after ost. treatments vs. measurements before treatment	Left eye		Right eye	
reduced IOP	8	66.7%	8	66.7%
increased/equal IOP	4	33.3%	4	33.3%

Table 19: Number of improvements of IOP and of ineffective treatments.

At two thirds of the patients, reduced IOP was measured at the first measurement after the last osteopathic treatment.

14.3.1. Evaluation of Possible Correlations with Myopia

Since most of the patients suffer from myopia, too, a correlation of the severity of myopia and the changes of intraocular pressure was calculated.
The results of Pearson correlations (correlation coefficient R, significance and number of considered paired values is summarized in Table 20.

		left eye			right eye		
Correlations		d1	d2	d3	d1	d2	d3
Myopia	R	0.00	-0.22	-0.25	0.01	-0.10	-0,20
	P (2-tailed)	1.00	0.47	0,42	0.97	0.75	0,51
	n	12	13	13	12	13	13

Table 20: Results of Pearson correlation of myopia and the difference of the results of the IOP measurement after treatment (d1… first measurement, d2… second one, d3… third one) and the mean value of the results before treatments.

There is no linear association of the severity of myopia and the change of IOP between the state before osteopathic treatment and afterwards.

14.3.2. Evaluation of Possible Influences of Internal Diseases on the Reduction of Increased Intraocular Pressure

Since diseases of the thyroid gland can be observed most often among the patients, an additional independent sample t-test was performed, comparing the differences of the deviations of the IOP results after treatment from the initial mean IOP values (e.g., d1_l= pre_l - post1_l) between patients with and without diseases of this kind. Results are summarized in Table 21. The number of patients with other internal diseases is too low for a reasonable evaluation.

Diseases of the thyroid gland (els_thyr)		n	Mean	SD	t	p
D1_l	no	7	0,57	1,90	3,208	**0,009**
	yes	5	-2,67	1,41		
D1_r	no	7	0,33	2,45	2,286	**0,045**
	yes	5	-2,67	1,89		
D2_l	no	8	0,00	1,69	3,302	**0,007**
	yes	5	-3,07	1,52		
D2_r	no	8	-0,21	1,89	2,065	0,063
	yes	5	-2,67	2,39		
D3_l	no	8	0,25	1,70	1,946	0,078
	yes	5	-1,67	1,78		
D3_r	no	8	0,42	2,42	1,334	0,209
	yes	5	-1,47	2,57		

Table 21: Mean value, standard deviation and results of t-tests calculated from the differences of the results of the IOP measurement after treatment (d1… first measurement, d2… second one, d3…third one) and the mean value of the results before treatments (pre_l(r)) after grouping by patients with and without diseases of the thyroid gland.

As can be observed in Table 21, there are significant differences in the changes of IOP after osteopathic treatment between patients without and with diseases of the thyroid gland. On average, a decrease of intraocular pressure can be observed among the patients with diseases of the thyroid gland during all measurements after osteopathic treatment, whereas patients without diseases of this kind even show higher IOP values during the measurements 48 hours and 8-9 weeks after the last osteopathic treatment. These differences are noticeable in the results of both eyes of the first measurement and the results of the left eye only of the second measurement. In these cases, differences are statistically firm.

14.3.3. Changes of Symptoms accompanying Increased Intraocular Pressure

The number of patients with accompanying symptoms, descriptive data, and the p-values of the Wilcoxon signed ranks test, which was used for comparing the severity of accompanying symptoms before and after treatment are summarised in Table 22.

	before treatment					after treatment					
	(n)	total mean	SD	Median	Maximum	(n)	total mean	SD	Median	Maximum	p
eye pain	2	0.85	2.3	0	8	2	0.46	1.2	0	4	0.18
head ache	8	2.85	2.51	4	7	9	2.46	2.73	2	10	0.61
neck pain	8	2.69	2.5	3	7	9	2.54	2.93	2	10	0.73
others	0	0	0	0	0	0	0	0	0	0	-

Table 22: Changes of the number of patients with accompanying symptoms and of their severity. Mean values, standard deviation (SD), and median are calculated from the total sample.

The number of patients who describe accompanying symptoms does not decrease after osteopathic treatments. In contrary, one additional patient (ID1) describes head ache and neck pain after treatment, only.

Generally, mean pain intensity is decreased after the treatments, but differences are not significant. As can be observed in Table 23, there are some patients, who describe higher pain intensities of neck pain and head ache after treatments.

Symptom	Relation	n	%
Eye pain	after tr < before tr	2	100
	after tr > before tr	0	
	after tr = before tr	0	
Head ache	after tr < before tr	6	66.7
	after tr > before tr	2	22.2
	after tr = before tr	1	11.1
Neck pain	after tr < before tr	5	55.6
	after tr > before tr	3	33.3
	after tr = before tr	1	11.1

Table 23: Numbers of patients with higher, equal and lower pain intensity after osteopathic treatment.

15.1. Discussions of Methodology

15.1.1 Study Design and Sampling Size

Due to the serious difficulty in patient recruitment for this study, I had to change the study design from a randomised experimental study with a control group to a quasi experimental study with within subject design. The risk inherent in these study types is a systematic bias of the findings due to the lack of a control group and retrospective measurements. This bias was lessened by the random patient assignment of the ophthalmologist. Twenty-five patients volunteered for the study at the ophthalmologist. Thirteen patients who strictly fulfilled the inclusion criteria were randomly chosen for the study. Another weak point of the study was the lack of a control group. In this study the evidence on the effectiveness of the treatment without a control group was replaced by frequent measurement repetitions.

15.1.2. Discussions of the Measurements

A total of six measurement values were available for statistical evaluation.

These were three retrospective values, which were obtained in a period of time of nine months prior to the beginning of treatment; and three measurement values

which were recorded after the treatment cycle. The retrospective measurements are a further weak point of the study. Retrospective measurement readings which are extremely negative can seriously influence the significance of the study. The retrospective values of this study were constant during the period of measuring and continuously in an increased, pathological range.

However, peak values and extremely low values were not recorded. Thus the risk of a bias of the findings after treatment was lessened. Circadian measurement aberrations, too, can influence the result.

Generally speaking, it can be stated that osteopathic treatments have an impact on intraocular hypertension. The studies of Esser (2002) and Bilgeri (2006) proved this as well. Recapitulatory, in a study with this type of design a high risk of a bias of findings can arise. Nevertheless, the pressure values at the first and second measurement repetition after the last treatment could be decreased almost significantly. At the third measurement repetition the pressure values nearly corresponded to the average of the retrospective initial basic values. Interestingly, the results of the patients suffering from thyroid diseases were better than those of the other patients. The treatment of the superior thoracic aperture ATS and using fluctuation and mobilisation techniques of the spine influence the outflow channels of the thyroid vein and the veins from the head region, which in turn can result in a reduced ocular pressure. This, however, is a hypothesis. This would represent a topic for a new study with the question of whether a treatment of the thyroid gland especially influences ocular hypertension.

Such a study would be desirably in cooperation with a university hospital, where a large sampling size with randomisation and a control group covering a period of one year with a higher number of treatment intervals are available. Here the significance of the impact of osteopathic treatment on ocular hypertension would become even clearer.

In the following sections the osteopathic dysfunctions in the parietal, visceral and cranial field were subjectively diagnosed and analysed statistically.

Thus this quasi experimental study investigates whether primary a decrease of intraocular hypertension is possible and secondary a reduction of side-effects such as headache, neck and eye pains is achievable. A further parameter is the internal diseases and osteopathic dysfunctions found in the anamnesis and whether this correlates to ocular hypertension.

16.1. Bibliography

Bilgeri, S. THE IMPACT OF OSTEOPATHIC TREATMENT ON INCREASED INTRAOCULAR PRESSURE IN PRIMARY OPEN-ANGLE-GLAUCOMA; Masterthesis 2006

Cipolla et al. Premiliminery study; AN EVALUATION OF THE EFFECT OF OSTEOPATHIC MANIPULATIONS THERAPY ON INTRAOCULAR PRESSURE; In JAOA 1975 pp. 433 - 437

Cloet, E. Groß, B. OSTEOPATHIE IM CRANIELLEN BEREICH; Hippokrates Verlag 1999

Corning, K.H.LEHRBUCH DER TOPOGRAPHISCHEN ANATOMIE; 3. Auflage Verlag von J.F. Bergmann 1907

Esser, T. KANN DURCH OSTEOPATHISCHE TECHNIK EINE SENKUNG DES AUGENINNENDRUCKES BEIM PRIMÄRCHRONISCHEN OFFENWINKELGLAUKOM BEWIRKT WERDEN; Masterthesis 2002

Flammer, J. GLAUKOM; 1. Auflage; Verlag Hans Huber 2000

Gruyter, de PSCHYREMBEL; KLINISCHES WÖRTERBUCH; 258. Auflage Walter de Gruyter Verlag 1998

Hansen, Lutz AUGENHEILKUNDE SYSTEMATISCH; 2. Auflage Uni-Med - Verlag 2007

Hoeppner J.P. EMBRYOLOGIE, ENTWICKLUNG DES NERVENSYSTEMS; Skript College Sutherland 1996

Jaeger E.Dr. PATHOLOGIE DES AUGES; Zweite Lieferung Wien Aus der kaiserlich königlichen Hof- und Staatsdruckerei; 1855

Krieglstein, G.K. GLAUKOM - EIN DISKUSSIONSFORUM, Springer Verlag 2003

Krieglstein, G.K. GLAUKOM; Springer Verlag 2006

Leydhecker W. / Krieglstein G.K; OKULÄRE HYPERTENSION;
Springer Verlag 1983

Leydhecker, W. AUGENHEILKUNDE; Springer Verlag 1990

Liem, T. KRANIOSAKRALE OSTEOPATHIE; 3. Auflage Hippokrates Verlag 2001

Liem, T. PRAXIS DER CRANIOSAKRALEN THERAPIE; 2. Auflage Hippokrates Verlag 2003

Misischewa, PJ. THE EVALUATION OF INTRAOCULAR TENSION FOLLOWING OSTEOPATHIC MANIPULATIONS 1981 In JAOA 84 (1) 72

Mitchell P, Wang JJ. Hourihan F. THE RELATIONSHIP BETWEEN GLAUCOMA AND PSEUDOEXFOLATION; The blue mountains eye study Arch. Ophthalmol. 1999 ; 117;1319 -24

Moll, K.J. ANATOMISCHE TAFELN – VERLAUFSBESCHREIBUNG VON NERVEN UND GEFÄßEN; Gustav Fischer Verlag

Morrison, J. et. Al. GLAUCOMA A COLOUR OF DIAGNOSIS AND TREATMENT; second eddition 1996 ISBN 0-750-61820-5

Mutschler /Wiederholt / Upmeyer REGULATIONSDYNAMIK BEIM GLAUKOM; Wissenschaftliche Verlagsgesellschaft

Netter, F. ATLAS DER ANATOMIE DES MENSCHEN; Novartis Verlag 1997.

Nöhring, F.J. FACHWÖRTEBUCH KOMPACKT MEDIZIN; 2. Auflage Urban & Fischer Verlag 2004

Pfeiffer N. GLAUKOM UND OKULÄRE HYPERTENSION; 2. Auflage Thieme Verlag 2005

Porter, R. DIE KUNST DES HEILENS; Spektrum Akademischer Verlag 2000

Schiebler, Schmidt, Zilles ANATOMIE; 8. Auflage Springer Verlag 1999

Schlote/Grüb/Mielke/Rohrbach; TASCHENATLAS AUGENHEILKUNDE; Thieme Verlag 2004

Schwarz M- NEUROPROTECTION AS A TREATMENT FOR GLAUCOMA PHARMAGOLOCIGAL AND IMMUNOLOGICAL APPROACH Eur.J. Ophthalmol 2001; 11 Suppl 2. S 7-11

Travell, J.G. Simons, D.G. MYOFASCIAL PAIN AND DYSFUNCTION Volume 1. Williams and Wilkins, Baltimore 1983 S. 290, 29

Wolfs RC. Klaver CC Ramrattan RS, van Duijn CM, Hofman A, de Jong PT Genetic risks of primary open-angle-glaucoma. Population-based familial aggregation study. Arch Ophthalmol. 1998; 116; 1640 -5

16.2. INTERNETRECHERCHE:

@1 www.oeteomed.hsc.unt.edu/scripts/startfinder download am 10.04.2007

@2 www.flexicon.doccheck.com download am 20.04.2007

@3 www.initiative-auge.de/index.html download am 12.06.2007

@4 www.glaucoma.org/treating/alternative-med download am 20.02.2007

@5 www.wissenschaft&medizin.de download am 10.10.2007

@6 www.highbeam.com/doc/ download am 29.12.2007

@7 http://www.glaucoma.org/research/optic_nerve_axo.html download **13.11.06**

Praxis für osteopathie

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Gerolzhofen, den 17.Mai 2007

Klinische osteopathische Studie über die intraokuläre Hypertension

Sehr geehrter Herr Dr. ……..

Für eine klinische Master-Studie suche ich Patienten, die an einer okulären Hypertension leiden.

Diese Studie wird wissenschaftlich von der Donau-Universität Krems/ AT überwacht und bewertet.

Mit dieser Studie soll wissenschaftlich bewiesen werden, dass man mit osteopathischen Behandlungen den Augendruck senken kann.

In Frage kommen Patienten mit einer grenzwertigen Hypertonie bis max. 25 mmHg (siehe Einschlußkriterium). Diese erhalten von mir drei kostenlose osteopathische Behandlungen im Abstand von jeweils einer Woche.

Die Messung des Augendrucks soll einmal vor der ersten Behandlung, 48 Stunden nach der letzten Behandlung und 4 Wochen nach der letzten Behandlung erfolgen, um ein Langzeitergebnis zu messen. Ein wichtiger Parameter ist noch die Dicke der Hornhaut, diesen Wert benötige ich noch für die statistische Auswertung.

Die Therapie ist völlig schmerzfrei, es werden sowohl der Schädel, die Augen, die Wirbelsäule und innere Organe behandelt. Sekundärerscheinungen, wie Kopf- und Nackenschmerzen, Schwindel und Augenschmerzen ect. sollen positiv beeinflusst werden.

Vielleicht lässt sich durch eine osteopathische Therapie der grenzwertige Augendruck so beeinflussen, dass eine Schädigung des Sehnervs auf natürlicher Weise verhindert wird und auf eine medikamentöse Therapie verzichtet werden kann. Es zeigte sich in der Vergangenheit, dass die osteopathische Behandlung bei einigen Patienten eine drucksenkende Wirkung hatte.
Die Patienten haben durch diese Behandlung keinerlei Gesundheitsgefahren und die medikamentöse Therapie wird unverändert wie verordnet weitergeführt.
Diese klinische Studie ist für mich eine wissenschaftliche Diplomarbeit – Master of Science -
Ich würde mich freuen, mit Ihnen diese Studie durchführen zu dürfen.

Mit freundlichen Grüßen

Oskar Kuhmann
(Osteopath)

Praxis für osteopathie

OSKAR KUHMANN

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HEILPRAKTIKER / OSTEOPATH

Klinische osteopathische Studie über die okuläre Hypertension

Sehr geehrter Herr Dr. ……

ich führe momentan eine klinische Studie über die okuläre Hypertension durch. Für diese Studie konnte ich Frau …….. aus …….. gewinnen. Ziel der Studie ist die Reduktion des Augeninnendruckes durch osteopathische Behandlungen. Osteopathie ist eine ganzheitliche Behandlungsart, wo man mit manuellen Techniken am Schädel, den Augen, Kiefer und Gaumen, Wirbelsäule und visceralen System, versucht den Augendruck positiv zu beeinflussen.
Frau …….. bekommt von mir drei osteopathische Behandlungen. Die erste Behandlung erfolgt am 26. Mai und ein bis zwei Tage vorher sollte der Augendruck mit dem Applanationstonometer gemessen werden. Bist jetzt konnte ich erst eine von Ihren Patienten für diese Studie gewinnen. Um ein aussagekräftiges Ergebnis zu erzielen, benötige ich noch einige Patienten für diese Studie. Hierfür habe ich Ihnen eine Patienteninfo zur Auslage beigelegt. Vielleicht findet sich noch der ein oder andere Patient, der die Einschlusskriterien erfüllt und bei dieser Studie mitarbeiten möchte. Ich bin dankbar für jeden Patienten.
Diese Studie ist für Abschlussarbeit eines Masterstudiums (Master of science).
Ich befinde mich momentan wieder in Wien und werde ich Sie in der nächsten Woche anrufen.
Für Ihre Bemühungen vorerst recht herzlichen Dank.

Mit freundlichen Grüßen

INFORMATION FÜR PATIENTEN MIT ERHÖHTEN AUGENDRUCK

Mein Name ist Oskar Kuhmann und bin von Beruf Osteopath. Zurzeit absolviere ich ein Masterstudium an der Donau-Universität Krems/at. Als Abschluss dieses Hochschulstudiums schreibe ich eine Diplomarbeit über den erhöhten Augendruck.

Für diese Studie suche ich Patienten mit einem erhöhten Augendruck, die interessiert sind mitzuarbeiten.
Sie erhalten drei kostenlose osteopathische Behandlungen.

Ziel der Behandlung ist die Senkung ihres Augendrucks. Die osteopathische Behandlung ist eine ganzheitliche, sanfte, manuelle Behandlung, die keinerlei negativen Folgen oder Gesundheitsschäden mit sich bringt.

Wenn Sie interessiert sind, fragen sie ihren Augenarzt oder rufen mich direkt unter:

Oskar Kuhmann
- Osteopath-

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Email: okuhmann@t-online.de

Praxis für osteopathie

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Gerolzhofen, den 21. Juni 2007

KLINISCHE STUDIE FÜR DEN ERHÖHTEN AUGENDRUCK

Sehr geehrte Frau ……..

ich freue mich, über Ihre Teilnahme an der Studie für den Augendruck. Ziel dieser Studie ist die Reduzierung ihres Augendruckes mit osteopathischen Behandlungen. Ich versichere Ihnen, dass die Behandlung nicht schmerzhaft ist und keinerlei negativen Auswirkungen für Ihre Gesundheit hat. Im Gegenteil es stärkt ihren Körper und bringt ihn wieder in sein Gleichgewicht. Sie erhalten von mir drei kostenlose Behandlungen im Abstand von einer Woche.48 Stunden nach der letzten Behandlung benötige ich den ersten Messwert und den letzten Wert vier Wochen später.
Die medikamentöse Basistherapie muss während der Studie unverändert weiter laufen.

Ihr erster Behandlungstermin ist am Freitag, den 29. Juni um 18 Uhr in Gerolzhofen, Phillip-Stöhr-Weg 9; Tel 09382 /4297

Die Behandlung dauert bei der ersten Behandlung eine Stunde, die weiteren Behandlungen dauern ca 45 Minuten.

Ich werde noch Ihren Augenarzt über die Studie informieren.

Ich freue mich sie für diese Studie gewonnen zu haben.

Mit freundlichen Grüßen

Praxis für osteopathie

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Frau

……..

Gerolzhofen, 09.07.07

AUGENDRUCKMESSUNG

Sehr geehrte Frau ……..,

hiermit möchte ich Sie an die Augendruckmessung für die klinische Studie erinnern. Sie müsste in dieser Woche (4 Wochen nach der letzten Behandlung) erfolgen.
Ihr Augenarzt Frau Dr. Lange ist bereits informiert.
Vielen Dank für Ihre Mitarbeit

Mit freundlichen Grüßen

Oskar Kuhmann

EINVERSTÄNDNISERKLÄRUNG

Hiermit erkläre ich mich für einverstanden, mich von Herrn Oskar Kuhmann dreimal kostenlos osteopathisch behandeln zu lassen. Ich wurde über die osteopathische Behandlung aufgeklärt und mir wurde versichert, dass ich hierdurch keine gesundheitlichen Schäden erleide. Die dabei ermittelten Augendruckwerte stelle ich für die wissenschaftliche Studie „ Einfluss der osteopathischen Behandlung bei der okulären Hypertension“ zur Verfügung. Mir ist bekannt, dass Diagnosen und Augendruckwerte streng vertraulich behandelt werden.

Datum: **Unterschrift**

ANAMNESEBOGEN

Name des Patienten:

Datum:

1. Parietales System

a.) Beckentorsion **JA**
NEIN

b.) Wirbeldysfunktion

LWS	**JA**
	NEIN
BWS	**JA**
	NEIN
CTÜ	**JA**
	NEIN
HWS	**JA**
	NEIN
OAA	**JA**
	NEIN

c.
sonstige **……**

2. viscerales System

kleines Becken

PPI **JA**
NEIN

DD-RADIX **JA**
NEIN

LEBER **JA**
NEIN

NIEREN **JA**
NEIN

MAGEN **JA**
NEIN

sonstige…….

3.
cranielles System

MEMBRANE **JA**
NEIN

KNOCHEN **JA**
NEIN

FLUIDA **JA**
NEIN

Sonstiges ……

4. Diaphragmas	**PPI**	**JA**
		NEIN
	T/L	**JA**
		NEIN
	ATS	**JA**
		NEIN
	TENDORIUM	**JA**
		NEIN
	T: SELLAE	**JA**
		NEIN

Komentar:

S T A T I S T I S C H E R E R F A S S U N G S B O G E N

1. GESCHLECHT **M** **W**

2. ALTER **JAHRE**

3. WIEVIEL JAHRE LEIDEN SIE AN EINEM ERHÖHTEN AUGENDRUCK?

4. GIBT ES ANGEHÖRIGE BEI DENEN EIN ERHÖHTER AUGENDRUCK BEKANNT IST?

JA **NEIN**

5. MÜSSEN SIE FÜR DEN AUGENDRUCK MEDIKAMENTE EINNEHMEN?

NEIN **WENN JA**

WELCHE?

6. HABEN SIE VON DEN MEDIKAMENTEN UNERWÜNSCHTE NEBENWIRKUNGEN?

(Kopfschmerzen, Bindehautentzündung, Sehstörung, Blutdruckprobleme, Depression, Allergien; Augenschmerzen)

NEIN

JA; WELCHE?

LEICHT **MITTTEL** **STARKE**

BESCHWERDEN

1 2 3 4 5 6 7 8 9 10

7. HABEN SIE DURCH DEN ERHÖHTEN AUGENRUCK FOLGENDE BESCHWERDEN:

	leichte Schmerzen								sehr starke Beschwerden
Augenschmerzen	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Kopfschmerzen	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Nackenschmerzen	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
sonstiges	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

8. WIE STARK WAREN DIE SCHMERZEN NACH DEN BEHANDLUNGEN?

Augenschmerzen	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Kopfschmerzen	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Nackenschmerzen	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
sonstiges	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

9. Haben Sie andere internistische Erkrankungen?

Herzerkrankungen

Bluthochdruck

Diabetes mellitus

Schilddrüsenerkrankungen

Lebererkrankungen

10. Welche medikamente nehmen Sie zusätzlich ein?

VIELEN DANK FÜR IHRE MITARBEIT !!!!!

Name		

A. Questionnaire		
German (original)	English	
ID	ID	
1. Geschlecht	1. Sex	
2. Alter	2. Age	
3. Wieviele Jahre leiden Sie an einem erhöhten Augendruck?	3. For how many years have you been suffering from increased intraocular pressure?	
4. Gibt es Angehörige bei denen ein erhöhter Augendruck bekannt ist?	4. Do you have relatives with known increased intraocular pressure?	
5. Müssen Sie für den Augendruck Medikamente einnehmen?	5. Do you have to take drugs against increased intraocular pressure?	
Welche?	Which drugs do you have to take?	
6. Haben Sie von den Medikamenten unerwünschte Nebenwirkungen?	6. Are there undesireable effects of these drugs?	
Welche?	What side effects do they have?	
Beschwerden	Please scale the extent of these undesireable effects:	1
7. Haben Sie durch den erhöhten Augendruck folgende Beschwerden:	7. Do you have any of the following symptoms due to increased intraocular pressure:	
Augenschmerzen	eye pain	1
Kopfschmerzen	head ache	1
Nackenschmerzen	neck pain	1
sonstiges	other symptoms	1
8. Wie stark waren die Schmerzen nach den Behandlungen:	8. How intense was pain after treatments:	
Augenschmerzen	eye pain	1

Kopfschmerzen	head ache	
Nackenschmerzen	neck pain	
sonstiges	other symptoms	
9. Haben Sie andere internistische Erkrankungen:	9. Do you have other internal diseases:	
Herzerkrankungen	heart diseases	
Bluthochdruck	Hypertension	
Diabetes mellitus	Diabetes	
Schilddrüsenerkrankungen	diseases of the thyroid gland	
Lebererkrankungen	diseases of the liver	
10. Welche Medikamente nehmen Sie zusätzlich ein?	10. Do you take additional drugs?	
Med_name	What additional drugs do you take?	
B. Osteopathic check up		
Erstbefund	date of the first osteopathic check up	
Par_HWS	parietal dysfunction/ cervical spine	
Par_BWS	parietal dysfunction/ thoracic spine	
Par_LWS	parietal dysfunction/ lumbar spine	
Par_ILIUM	parietal dysfunction/ ilium	
Par_UE	parietal dysfunction/ lower limbs	
Par_OE	parietal dysfunction/ upper limbs	
Par_Kiefergelenk	parietal dysfunction/ mandibular joint	
Visc_Urogenital	visceral dysfunction/ urogenital tract	
Visc_Dünndarm	visceral dysfunction/ small intestine	
Visc_Colon	visceral dysfunction/ colon	

Visc_Magen	visceral dysfunction/ stomach
Visc_Pankreas	visceral dysfunction/ pancreas
Visc_Leber	visceral dysfunction/ liver
Cran_knöchern	cranial dysfunction/ bone
Cran_membran	cranial dysfunction/ membrane
Cran_fluidisch	cranial dysfunction/ fluid
Cran_CRI	cranial dysfunction/ CRI
Dia_PPI	dysfunction of diaphragm/ PPI
Dia_Thorakolumbale	dysfunction of diaphragm/ thoracolumbal
Dia_Apertura Thorakocervicale	dysfunction of diaphragm/ thoracocervical aperture
Dia_Tendorium	dysfunction of diaphragm/ Tendorium
Dia_Diaphragma sellae	dysfunction of diaphragm/ diaphragm of sella turcica
Myoptie (Dioptrien)	myopia (dioptres)
Medikamente	Drugs
Emotionale Störungen	emotional disturbances
C. Measurements of the intraocular pressure	
1. Messung Datum	first measurement of the intraocular pressure in advance of the treatment
1. Messung Augendruck links	intraocular pressure (left) 1st measurement
1. Messung Augendruck rechts	intraocular pressure (right) 1st measurement
2. Messung Datum	second measurement of the intraocular pressure in advance of the treatment
2. Messung Augendruck links	intraocular pressure (left) 2nd measurement
2. Messung Augendruck rechts	intraocular pressure (right) 2nd measurement
3. Messung Datum	third measurement of the intraocular pressure in advance of the treatment
3. Messung Augendruck links	intraocular pressure (left) 3rd measurement
3. Messung Augendruck rechts	intraocular pressure (right) 3rd measurement

1. Messung nach letzter Behandlung Datum	first measurement of the intraocular pressure, 48 hours after the last treatment
1. Messung nach letzter Behandlung Augendruck links	intraocular pressure (left) 1st measurement, 48 hours after the last treatment
1. Messung nach letzter Behandlung Augendruck rechts	intraocular pressure (right) 1st measurement, 48 hours after the last treatment
2. Messung nach letzter Behandlung Datum	second measurement of the intraocular pressure, 48 hours after the last treatment
2. Messung nach letzter Behandlung Augendruck links	intraocular pressure (left) 2nd measurement, 48 hours after the last treatment
2. Messung nach letzter Behandlung Augendruck rechts	intraocular pressure (right) 2nd measurement, 48 hours after the last treatment
Mittelwert der 3 Augeninnendrücke (links) vor den Behandlungen	mean value of the intraocular pressures (left) before the treatments
Mittelwert der 3 Augeninnendrücke (rechts) vor den Behandlungen	mean value of the intraocular pressures (right) before the treatments

	A. Questionnaire										
Answer											
	ID	1	2	3	4	5	6	7	8	9	10
m/f	Sex	f	f	F	f	m	f	M	f	f	f
years	Age	54	70	39	48	55	64	65	52	39	52
years	IOP_year	8	20		8	5	2	5	8	15	7
y/n	IOP_rel	n	j	N	n	n	n	N	j	j	n
y/n	IOP_drug	n	j	N	j	n	n	N	n	n	n
descriptive	IOP_drug_descr		1)		2)						
y/n	IOP_drse	n	j	N	j	n	n	N	n	n	n

descriptive	IOP_drse_descr		4)								
low = 1 - high = 10, 0= no	se_scale	0	5	0	4	0	0	0	0	0	0
low = 1 - high = 10, 0= no	IOP_eye	0	8	0	0	0	0	0	0	0	0
low = 1 - high = 10, 0= no	IOP_head	0	4	0	4	5	4	7	0	0	3
low = 1 - high = 10, 0= no	IOP_neck	0	0	4	5	4	7	3	0	0	2
low = 1 - high = 10, 0= no	IOP_else	0	0	0	0	0	0	0	0	0	0
low = 1 - high = 10, 0= no	IOP_Peye	0	4	0	0	0	0	0	0	0	0
low = 1 - high = 10, 0= no	IOP_Phead	4	4	0	2	3	2	3	0	0	1
low = 1 - high = 10, 0= no	IOP_Pneck	7	0	2	2	2	2	3	0	0	3
low = 1 - high = 10, 0= no	IOP_Pelse	0	0	0	0	0	0	0	0	0	0

y/n	els_heart	n	n	N	n	n	n	N	n	n	n
y/n	els_hyp	n	j	N	n	n	n	N	n	n	n
y/n	els_diab	n	n	N	n	n	n	N	n	n	n
y/n	els_thyr	j	n	J	n	j	j	N	n	n	n
y/n	els_liv	n	n	N	n	n	n	N	n	n	n
y/n	drug_ad	j	j	N	n	n	j	N	n	n	n
descriptive	drug_ad_descr	5)	6)	7)			8)				
Answer	**B. Osteopathic check up**										
date	chu_date	26.05.2007	26.05.2007	30.06.2007		26.05.2007	30.06.2007	30.06.2007	29.06.2007	26.05.2007	30.06.2007
y/n	par_cs	j	j		j	j	j	J			j
y/n	par_ts			J	j			J			
y/n	par_ls	j	j		j	j	j			j	j
y/n	par_il	j	j	J		j	j			j	j
y/n	par_ll					j					
y/n	par_ul										
y/n	par_mand	j	j			j			j		
y/n	vis_uro					j	j				
y/n	vis_smi				j				j		j
y/n	vis_col						j			j	
y/n	vis_sto						j				j
y/n	vis_pan										
y/n	vis_liv										j
y/n	cran_bone					j					j
y/n	cran_memb	j	j	J	j	j	j	J	j	j	j
y/n	cran_flu		j				j				
y/n	cran_CRI		j		j		j	J		j	j
y/n	dia_ppi	j	j				j			j	j
y/n	dia_thlu	j		J			j	J			

y/n	dia_thce	j	j	J			j	J	j		j
y/n	dia_tend	j	j	J		j	j	J	j	j	j
y/n	dia_sell	j						J			
dioptres	myop	2	2,8	7,5	2,5	2,5	3	2,5	0	0	2,3
descriptive	drug_3		11)		12)						
descriptive	em	13)									14)
	C. Measurements of the intraocular pressure										
date	pre1_date	24.01.2007	20.11.2006	24.10.2006	17.12.2006	19.03.2007	28.11.1996	28.07.2006	15.01.2007	20.11.2006	28.11.2006
mm Hg	pre1_l	26	20	23	21	19	19	20	20	19	21
mm Hg	pre1_r	26	20	22	21	20	21	19	23	18	21
date	pre2_date	11.04.2007	39126	30.01.2007	23.01.2007	39196	26.02.2007	39049	39195	24.05.2007	26.02.2007
mm Hg	pre2_l	23	21	21	18	23	19	24	17	21	19
mm Hg	pre2_r	23	21	21	17	23	22	25	16	20	20
date	pre3_date	11.06.2007	39226	26.04.2007	24.04.2007	39227	14.06.2007	39247	39266	11.06.2007	11.06.2007
mm Hg	pre3_l	23	23	22	17	26	22	22	21	20	25
mm Hg	pre3_r	25	23	22	17	26	21	22	20	18	24
date	post1_date	12.07.2007	39244	16.07.2007	16.07.2007	39274	17.07.2007		39278	17.07.2007	16.07.2007
mm Hg	post1_l	21	21	21	22	18	17		21	20	20
mm Hg	post1_r	23	21	20	19	18	17		23	20	18
date	post2_date	27.0	39275	27.08.2	27.08.2	39307	27.08.	39321	39314	16.08.	16.08.2007

		8.2007		007	007		2007			2007	
mm Hg	post2_l	20	20	21	19	18	18	23	22	19	19
mm Hg	post2_r	22	20	23	19	18	18	21	22	19	18
mm Hg	pre_l	24,0	21,3	22,0	18,7	22,7	20,0	22,0	19,3	20,0	21,7
mm Hg	pre_r	24,7	21,3	21,7	18,3	23,0	21,3	22,0	19,7	18,7	21,7

Schleichert W	Schmitt	Schmutzer	Sterzer	Wagner	Weth I	Weth S
7	8	9	10	11	12	13
m	f	f	f	f	F	F
65	52	39	52	54	63	39
5	8	15	7	10	17	8
n	j	j	n	j	J	J
n	n	n	n	n	J	N
					3)	
n	n	n	n	n	J	N
0	0	0	0	0	3	

0	0	0	0	0	3	0
7	0	0	3	5	0	5
3	0	0	2	5	5	0
0	0	0	0	0	0	0
0	0	0	0	0	2	0
3	0	0	1	10	0	3
3	0	0	3	10	2	0
0	0	0	0	0	0	0
n	n	n	n	n	J	N
n	n	n	n	n	J	N
n	n	n	n	n	J	N
n	n	n	n	n	N	J
n	n	n	n	n	N	N
n	n	n	n	n	J	N
					9)	10)
30.06.2007	29.06.2007	26.05.2007	30.06.2007	26.05.2007	26.05.2007	26.05.2007
j			j	j		J
j				j	J	
		j	j		J	
		j	j			
	j					J
					J	
	j		j	j		
		j				
			j	j	J	

			j			
			j			J
j	j	j	j	j	J	J
j		j	j			J
		j	j		J	
j				j		
j	j		j			J
j	j	j	j	j		J
j						
2,5	0	0	2,3	0	7,5	11,5
			14)		15)	16)
28.07.2006	15.01.2007	20.11.2006	28.11.2006	12.02.2007	29.12.2006	09.11.2006
20	20	19	21	20	15	23
19	23	18	21	20	15	23
39049	39195	24.05.2007	26.02.2007	13.03.2007	06.03.2007	12.01.2007
24	17	21	19	17	18	22
25	16	20	20	18	18	23
39247	39266	11.06.2007	11.06.2007	25.05.2007	04.06.2007	04.06.2007
22	21	20	25	21	20	23
22	20	18	24	21	19	22
	39278	17.07.2007	16.07.2007	12.07.2007	22.06.2007	22.06.2007
	21	20	20	18	20	21
	23	20	18	18	20	22
39321	39314	16.08.2007	16.08.2007	13.08.2007	20.07.2007	20.07.2007
23	22	19	19	19	19	19
21	22	19	18	19	19	19

22,0	19,3	20,0	21,7	19,3	17,7	22,7
22,0	19,7	18,7	21,7	19,7	17,3	22,7

MESSERGEBNISSE

NAME :

ALTER:

3 MESSUNGEN VOR DER ERSTEN BEHANDLUNG

DATUM ……. Li A mmHg re A

DATUM …….. Li A mmHg re A

DATUM …….. Li A mmHg re A

ERSTE MESSUNG NACH DER LETZTEN BEHANDLUNG

DATUM …… Li A mmHg re A

ZWEITE MESSUNG 4. WOCHE nach der letzten Behandlung

DATUM ……. Li A mmHg re A

Hallo Herr Kuhmann,

hab mich mal bei meiner Arbeitskollegin wegen den Zahlen für den Grünen Star erkundigt. So wie es aussieht sind die Daten für 2004 die aktuellsten, die bereinigt sind und herausgegeben werden dürfen. Kann mal nachfragen, ab wann es Zahlen für 2005 gibt. In Bayern werden wohl aber die Kosten nur nach Fachabteilungen und nicht nach Diagnosen erhoben. Tut mir leid, dass ich Ihnen in dieser Hinsicht nicht weiterhelfen konnte!

Meiner Tochter Svenja geht es übrigens schon bedeutend besser, würde aber gerne nochmal vorbeikommen. Bin auch vollkommen flexibel, was den Termin angeht. Wäre toll, wenn sie das irgendwie noch einrichten könnten. Wäre schön, wenn sie sich wegen einem Termin nochmal bei mir melden würden! Danke!

Liebe Grüße!

Manuela Schreckenbach

Hi Manu,

anbei die Auswertung. Mit den Kosten ist das nicht zu verbinden da die Kosten nur nach Fachabteilungen bei uns ausgewiesen sind.

mfg

ulli

****
Bayerisches Landesamt für Statistik und Datenverarbeitung
- Außenstelle Schweinfurt -
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97421 Schweinfurt
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Telefon: (**09721**) **2088-307** Fax: (**09721**) **2088-149**
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E-Mail:***info-sw@statistik.bayern.de***

****

Bayerisches Landesamt für Statistik und Datenverarbeitung

Sonderauswertung:

Entlassene Patienten in Bayern, (einschl. Stundenfälle)

ICD-10 Schlüssel	Operation in Zusammenhang mit der Hauptdiagnose 2004				ins-ge-samt	darunter			Stundenfälle	Sterbefälle
	OP Ja	OP Nein	Männlich	Weiblich		ohne Stdfall	ohne Sterbefall	ohne Std/Sterbefälle		
Grüner Star-Glaukom										
H40	2 356	3 068	2 390	3 034	5 424	5 374	5 423	5 373	50	1

vo***n:*** Nink, Katrin

Datum: 12.01.2007 10:17:22

An: 'okuhmann@t-online.de'

Cc: "Schröder, Helmut"

Betreff: AW: Ausgaben 2005 für Glaukom und okuläre Hypertension

Sehr geehrter Herr Kuhmann,

vielen Dank für Ihre E-Mail und Ihr Interesse an unseren Auswertungen. Informationen zu den Ausgaben im Arzneimittelbereich finden Sie im jährlich erscheinenden Arzneiverordnungs-Report, der die Arzneimittelverordnungen zu Lasten der gesetzlichen Krankenversicherung in Deutschland eines Jahres (ambulante Versorgung) analysiert. Aktuell liegt der Arzneiverordnungs-Report 2006 vor, der die Daten des Jahres 2005 analysiert. Hiernach wurden im Jahr 2005 bei den Ophthalmika 432 Mio. Tagesdosen (DDD) mit einem Umsatz von circa 250 Mio. Euro Glaukommittel zu Lasten der GKV verordnet.

Informationen zum Arzneiverordnungs-Report und der Datenbasis des Forschungsprojekts GKV-Arzneimittelindex finden Sie auf unserer website: http://wido.de/arz_arzneimittelmark.html

Wir hoffen, Ihnen mit diesen Informationen weiter geholfen zu haben.

Mit freundlichen Grüßen

Katrin Nink

Katrin Nink
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Kortrijker Straße 1
53177 Bonn
Tel.: 0228/843 - 111 (Sekr.: - 393)

Fax: 0228/843 - 144
http://www.wido.de

Von: Jennifer Rulon
Datum: 11/16/06 19:27:16
An: Oskar Kuhmann
Betreff: RE: Intraoccular pressure

Dear Oskar Kuhmann,

Hello and thank you for contacting the Glaucoma Research Foundation. Unfortunately, with what we know today, we cannot restore vision lost from glaucoma. However, there is a great deal of research being done to repair or replace optic nerve cells injured by glaucoma, so that it will be possible in the future.

The two main studies that we are aware of regarding optic nerve regeneration is at Children's Hospital Boston and the Schepens Eye Research Institute.

Here is a link to our information on Dr. Benowitz's research in 1999: http://www.glaucoma.org/research/optic_nerve_axo.html

And here is a link to his progress in 2006: http://www.childrenshospital.org/newsroom/Site1339/mainpageS1339P1sublevel206.html

Also here is a link to more information on the progress at Schepens Eye Research Institute: http://www.theschepens.org/df_chenrelease.htm

The Glaucoma Research Foundation is also funding research into Catalyst For a Cure (CFC), a unique research collaboration which seeks to find ways to change the genetic and neurologic development of the eye so that glaucoma's damage need never occur.

Here is a link to more information: http://www.glaucoma.org/research/researchers.html

And their latest findings: http://www.glaucoma.org/research/three_new_hypot_1.html

Sincerely,

Jennifer Rulon
Information and Research Specialist
Glaucoma Research Foundation
251 Post Street, Suite 600
San Francisco, CA 94108
(415) 986-3162, ext. 272 | Fax: (415) 986-3763

JRulon@glaucoma.org | www.glaucoma.org

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The Glaucoma Research Foundation is a national nonprofit
dedicated to curing glaucoma. We receive no government funding.
Your contribution is tax-deductible as allowed by law.
www.glaucoma.org/help/

From: Oskar Kuhmann [mailto:550232359488-0001@t-online.de]
Sent: Tuesday, November 14, 2006 10:21 PM

To: question
Subject: Intraoccular pressure

Dear scientist,

I am an osteopath who's living in Germany. At the moment I will write a master thesis to become the Master of Science. My hypothesis is that I can influence the intraocular pressure and sight field also with an osteopathic treatment. I will write a nonrandomized study with patients with high IOP and sight field's problems. My question now, that it is possible that the optic nerve that is deceased can be positive influenced with it? When you have researches about regeneration of the optic nerve send me the result outcome.
For your efforts many thanks

Sincerely

Oskar Kuhmann