

Treatment of monosymptomatic Nocturnal enuresis

**Master Thesis zur Erlangung des Grades
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DECLARATION

Hereby I declare that I have written the present master thesis on my own.

I have clearly marked as quotes all parts of the text that I have copied literally or rephrased from published or unpublished works of other authors.

All sources and references I have used in writing this thesis are listed in the bibliography. No thesis with the same content was submitted to any other examination board before.

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ABSTRACT

Background: 15 – 20 percent of the children older than 5 years and 1 – 2 percent of the adolescents still wet their bed at night. In our society this behaviour is very much frowned upon and nobody talks about the issue. Both the parents and the children are subject to a lot of pressure.

Topic: The present study evaluates whether four osteopathic treatments have an influence on children with monosymptomatic primary nocturnal enuresis.

Research question: Do children wet their bed during the night less often after four osteopathic treatments within a period of six weeks and how high is the relapse rate six weeks after the end of the course of treatments?

Study design: clinical study with a within- subject- design; 26 children participate in the study. After the first contact with case history and first examination the test persons do not receive any treatment for a period of six weeks. After these six weeks four osteopathic treatments are carried out within a period of six weeks. Another six weeks after the end of the treatment interval the test persons are contacted by phone to establish the possible relapse rate. The following issues are compared: frequency of enuresis per week within the period A (=without treatment) and frequency of enuresis per week within period B (=during and immediately after four osteopathic treatments). Possible relapses six weeks later are documented.

Result: The hypothesis that an osteopathic treatment tailored to the needs of the individual test person can reduce the frequency of bedwetting in children with monosymptomatic primary nocturnal enuresis could be confirmed. In the treatment interval more children became dry than in the observation interval and the number of wet nights per week could be significantly reduced. Another advantage in comparison with other interventions is the high sustainability.

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1. INTRODUCTION

Due to its high prevalence during infancy bedwetting is defined as dysfunction only from the age of five onwards. At school age this problem is one of the most frequent ones and it is linked with a great psychological strain for both children and parents. Primary nocturnal enuresis is a worldwide problem. Epidemiologic examinations in Western countries have shown an incidence of 15-22% among children at the age of five (Verhulst et al 1985, Devlin, J. 1991, Rutter et al 1973, Feeham et al 1990). The problem disappears spontaneously in 15% of the cases per year, however, 1-2% of the affected persons are still bedwetters at the age of 20 (Forsythe & Redmond 1974).

Often the parents have a resigned attitude and a feeling of helplessness when confronted with the problem. Quite a number of parents react with anger and intolerance; they blame their children and punish them (Butler et al. 1986 & 1993). Some children develop psychic disturbances and display behavioural problems related to the embarrassing situation. A lack of self-esteem and anger can be the consequence. (Warzak, 1993; Butler & Heron, 2007)

The children are afraid to spend the night at a friend's home or school youth hostels because they are worried that an "accident" might happen. (Anonymos, 1987; Ng et al, 2004).

Although there are numerous studies on the problem of nocturnal enuresis, which paint an ever more differentiated picture of bedwetting and the possible treatment methods, no consistent way of treatment for nocturnal enuresis has been found to date (Brown et al., 1995; Butler et al., 2001; Devlin, 1991; Eiberg, 1995b; Järvelin, 1989; Norgaard et al., 1985b).

Often the parents do not support the traditional treatment options, e.g. the administration of hormonal preparations over a longer period or disturbed nights due to the ringing of an alarm bell. What is also disappointing are the high relapse rates after the end of the courses of treatment (Glatzener et al., 2005).

Based on this information the question of this paper, whether osteopathy can represent an alternative treatment method in these cases, was formulated.

The present study evaluates the question whether an osteopathic treatment can significantly reduce the frequency of bedwetting in children with primary nocturnal enuresis and whether there are relapses after the end of the course of treatments. The study is a clinical study with a within –subject – design. 26 children aged between five and thirteen participated in the study. On the occasion of the first contact with the test persons the parents of the children were asked to document the number of wet nights. After a waiting period of six weeks the children were treated four times within a period of another six weeks. The frequency of wet nights before and during the treatments was compared. Another six weeks after the treatment interval the participants were phoned up to find out again about the frequency of bedwetting, which was compared with the data of the treatment interval.

The first part of the paper provides an overview of the current state of knowledge regarding the causes of nocturnal enuresis and the traditional treatment approaches. The second part describes the methodology and the final part presents the results of the study.

1.1. Definition of terms

According to the clinical criteria of the International Classification of Diseases (ICD-10) nocturnal enuresis (Latin: Enuresis nocturna, EN) is defined as the involuntary passage of urine while asleep from a chronological age of five years onwards. Underlying organic conditions like epilepsy, neurological incontinence, structural changes of the urinary tract, i.e. organic pathologies have to be excluded. The minimum duration of the symptoms is three months; the minimum frequency is twice per month in children under the age of seven and once per month in older children. (ICD-10 research criteria, German Society for Child and Adolescent Psychiatry, 2003)

One distinguishes between primary nocturnal enuresis (PNE), i.e. the child has since birth never been dry at night, and secondary nocturnal enuresis (SNE) which means that the child has been dry for a period of at least six months but has started again to wet the bed at night (DSM-IV Classification, 1994).

If no disturbances of bladder or urinary tract can be observed one speaks about a monosymptomatic PNE. A non-monosymptomatic PNE is present if the bedwetting is linked with bladder instabilities and disturbed micturition like urge incontinence symptoms, delay or dyscoordination, which also occur during day-time.

These definitions correspond to the recommended standards of the International Children's Continence Society (Nevéus et al, 2006).

It is assumed that PNE and SNE have different backgrounds. In this paper I will focus exclusively on the monosymptomatic PNE. In her study on osteopathy in the case of enuresis Kargl (2008) recommends to choose study participants with the same diagnosis.

1.2. Prevalence

PNE is a common problem all over the world. Epidemiologic examinations in Western countries have shown an incidence of 15-22% among boys at the age of five years, 13-19% at the age of seven, 9-13% at the age of nine and 1-2% at the age of 16. Among girls an incidence of 9-16% can be observed at the age of five, 7-15% at the age of seven, 5-10% at the age of nine and 1-2% at the age of 16 (Verhulst et al 1985, Devlin, J. 1991, Rutter et al 1973, Feeham et al 1990).

All studies show that the frequency of bedwetting decreases with increasing age and that the children learn to control their bladder during the night.

Even though the rate of spontaneous remission lies around 15% per year, 1-2% of the affected persons are still bedwetters at the age of 20 (Forsythe & Redmond 1974).

Hirasing et al (1997) examined more than 13000 adults (18-64 years of age) and found a prevalence of 0.5% regarding nocturnal enuresis.

To date it is not clear whether an active treatment of PNE in childhood can reduce the number of adults suffering from nocturnal enuresis.

1.3. Degree of severity

No uniform definition of the severity of PNE is available. In every country there are different definitions as to when a PNE is present. In Germany the ICD-10 diagnosis-code defines that a PNE is present, if the child wets the bed at least twice per month from the chronological age of five onwards and at least once per month from the chronological age of seven onwards. (German Society for Child and Adolescent Psychiatry)

According to the American Psychiatric Association the child has to have reached the chronological age five or developmental status of a child aged five to diagnose a PNE. Involuntary bedwetting has to occur at least twice per week over a period of at least three months. Or the frequency must represent a significant disturbance which affects the child in his/her social and/or school life. (DSM-IV criteria)

The frequency of bedwetting varies among the children. Only about 15% of the children wet their bed every night, while almost all other children wet their bed more often than once a week. (Verhulst 1985, Foxman 1986)

Nijman et al (2002) propose to classify the clinical frequency as infrequent (1-2 times per week), intermediate (3-4 times per week) and frequent (5-7 times per week).

In the clinical practice the parents are mainly worried about the bedwetting as such, not so much about the frequency. Some children and their parents are freaked out about an occasional wet bed others can accept regular bedwetting better.

1.4. Historical overview

The first recordings regarding nocturnal enuresis (in the following abbreviated with NE) in the literature can be found in the papyrus of Ebers, dated 1550 BC. In this writing a juniper berry, a cypress leaf and a beer were recommended as remedy. NE is also mentioned in the first printed book on childhood diseases, which was published by Paul Bagellardus in 1472. He wrote that first the body needs to be

purged so that the muscles of the bladder can relax. The belief was that besides all the magic causes NE is also the consequence of a weakness of the neck of the bladder (Glicklich, 1951).

In the Middle Ages the treatment methods for NE were in part very cruel and brutal, e.g. it was recommended to give the child the crown of a hen in lukewarm water or the testicles of a rabbit in a glass of wine. Others dried the crown of a rooster and dispersed it as ground powder over the bed of the child. In the middle of the 18th century the recommendation was to provoke blisters in the region of the child's sacrum.

Due to the progress of anatomical studies, in particular regarding the nervous system, anatomically-oriented treatment methods came to the fore, while the magic treatments gradually disappeared. In Europe, in particular in England, the scientific examination of the problem started in the 19th century, when upper-class students of boarding schools wet their beds. Social pressure forced the scientific community to deal with the topic. Almost at the same time similar studies started in the United States. Traditionally, most of the studies on the problem of NE come from the aforementioned two countries (Järvelin, 2000).

New therapeutic approaches were developed, e.g. reduction of liquids, special plans of diet and exercise, application of cold wraps in the region of the perineum and lower spine, electrical stimulation of the genital and perineal regions and burning of the urethra with silver nitrate. Also various penis bandages were used until a patient developed gangrene (Glicklich, 1951).

The biggest change in the view of NE, which also produced a change in the recommended therapies, took place at the end of the 19th century: The etiological emphasis shifted from the organic to the psychic. Sigmund Freud's studies led to the development of the theory that NE is a neurosis or personality disorder. Over the next 30 to 40 years this concept was widely accepted, until research regarding the genetic predisposition and other organic causes became possible.

The influence of psychic factors and the use of psychotherapy in the case of NE has been intensively discussed; psychotherapy always with the worries to simply coverlay symptoms.

Psychotherapy and other forms of therapy have been systematically evaluated since the 1960s (Mellon & McGrath, 2000).

2. ANATOMICAL AND PHYSIOLOGICAL FOUNDATIONS

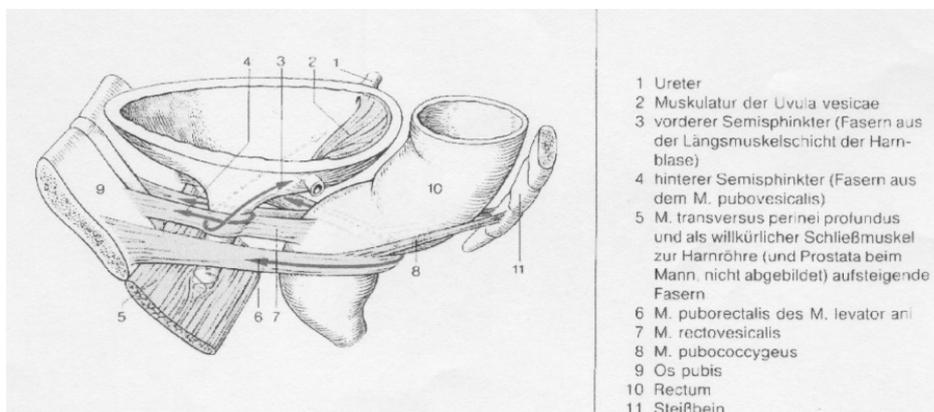
2.1. Anatomy of the urogenital tract

2.1.1. Urinary bladder-Vesica urinaria

In the adult body the urinary bladder is a subperitoneal structure located behind the symphysis in the small pelvis resting on the pelvic floor. In the case of infants and children the urinary bladder is located in the abdomen also when it is empty. At about the age of six years it starts to move into the small pelvis and reaches its final position only after puberty.

The urinary bladder comprises one major muscle (**M. detrusor vesicae**) and is made up of three of network-like layers of smooth muscle. Like in the cases of all other pelvic organs muscles fibres of the wall of the bladder fuse with the suspensory ligaments of the organs and thus provide stability.

The **Trigonum vesicae** is situated at the base of the bladder (fundus vesicae) and consist of smooth muscles. The mucus membrane of the Trigonum vesicae always remains smooth and without folds; it is confined by the ureteral orifices and the internal urethral orifice. In the region of the Trigonum vesicae the muscle layers are arranged in a way that they can operate as opener and closer of the ureteral orifices and the internal urethral orifice. The emptying of the bladder cannot function exclusively via the M. detrusor vesicae; if the detrusor muscle contracts the internal sphincter is opened. The urinary tract is closed by the M. sphincter urethrae externus, which is composed of diagonally striated muscles, supported by bands of fibres of the M. transversus perinei profundus of the pelvic floor.



Involuntary and voluntary opening and closing loops of the urinary bladder and the urethra. Rauber/Kopsch: Anatomie des Menschen, 1987

2.2. Anatomy of the pelvic floor

2.2.1. Pelvic cavity

The pelvic cavity, Cavum pelvis, is the part of the abdominal space that is situated in the small pelvis and is bounded by bony structures. It primarily contains the urinary bladder, the reproductive organs and the rectum.

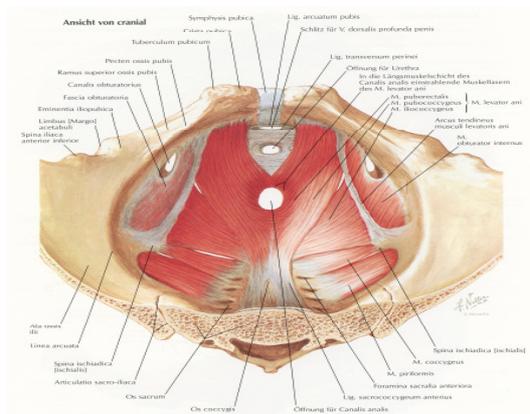
2.2.2. The pelvic floor

The pelvic floor forms the most inferior boundary of the trunc. It has a double function: It stabilizes the position of the pelvic and abdominal organs and controls the opening of the lower urinary tract, the reproductive tract and the anus with its sphincter muscles. It also forms an important part of the birth canal in the birth process.

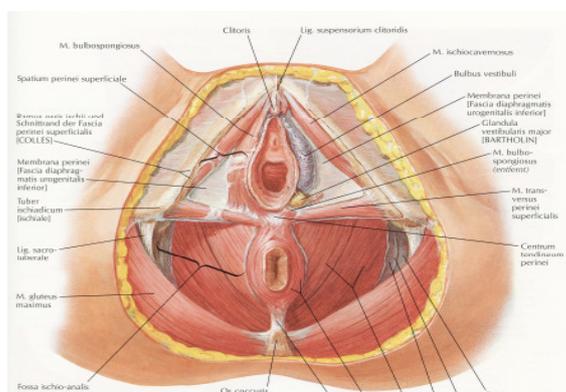
The pelvic floor consists mainly of striated muscles and connective tissue sheets:

- Diaphragma pelvis (pelvic diaphragm)
- Diaphragma urogenitale (urogenital diaphragm)
- Sphincters, which surround the urogenital orifices and the anus

Each diaphragm consists of a muscle layer supported by fascias. In addition, they are interspersed with many smooth muscle cells.



II. Diaphragma pelvis from cranial. Netter: Anatomie des Menschen, 1997



III. Perineum and Diaphragma Urogenitale. Netter: Anatomie des Menschen, 1997

2.2.3. The perineum

The soft tissue bridge between the anal orifice and genitals is called perineum. At the centre of the perineum is a sheet of tissue, which is rich in smooth muscles. This is the Centrum tendineum perinei, an important point from a mechanical perspective, where fascias and tendons of the diaphragms of the pelvic floor are connected with the smooth muscles of the pelvic organs. Due to the traction of muscles which is transmitted by the fascias the Centrum tendineum perinei is subject to a stretching force from almost all sides so that it becomes a tight elastic sheet, which is an important centre for the mechanics of the muscles of the pelvic floor.

2.2.4. Anatomical connections of the urinary bladder with its surrounding

The Lamina sacro-recto-genito-pubicale stabilizes the urinary bladder laterally. In the female body it consist of three parts (Ligamenti pubovesicale, vesicouterina and sacrouterina), in the male body it consists of two parts (Ligamenti pubovesicale and sacrogenitale). It ensures the central position of the organs that it envelops. This produces a direct ligamentous connection between the Os pubis (pubic bone) and the Os sacrum (sacrum), as well as an indirect connection with the lumbar vertebrae, the iliosacral joints, the Os coccygeus (coccyx) and the hip joints. There is a close relationship between the muscles of the pelvic floor, the M. piriformis (piriform muscle) as well as the M. obturator internus (internal obturator muscle) and the urinary bladder. This means that it is imaginable that the function of the urinary bladder could be influenced via its relationship with the hip joints, the sacrum, the iliosacral joints, the lumbar spine and the coccyx.

The Ligamentum umbilicale medianum (median umbilical ligament, urachus) links the apex of the bladder with the umbilicus and from there continues to the liver as Ligamentum falciforme (falsiform ligament). The Ligamentum umbilicale mediale (medial umbilical ligament) is located on both sides of the urachus and supports it.

2.3. Neurophysiology of micturition

2.3.1. Neurological foundations

The parasympathetic nervous system supplies the muscles of the bladder and transmits the contraction of the bladder via the pelvic nerves originating from S2 and S4 of the Conus medullaris (medullary cone), where the detrusor nucleus is located. The sympathetic nerve fibres originate from the levels of D11-L2 and run along the large blood vessels all the way down to the Plexus mesentericus inferior (inferior mesenteric plexus) and Plexus hypogastricus (hypogastric plexus). The postganglionic hypogastric nerve supplies the neck of the bladder and the proximal urethra and transmits mainly sensory information about the state of replenishment of the bladder. In addition, it passes on information about mucus membrane pain and temperature.

The somatic N.pudendus (pudendus nerve) emanates at the levels of S2-S4 and runs along the autonomous nerves. It innervates the external striated muscles and perceives information about the degree of replenishment of the bladder through the increasing pressure of the urethra. (Schmid, Lang, Thews, 2005; Boemers, 1997)

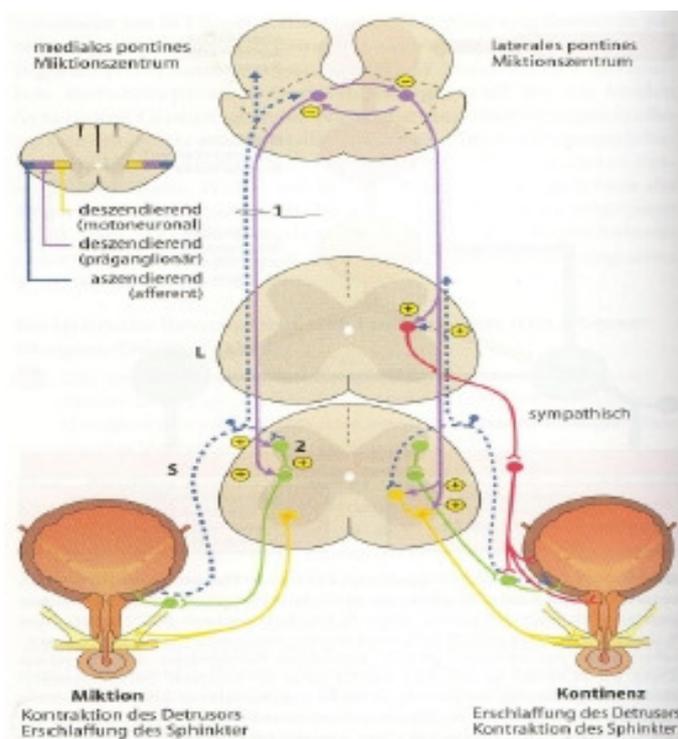
2.3.2. Physiology of micturition

Once bladder control is established during childhood, the central nervous system (CNS) controls and coordinates micturition (Benninghoff, 1994; de Groat et al, 1990). During **phase I of micturition (filling phase)** the bladder volume increases, while the bladder pressure does not increase. Due to spinal multineuronal reflexes (spinal urine storage reflex) micturition is inhibited: activation of the striated sphincter (N. pudendus) and activation of the N. sympathicus (detrusor inhibition, contraction of the smooth-muscle sphincter and inhibition of the parasympathetic ganglia). The contraction of the closing muscles increases with the increasing filling of the bladder. Afferences from the pelvic floor muscles (stretching of the pelvic floor) produce a contraction of the striated sphincter and an inhibition of the M. detrusor (Olbing, 1993).

With the increase in the filling of the bladder the afferent neuronal activity of the urinary bladder increases which activates the rostral micturition centre of the pons in the brain stem (pontine micturition reflex). The pontine micturition centre inhibits the spinal urine storage reflex, which activates the M. detrusor and causes an inhibition of the closing apparatus (Olbing, 1993).

In **phase II** the feeling of replenishment of the urinary bladder is transmitted to the frontal cortex of the cerebral cortex. Certain fibres run through the pons into the reticulospinal tract of the spinal cord to the detrusor nucleus. The start of the micturition can be controlled voluntarily, the cortical micturition centre can inhibit the pontine micturition centre during a certain range of the bladder replenishment. Like every striated muscle also the striated sphincter of the urinary bladder is subject to voluntary control via the pyramidal tract and the extra-pyramidal system. Micturition is initiated when the micturition centre of the pons relaxes the sphincter of the urethra just before the M. Detrusor contracts (Olbing, 1993).

The flow of urine or the mechanical stretching of the urethra produce a stimulation of the urinary bladder contractions. This reflex has an important function in the context of a complete emptying of the urinary bladder (urethra to bladder micturition reflex) (Benninghoff, 1994; Lin, Wernon, 2003).



2.3.3. Development of bladder control

The development of bladder control is a normal maturation process of the nervous system. It is very complex and is not yet fully understood. Different phases of development can be observed (Müllner, 1960; Hjälmås, 1976; Klimberg, 1988).

During the infantile period micturition is a spinal reflex involving the coordination of the sphincters (Klimberg, 1988). The bladder fills with little pressure and not necessarily up to its maximum volume; it is emptied through a coordinated action of a simultaneous relaxation of the pelvic floor and the contraction of the M. Detrusor (Hjälmås, 1976). This contraction is maintained until the bladder is empty. The infant seems to have no perception of the full bladder because he/she does not show any sign that he/she is going to urinate. In this phase the emptying of the bladder can neither be initiated nor interrupted voluntarily. During the first days directly after the delivery micturition occurs rather infrequently. After the first week the frequency increases rapidly and reaches its peak during weeks 2-4 (once every hour on average). Afterwards the frequency decreases again. From the 6th month onwards it remains stable with a frequency of 10-15 times per day. After the first year of life the frequency decreases again (8-10 times per day) while the volume triples or quadruplicates (Göllner et al., 1981)

The next phase in the physiological development of voluntary bladder control is the development of the child's ability to signal that the bladder is full and that he/she is going to urinate soon. This happens at the age of about one to two. During this time the child gradually gains control over the bladder function during the day. At the age of two important development steps are completed: the awareness of a full bladder and the possibility to hold back the urine for a short time. However, the child cannot yet initiate the micturition voluntarily and is not able to pass water if the bladder is not completely filled (Hjälmås, 1976; Göllner et al., 1981).

At the age of three the child is able to hold back the urine for a longer and longer time, which means that the capacity of the urinary bladder gradually increases. In addition, the bladder control during the day is stabilized (Holmdahl et al, 1996; Göllner et al, 1981 ; Yeats, 1973).

The “potty training” also takes place in this phase, i.e. the development of a social awareness for the right time and place for the emptying of the bladder (Berk 1990). However, the voluntary bladder control is still deficient since spontaneous and uninhibited bladder contractions still happen and cases of incomplete emptying of the bladder occur at socially inappropriate places. In this phase of development the child delays the emptying by contracting the pelvic floor muscles until the urge to urinate is gone (Göllner et al, 1981; Kaplan, Brock 1980).

Most children are able to voluntarily stop the flow of urine at the age of four. However, they still have problems to initiate micturition in every state of filling of the bladder. The exact age at which this control is completely established varies considerably, but in general it is achieved at some moment between the ages of four and six (Müllner, 1960; Nijman, 2002).

By then the following significant changes have taken place: the emptying of the bladder does no longer take place automatically and the emptying is well coordinated with the simultaneous relaxation of the pelvic floor muscles and the contraction of the M. detrusor. The storage capacity of the bladder has doubled since the second year of life and the child now has a voluntary control over starting and stopping the flow of urine at any moment. Thus the child has achieved the voluntary bladder control of an adult (Yeates, 1973, Hjalmas 1988).

3. PATHOGENESIS OF MONOSYMPTOMATIC PRIMARY NOCTURNAL ENURESIS

The common characteristics of the affected children are that they do not notice that their bladder is full during the night and that they do not wake up to go to the toilet. An etiologic precondition is that the bladder reaches its filling capacity during the night (Nijman et al, 2002; Järvelin et al., 1988; Norgaard, Rittig, Djurhuus, 1998).

3.1. Diagnosis

Monosymptomatic primary nocturnal enuresis (in the following abbreviated with PNE) represents an exclusion diagnosis. All other possible organic causes for bedwetting have to be excluded (Gontard, 2001; Cayan et al, 2001; Nijman 2002). Regarding the definition, the spontaneous development and the neurobiological foundations of enuresis the diagnosis of a purely nocturnal bedwetting makes sense only from the age of five onwards (Forsythe, Redmond, 1974; Rubenwolf et al, 2007). The basic diagnosis (Schulz-Lampel, 1998) serves to distinguish between enuresis and incontinence of the child, i.e. to exclude an organic-morphological correlate and/or a psychiatric origin.

Basic diagnosis (Schulz-Lampel, 1998; von Gontard, 2001):

- Detailed case history; in particular with regard to micturition, drinking habits and bowel movements
- Social and family case history
- Recording of a micturition and drinking protocol over a period of at least three days: documentation of the number of visits to the toilet within 24 hours, the volume of micturition, the amount of fluid intake and the times of fluid intake as well as the frequency and severity of bedwetting
- Physical examination including the evaluation of the neurological status
- urinalysis
- sonographic examination (kidney, bladder, residual urine)

In their study on 163 children aged between 5 and 19 with and without PNE Cayan et al. (2001) could not detect any differences in the results of the sonographic examinations and uroflow values. They also think that routine urinalyses do not make much sense because no statistically significant difference could be detected in the two groups.

3.2. Pathophysiology

Despite intensive research work the understanding of the pathophysiology of PNE still has some gaps and it is the subject of controversial discussions.

Butler and Holland (2000) propose a conceptual model where the main focus lies on the problem of delayed maturation of one or several of the following systems: inability to wake up when the bladder is full, deficient bladder stability, change in the circadian rhythm of the antidiuretic hormone (ADH).

3.2.1. Urodynamics

Von Gontard (2001) explains that the problem is not a disturbance of the bladder. The bladder function of bedwetting children is examined during the day and night with regard to the obvious question whether the bedwetting is a bladder disorder. Methodically comparable research methods provided the following urodynamic characteristics of PNE (Norgaard, 1991):

- A normal structural and functional bladder capacity, which during the day and during the night remains within the normal range for the age. The bedwetting is caused by the full bladder (Watanabe et al, 1996). Older studies that advanced the opinion that the bladder capacity of the children is too small for their age (Müllner, 1960) are obsolete.
- The emptying of the bladder during the day and during the night is coordinated and complete. During the day no increased signs of bladder instability, i.e. of uncontrolled, spontaneous contractions of the detrusor muscle, can be observed.
- In certain subgroups of enuretics detrusor contractions can be observed during the night as signs of instability. According to the research work of Watanabe this affects 30% of the enuretics. The remaining 70% do not show bladder contractions (Watanabe und Azuma, 1987; Watanabe, 1995)

3.2.2. Development and fine neurology

On the basis of the available literature at the time Bakwin (1961) came to the conclusion that PNE “can appropriately be counted to the development disorders – like problems of language and speech.” Due to the known correlations between development disorders and delays the hypothesis that PNE is not a disorder of the bladder but of the central nervous system is confirmed. For instance, correlations between PNE and delayed development of language and motor skills could be observed empirically (Essen, Peckham, 1976).

Järveling et al. (1988) were able to prove in their study on 3206 Finnish children that the incidence of PNE among children who started to go to school later is 24.8%, while it is 26.6% among physically and mentally challenged children and 9.5% among children who started to go to school at the normal age. Children with a low birth weight suffer more often from nocturnal enuresis than children with a normal birth weight.

The bone age (Mimouni et al., 1985, Dündaröz et al., 2001) and the longitudinal growth (Power, Manor, 1995) can be reduced, which might be due to a delayed maturation of certain regulating functions of the central nervous system.

A study of a birth cohort in Holland showed that 10% of the 12-year-old, who also display minimal neurological peculiarities (so-called “soft signs”), also suffer from PNE, while this is the case in only 1% of the 6- and 9-year-old without neurological symptoms (Lunsing et al., 1991). Neurological "soft signs" are changes or peculiarities that can be observed in the neurological examination of the children and do not correspond to the traditional neurological symptoms. This includes among other things:

- Abnormal difference in the reflexes of the left and right side
- Left-right difference of sensitivity
- Abnormally flaccid muscle tone
- Clumsiness in tests etc.

Clinical studies involving children with PNE and other forms of enuresis showed that those children display a great number of neurological “soft signs“ in non-standardized neurological examinations (Shaffer et al., 1984; von Gontard et al., 1999). In a case-control study comprising 156 children with enuresis and 170 comparable children

without enuresis the children who also have day-time symptoms display the greatest motoric impairment; the children with PNE have an intermediate motoric impairment (Järveling, 1998). Largo et al. (2001a, b; 2002) developed the Zürcher Neuromotorik Assessment (ZNA) a standardized test instrument to evaluate the neuromotoric abilities. It comprises tasks of different complexity involving fine and gross motor skills. Two dimensions are assessed: speed (time) and quality of movement.

In his study Gontard et al. (2006) used the ZNA method to evaluate children aged between 8 and 14 suffering from PNE and a control group without PNE. Since NE is regarded to be a disturbance of the maturity of the brain, the hypothesis was put forward that children with NE would need more time to complete the motoric tasks and that the quality of their movements would be worse. In addition, the assumption was that no difference regarding the time that was necessary to complete adaptive tasks would be observed since adaptive motoric movements have more to do with a habituation/training effect than with the maturity of the motoric functions.

In fact, the children with NE fulfilled the purely motoric tasks (e.g. repeated hand or finger movements) more slowly, but no difference could be observed between the groups in all adaptive tasks. Children with secondary NE were even slower in their movements than the group of children with PNE.

Several functional studies localize the control of repeated finger and hand movements in the region of the contralateral cortex (Kawashima et al., 1995; Catalan et al., 1998).

Thus the results of Gontard et al. (2006) indicate that besides the delay of maturation in the brainstem (centre responsible for bladder control) the affected children also display a deficit of maturation of the motor cortex and the associated cortical regions.

3.2.3. Sleep patterns

Since NE occurs exclusively during sleep, a direct examination of the sleep behaviour is very important (Gontard, 2001). 30 years ago it was assumed that bedwetting happened during the phases of deep sleep, that it would be linked to dreams or that it would happen in the transition from one phase of sleep in the other (Kales et al., 1977; Mikkelsen, Rapoport, 1980).

Sleep studies evaluate neurophysiological parameters like EEG (electroencephalogram), EOG (electrooculogram), EMG (electromyogram) and

respiration (Mikkelsen et al., 1980, Neveus et al. 1999) or carry out examinations in combination with measurements of the pressure of the bladder (cystomanometry) (Norgraad et al., 1985a und 1989; Watanabe, Azuma, 1989; Watanabe, 1995; Robert et al., 1989). Through this electrical brain currents and other physiological parameters of the brain as well as the simultaneous bladder activity can be recorded. It could be proven repeatedly that:

- the EN does not correspond to a dream equivalent,
- bedwetting during a dream phase is the exception
- it does not correspond to an epileptogenic activity
- the sleep architecture is inconspicuous, i.e. that the sleep phases are not altered
- episodes of bedwetting occur in all phases of sleep
- bedwetting occurs most frequently in the first hours of sleep

Despite an inconspicuous EEG activity there is evidence that children with NE actually sleep very deeply and that it is very difficult to wake them up. Wolfish et al. (1997) assessed standardized attempts to wake up test persons via headphones with a volume of up to 120 dB. They found out that enuretics could actually be woken up in only 9.3% of the attempts – significantly more rarely than the test persons in the control group, who could be woken up in 39.7% of the attempts.

Non-enuretics wake up at night when their bladder is full and they need to go to the toilet. (Butler, Holland, 2000) Watanabe et al. (1994) analyzed 2033 questionnaires of non-enuretic children: 1818 indicated that they would regularly wake up during the night to go to the toilet.

In the sleep laboratory an EEG measurement was used to assess the brain currents and thus the sleep phases of 1033 children with NE, while at the same time the pressure within the bladder was measured by means of cystomanometry (CMG) (Watanabe, Azuma, 1989; Watanabe, 1995). In the case of non-enuretics the CMG during sleep showed a line, which means that the intravesical pressure is stable like in the waking state. When the bladder begins to fill up, the CMG records an increase in pressure. At this moment also the EEG starts to change, the person enters into a less deep phase of sleep. About 10-20 minutes after entering the different sleep

phase the test persons woke up, felt the full bladder and went to the toilet. Without exception the researchers found three different patterns among the enuretic patients:

Type I: when the CMG signals a filling of the bladder, the persons also enter into a less deep phase of sleep. However, the bedwetting happens 5-10 minutes after the change and the children do not wake up. 60% of the patients fall into this category.

Type IIa: when the CMG indicates a filling of the bladder, no change of the sleep phase can be observed in the EEG. 7 – 15 minutes afterwards the bladder is emptied. 10% of the patients fall into this category.

Type IIb: when the deep sleep phase has started the CMG shows a constant, unimpeded contraction of the bladder, which cannot be observed during the waking state. If the bladder is full it is emptied spontaneously without a reaction of the central nervous system in the EEG and without the waking up of the patient. This is the case in 32% of the patients.

As serious waking up disorder Type IIa corresponds to the physiological waking up reaction of children under the age of two years. Type I is a minor waking up disorder, which is typical for children older than two years. Thus Type I and IIa are central disorders of the regulation between the sleep-wake centres with patterns that correspond to more premature states of development (von Gontard, 2000). The centres which are responsible for the regulation of the sleep-wake cycles and also for the bladder control are located in the brainstem.

On the basis of the available results Koff (1996) writes that nocturnal enuresis is a “functional immaturity of the CNS” with the following two components:

- **an afferent maturation disorder:** afferent stimuli of the full and contracting bladder are not perceived by the CNS and thus do not lead to the waking up of the person
- **an efferent component:** during sleep the micturition reflex is not suppressed by the CNS

3.2.4. Endocrinology

The first physiological explanation of PNE was presented in 1985 by Norgaard et al. and later on by Rittig et al (1989a). Enuretics are characterized by nocturnal polyuria with low urine molality, i.e. the urine is diluted. They were also able to show that in contrast to non-enuretics who had a circadian rhythm of the anti-diuretic hormone (ADH), no difference in the ADH secretion of day and night could be observed in the case of enuretics. ADH is responsible for the regulation of the water balance in the body and leads to a reduction of the amount of urine. Based on the research results the “polyuria and ADH deficiency hypothesis” was postulated as cause of NE and thus a substitution therapy with Desmopressin is justified (Rittig et al. 1989b).

More recent studies could not reproduce all of these research results. Eggert and Kühn (1995) did not find a difference in the ADH level of day and night. Enuretics even need higher levels to regulate the urine concentration. In addition, enuretic children have a higher intra- and interindividual variability. It also seems that ADH is secreted in phases so that changes can only be recorded in ADH measurements that are carried out in short 15-minute intervals (Rittig et al., 1995).

The substitution therapy with Desmopressin requires considerably high doses which even exceed those that are necessary in the treatment of Diabetes insipidus with a total lack of ADH (von Gontard, Lehmkuhl 1996). In addition, only 70% of the patients respond to the treatment with Desmopressin. Therefore, it was postulated that in some of the affected persons there must be a peripheral lack of ADH and Desmopressin receptors (Norgaard et al. 1997). Koff (1996) proposes to consider the variations in the ADH secretion not as cause of the bedwetting but as another symptom of a general maturation disorder of the CNS.

3.2.5. Genetics

Empirical evaluations of families showed that in 60-80% of the bedwetting children also other relatives are affected (Bakwin, 1973; Järvelin et al., 1988; von Gontard, 1997c).

In cases where both parents were affected the incidence is 77%, if only one parent was affected it is 43%. Järvelin et al.(1988) documented that the risk of a 7-year-old child to still wet his/her bed is increased 11-fold if both parents were enuretics. The

risk is increased 7-fold if only the father was affected and 5-fold if only the mother was affected.

Fergusson et al. (1986) carried out a longitudinal cohort study in New Zealand and showed that if two first-degree relatives have a history of NE the children display a mean delay of obtaining nocturnal bladder control of 1.5 years. They also found out that boys take longer than girls. This also corresponds with the results of a study by Bakwin (1973).

Studies involving monozygotic and dizygotic twins provided evidence that the genetic influence acts stronger on boys than on girls, with concordance rates of 70% and 30% among boys and 65% and 44% among boys in the case of monozygotic and dizygotic twins respectively (Bakwin, 1973; Butler et al. 2001). In 2001 Butler et al. analyzed the concordance data of 2900 twins with regard to NE, including dizygotic twins of mixed gender. They could confirm the hitherto existing results: boys are more often affected and on average have a delayed maturation of the bladder control in comparison with girls of the same age. The risk of NE increases if first-degree relatives were also affected, in particular the father.

Moleculargenetic examinations discovered gene sites on four chromosomes which are related to the occurrence of NE (Eiberg et al. 1995; Eiberg et al. 1996 ; Eiberg 1998).

3.2.6. Psychiatric symptoms

Primary psychogenic disorders play rarely a role in the case of PNE in comparison with other forms of enuresis. (Feeham et al., 1990 ; Rubenwolf et al., 2007).

Behavioural disorders that can be observed are usually a consequence of the problem.

Von Gontard (2003) refers to a large number of empirical studies which facilitate a differentiated view of the problem:

Psychic disorders or symptoms can occur as consequence of the bedwetting and then persist.

Many children suffer from subclinical symptoms. In many cases these are understandable and adequate reactions to the bedwetting which disappear after a successful treatment (Muffed et al., 1987, Haggie et al. 1996). Morrison et al. (2000) examined children and adolescents with PNE by means of a structured interview.

72% see disadvantages in the bedwetting, only 4.6% of the enuretic children consider it to be of advantage. Mainly boys think that the wet bed and the subsequent attention of the mother is something positive for them. Several studies evaluate the self-esteem of the affected persons. Resell and Collier (2000) carried out a literature review and documented that nocturnal bedwetting does not necessarily entail a low self-esteem. In contrast Collier et al., (2002) and Theunis et al. (2002) observed that the self-esteem is clearly lowered, while in another study the overall value did even exceed the normal range (Moffat et al., 1987).

Enuresis and psychic factors can both be dependent on common neurobiological factors:

Like in the case of the association of enuresis with ADHD (attention deficit-/hyperactivity disorder). Studies showed a highly specific comorbidity of nocturnal enuresis and ADHD. Von Gontard et al. (2003) described a rate of 13.5% in comparison with 2.5% in the control group. A retrospective study among 153 children with ADHD showed that 25% suffered from NE. Among the 120 children in the control group this was the case in only 10.8% (Biederman et al., 1995). Baeyens et al. (2006a) even indicate a prevalence of 30%. It is postulated that a central frontostriatal localized dysfunction, like ADHD, can have a negative impact on the function of the nuclei in the brainstem which have to do with enuresis (Baeyens et al. 2006b). Possible neurobiological connections are not clarified yet, however, both disorders are not genetically inherited together according to a formal-genetic examination (Bailey et al., 1999).

Tietjen and Husmann (1996) formulated the theory that it is difficult to impossible to establish whether the disturbed behaviour of the children with ADHD can be attributed to the embarrassment of the bedwetting or whether the enuresis is a possible "soft sign" of an underlying neurological disorder.

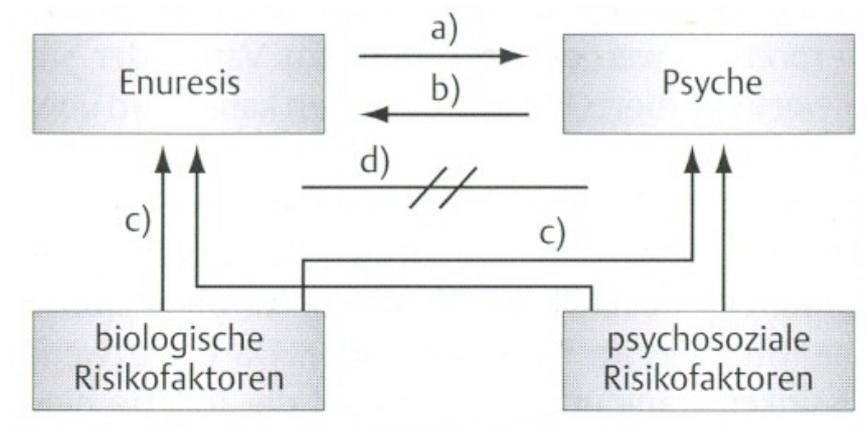
Enuresis and psychic disorders can accidentally occur together, without a causal connection.

According to transcultural studies the general incidence of psychiatric disturbances in children ranges between 12% according to the ICD-10 and 14.3% according to the DSM-IV (Bird, 1996). Epidemiologic studies (Feehan et al., 1990; Hirasings et al. 1997; Liu et al., 2000; Berg et al., 1981) showed clearly that 20-30% of all children

with nocturnal enuresis display relevant disorders two- to four-times more often than non-enuretic children. This comorbidity rate is comparable with that of children with serious chronic paediatric disorders, who also display psychic disturbances two- to three-times more often (Cadman, 1988; Eiser, 1990). In contrast, children with a monosymptomatic PNE only carry a slightly increased risk of developing a psychic disorder (Feehan et al., 1990) Von Gontard (1999) described that children with a monosymptomatic PNE are not more conspicuous than their colleagues.

Psychic factors can precede the bedwetting and e.g. can have the etiologic effect of provoking a relapse.

It is confirmed that a number of risk factors can favour the occurrence of enuresis. Particularly serious are events, which involve feelings of separation and loss, whether through divorce, death, moving houses or birth of a sibling (Butler, 1987; Järvelin et al. 1990). Also children who react with a secondary enuresis are psychically more conspicuous than control persons already before they start to wet their bed (Feehan et al., 1990)



V. Correlations between enuresis and psychic factors (Shaffer 1994). a) Reactive, as consequence of enuresis, b) psychogenic cause of bedwetting, c) common biological and psychosocial risk factors, d) coincidence, no causal relationship

3.2.7. Dietetic and allergic factors

In the literature only few indications can be found regarding a correlation between PNE and dietary aspects. A study by Egger et al. (1992) describes a positive effect of food abstention on PNE, migraine and ADHD. During the abstention phase 12 out of

21 children became dry and in four cases the number of wet nights was reduced. When provocative foods were gradually reintroduced, eight of the dry children and the four, where the wet nights were reduced, suffered a relapse. In the placebo group no relapse could be observed. The following substances are regarded as provocative: caffeine, chocolate, sugar, citrus fruit and red food colouring. In order to understand the correlation between PNE and allergies better, the blood of 37 enuretic children and 18 children without enuresis was analyzed for IgE as allergy marker. No statistically significant difference in the total IgE value of both groups could be detected; however, in the case of two food-related IgEs, soy bean and hazelnut, a statistically significant difference between the PNE-group and the control group could be observed (Mungan et al., 2005). Further studies in this direction will definitely be necessary to verify a possible causal relationship. Epidemiologic studies showed a highly significant correlation between enuresis, constipation and encopresis (Hersov, 1994). In 32% of the children with constipation with or without encopresis Löning-Bauke (1997) found also a nocturnal enuresis. Working groups around Yazbeck et al. (1987) and O'Regan et al. (1985,1986) demonstrated that until puberty every major rectum expansion entails a compression of the neck of the bladder and expansion of the urethra due to the anatomical vicinity of rectum and back wall of the bladder, with secondary consequences for the urinary tract.

3.2.8. Sleep apnoea

Children whose PNE is associated with obstructive sleep apnoea, snore very loud because the adenoids and tonsils are enlarged. Follinus et al. (1991) proved that these children have an increased production of urine during the night (polyuria) with an increased excretion of sodium. Baruzzi et al. (1991) showed that sleep apnoea can cause NE though polyuria and changes in the hormonal secretion. Case studies demonstrated that the PNE disappears once the obstructive polyps are removed (Brown et al., 1995; Everaert et al., 1995; Wengraf, 1997).

4. THERAPY

4.1. Treatment objective

According to the DGU (German Society for Urology, Deutsche Gesellschaft für Urologie) the objective of the treatment of enuresis is less than two wet nights of the child per month. However, already a general reduction of the bedwetting frequency can achieve a great relief for the family.

Internationally, the following definitions are used to measure the treatment success: (ICCS, International Children's Continence Society; Terminology paper of the Enuresis Academy Frankfurt)

4.1.1. Initial success

Description of the reduction of wet night per week in percent

- non-response (0-49% reduction)
- partial response (50-89% reduction)
- response (90% or more)
- full response (100% reduction or the occurrence of one symptom per month)

4.1.2. Long-term success

- Relapse: if more than one wet night occurs per month
- Sustained success: no relapse within six month after the end of the therapy
- Complete success: if no relapse could be observed within a period of two years after the end of the therapy.

4.2. Ineffective measures

based on meta-analyses and empirical studies (Butler, 1987, 1994; Houts et al, 1994; Lister-Sharp et al., 1997)

4.2.1. Punishment

To date up to 30% of the children are still punished and put down because of their bedwetting. (Butler, 1987; Ng et al. 2004). The parents get angry, stressed out and intolerant in particular when the child is already older and the family is already subject to certain tensions. They blame the wet bed on their children and think that punishment can contribute to overcome the problem (Butler et al., 1986; Haque et al., 1981; Chao et el., 1997)

4.2.2. Waking up

Many parents are convinced that they help their children by waking them up at night and leading them to the toilet. Sometimes they follow this procedure for years. However, empirical studies have demonstrated repeatedly that this ritual can reduce the frequency of bedwetting (i.e. the night is dry) but that the problem cannot be solved for good (Butler, 1987; Lister-Sharp et al., 1997).

4.2.3. Lifting

In this case the child is carried to the toilet without waking him/her up, "lifting over the toilet" and empties his/her bladder passively while still asleep. Also this method, which is quite popular among parents, does not have a therapeutic effect (Lister-Sharp et al., 1997).

4.2.4. Bladder training

According to Butler (1987) this method is not indicated in the case of children with monosymptomatic PNE because it is not an organic disorder of the bladder. A non-physiological training, e.g. retention through the activation of the pelvic floor muscles, even involves the risk that a dyscoordinated behaviour is learned (von Gontard, 2001).

4.2.5. Limitation of fluid intake

A limitation of fluid intake does not have an effect (Butler, 1987). From a pathophysiological perspective the polyuria of enuretics is not provoked through exogenic fluids but through endogenic fluctuations of the antidiuretic hormone (Rittig et al, 1989b). In addition, the bedwetting does not happen because of the exceeding volume of urine but because of the fact that the children have difficulties to wake up (Wolfish et al., 1997).

4.2.6. Psychodynamic psychotherapy

Verbal and play therapies are not effective in the case of enuresis. In only 21% of the cases they produce dryness at the end of the therapy and in only 11% in the catamnesis (Houts et al., 1994; Listrer-Sharp et al. 1997). These kinds of therapy are only indicated and make sense in cases of psychiatric comorbidity, e.g. emotional disorders (von Gontard, 2001).

4.3. Baseline

In its guidelines on Nocturnal Enuresis (2007) the German Society for Child and Adolescent Psychiatry and Psychology recommends that before the start of a specific therapy a baseline is established and that this procedure involves advice, positive reinforcement, relief, motivation and the keeping of a log (e.g. sun-cloud calendar). This way of procedure proved to be quite successful in empirical studies, where

significantly more dry cases could be observed (Lister-Sharp, 1997; Läckgren et al., 1999).

4.4. Instrument-based behavioural therapy

The instrument-based behavioural therapy was initially introduced as standardized treatment method by Mowrer and Mowrer (1938). There are two different alarm devices. Either a humidity sensor has to be worn in the vicinity of the genital region or a so-called alarm mat is placed underneath the bed sheet. If the child wets his/her bed the device initiates an alarm sound, which keeps to ring until the child wakes up, switches off the device and possibly goes to the toilet or changes the sheets of the bed. The behaviour-therapeutic effect can even be exaggerated (if necessary). The device has to be used every night and the therapy needs to continue until 14 consecutive dry nights are reached, or for a maximum of 16 weeks. If the parents are very intolerant regarding the bedwetting this kind of behavioural therapy is not a good choice, because the whole family has to live with the nocturnal alarm (Butler et al., 1993; Haque et al, 1981).

The basic principle is that the afferent stimulus of the filled bladder does not lead to micturition but to an inhibition of micturition and/or waking up (Mowrer, 1980). How this exactly works is still not clear. What seems to be important is the coupling of the alarm signal with the subsequent behaviour, so that to date this form of behavioural therapy is considered to be a complex learning program with different active components. The alarm signal acts as negative stimulus producing a conditioned behaviour of avoidance by the children. Possibly the retention of urine and an expansion of the functional bladder capacity are trained. Social and motivational factors are coupled with each other. The alarm device has an effect on the general expectations and produces a motivation increase of children and parents (Butler, 1994).

Dryness can be achieved with the instrument-based behavioural therapy through two therapeutic effects: Part of the children sleep through without wetting their bed, i.e. the filled bladder is not emptied during the night. It seems that the contractions of the

bladder muscles are “calmed down” until the next morning. Another part of the children wake up due to the pressure of the filled bladder, the children get up and go to the toilet to empty their bladder. It is neither understood why these therapeutic effects can be achieved nor what physiological changes regarding sleep and polyuria occur after such a behavioural therapy (von Gontard, 2001).

The effectiveness of the method was documented by Houts et al. (1994) in a meta-analysis: Dry at the end of the course of treatment (maximum duration 16 weeks): 62%, catamnesis: 47% dry. The probability of 14 consecutive dry nights is 13.3-times higher than without treatment (Mellon, McGrath 2000). In combination with exaggeration the rate of dryness at the end of the course of treatment was 72-79.2%, while it was 56% in the catamnesis (Houts et al. 1994; Mellon & McGrath, 2000).

4.5. Pharmacotherapy

Only in the case of two groups of medication an anti-enuretic effect can be proven: Desmopressin (DDAVP) as synthetic correspondent of the antidiuretic hormone (ADH) and anti-depressants, in particular Imipramin (Houts et al., 1994; von Gontard, Lehmkuhl, 1996).

Indications for a pharmacotherapy comprise: therapy resistance with regard to other methods, combination with other methods, family and other problems, which do not allow the treatment with an instrument-based behavioural therapy, to achieve short-term dryness e.g. for school trips.

4.5.1. Desmopressin

Desmopressin has a rapidly onsetting anti-enuretic effect but entails a high rate of relapses. In a large-scale meta-analysis the following results could be observed: 10-91% of the patients displayed a reduction of wet nights, 24.5% of the patients displayed a complete dryness for 14 consecutive nights and 5.7% of the patients displayed a sustained dryness 6 months after the therapy (Moffat et al., 1993).

In a more recent study Limbach et al. (2007) examined the effect of Desmopressin on the ability of enuretics to wake up. They described that in EEG measurements the

waking up reaction and movements during sleep were characterized by a significant increase of activity.

4.5.2. Imipramin

Also Imipramin has a definitive anti-enuretic effect with a high rate of relapse after the patients stop to take the medication: 40% dry at the end of treatment, 17% in the catamnesis (Houts et al., 1994). Due to cardinal side-effects involving cases of death the indication is seen more and more hesitantly, possibly in cases of a comorbidity with ADHD (Dt. Gesellschaft f. Kinder u. Jugendpsychiatrie, 2007).

4.6. Alternative methods and other forms of therapy

There are slight indications that hypnosis, acupuncture and chiropractice could have a positive influence on PNE. However, this is only corroborated by a few, small studies, where some were carried out with a questionable methodological accuracy (Glazener et al., 2005).

After the evaluation of all available studies no evidence for the success of osteopathic manual treatment could be found. Kargl (2008), however, indicates a higher sustainability of the result if the children are also treated osteopathically. At the moment another study on osteopathy in the context of NE is being carried out (Stadler, 2008).

5. OSTEOPATHIC CONSIDERATIONS AND TREATMENT METHOD

An osteopathic treatment of nocturnal enuresis presupposes the knowledge of the specific anatomical and physiological dynamics of the bladder function. The diagnostic competency is closely linked with the understanding of pathophysiological processes. However, a specific osteopathic evaluation and diagnosis does not only mean the understanding of the pathophysiological processes. It is also based on other approaches and examination methods. The osteopathic treatment also considers the specific innervation, supply and drainage of the structures. The treatment consists of manipulations on a structural, visceral and cranial level. In every case the objective is to support the normal mobility and elasticity of the tissues in order to improve their normal function.

5.1. Parietal osteopathic lesions

According to the osteopathic perspective it is assumed that osteopathic lesions of the lumbar spine, the sacrum, the coccyx, the pubic bone or the ilia can have a direct influence on the urinary bladder due to the close anatomical (ligamentous and neurovegetative) connections (Barral, 2002; Puylaert 2000; DiGiovanna, 1991). Another assumption is that parietal osteopathic lesions in the region of the pelvis can influence the tension in the pelvic floor. A bad position of the sacro-coccygeal joint can, for instance, reduce the distance between the coccyx bone and the pubic symphysis, which means that the origin and insertion of the muscles of the pelvic floor are approximated and thus in part lose their contractility. The consequence is a change in the tone of the pelvic floor muscles which influences its ability to support the function of the urethral sphincter.

Barral (2002) describes that osteopathic lesions in the lower extremities could also have an influence on the function of the urinary bladder through changes in the muscle chains and tension (via the M. obturator internus).

5.2. Visceral dysfunctions

Liem (2008) points out that all organs in the vicinity of the bladder can restrict its mobility due to alterations of the gliding surfaces or ligamentous and fascial connections. A trauma, scar tissue formation or a persisting functional disturbance of haemodynamics can affect the gliding ability (Priest, 1945). In the case of chronic constipation also the bladder might be affected (O'Reagan et al., 1985 u.1986). The connections that play a role in the case of boys are the relations with the peritoneum, os pubis, prostate, the orifice of the spermatic duct and the seminal vesicles as well as the indirect gliding surfaces with the small intestine, rectum and pelvic floor. The connections that play a role in the case of girls are those with the peritoneum, cervix uteri, vagina, pelvic floor and the indirect gliding surfaces with the small intestine, rectum, corpus uteri and pelvic floor (Liem, 2008).

5.3. Restrictions due to ligamentous structures

According to the concept of osteopathy restrictions of mobility can also be caused by ligamentous structures themselves or by dysfunctions in the environment which are transmitted via the suspension/support system (Liem 2008; Puylaert, 2005).

A shortening of the Ligg. pubovesicale and puboprostaticum can, for instance, prevent that the bladder is able to expand superiorly when it is filling up. Instead, it is pulled down by those ligaments (Kuchera, Kuchera, 1994). Via the septum between rectum and pubic bone rectal dysfunctions can also affect the bladder. The Ligg. umbilicale medianum and umbilicalia medialis link the urinary bladder with the liver and it is possible that tensions are transmitted via these ligaments to the bladder (Puylaert, 2005)

5.4. Neuro-vegetative relations

The sympathetic fibres of the Nn. splanchnici lumbales have their nuclei in the region of D11-L2 and influence the closure of the bladder. The opening of the bladder is

controlled by the parasympathetic fibres of the Nn. splanchnici pelvici, which have their nuclei at the levels of S2-4.

The assumption is that via the central nervous system the spine has an influence on the innervation of the organs and that thus segmental restrictions can affect the continence of the bladder. If the nervous system receives an increased input, the bladder is stimulated too much and the M. detrusor contracts too much; consequently the pressure on the bladder increases, which influences the function of the sphincter muscles (Patterson & Wurster, 2003).

According to Fossum (2005) it seems to be possible that blockages of the vertebrae in the region of the origins of the sympathetic or parasympathetic innervation (lower thoracic spine, upper lumbar spine, sacrum) can cause a dysfunction of the M. detrusors, the bladder itself or the surrounding organs. The neurological supply of the pelvic floor should also be considered, which means the region of the Os coccygis.

5.5. Disturbed haemodynamics

The veno-lymphatic system depends on the tone of the skeletal muscles. From an osteopathic point of view every kind of congestion in the small pelvis can influence the function of the bladder. The aim is to establish a good local drainage via the lymphatic system, the Vv. vesicales and V. iliaca interna as well as a good function of the structures around the Cysterna chyli (diaphragm, L3, thoraco-lumbar junction) (Liem, 2008).

5.6. Endocrinal disturbances

Disturbances in the balance of the antidiuretic hormone, which are due to organic disorders, can probably not be influenced with osteopathic means.

6. STUDY DESIGN

6.1. Range of problem

Various studies on the problem of bedwetting identified a whole range of complex problems of the children which involve a lack of understanding, the feeling of humiliation, guilt and embarrassment, the avoidance of social activities, the feeling of being different, bullying and the loss of their self-esteem (Anon 1987; Butler 1994, 1998, 2007). Some of these experiences are empirically confirmed, e.g. the avoidance of social activities and the increased vulnerability regarding bullying, which are described as frequent among bedwetting children (Joinson et al. 2007).

Tijen and colleagues (1998) developed an alternative strategy to understand what influence the bedwetting has on the children. They interviewed children with NE between the ages of eight and twelve and asked them to rate the strain of the bedwetting in comparison with 10 other situations of life. The result of their study showed that the bedwetting was considered as the third most horrible thing after the divorce of the parents and arguments between the parents. In contrast, children who do not wet their beds rate this situation less horrible than wearing glasses (Tijen et al, 1998).

Even though the rate of spontaneous healing is about 15% per year, about 1-3% of the affected persons are still bedwetters at the age of 20 (Forsythe, Redmond 1974).

6.2. Study question

The aim of this study is to evaluate the effectiveness of osteopathic treatment in the case of children with primary monosymptomatic nocturnal enuresis.

The research question is, whether the symptoms of a primary monosymptomatic nocturnal enuresis improve or disappear completely after four osteopathic treatments within a period of six weeks.

The study evaluates whether four osteopathic treatments can reduce the frequency of nocturnal bedwetting of the children and how sustainable the result is six weeks after the end of the course of treatments.

6.3. Methodology

The study was carried out at the practice for osteopathy in Burgberg/Germany. After a thorough medical examination the paediatricians in the vicinity referred the children to the osteopath.

Period A (without treatment) is compared with period B (treatment interval); catamnesis after six weeks to find out about the sustainability.

6.4. Selection of the test persons

6.4.1. Inclusion criteria

Children older than five years who wet their bed at least two times per month and children older than seven years who wet their bed at least once per month (ICD-10 criterion)

The children must not have been dry already for a period of six months or longer.

6.4.2. Exclusion criteria

Excluded were children with anatomical anomalies of the urogenital tract, acute inflammation in the urogenital tract, children with congenital or acquired disorders of the central or peripheral nervous systems, as well as urge symptoms, urine retention or dyscoordination of the bladder emptying.

Children who were at the same time treated with other therapeutic measures (e.g. alarm signal device, hormone medication etc.) were not included in the study in order to not distort the results. Due to the same reason also other accompanying measures of complementary medicine like kinesiology, acupuncture or traditional Chinese medicine are also excluded.

6.5. Osteopathic examination and treatment

At the occasion of the first contact the case history was taken and the parents were asked to record the wet nights until the start of the treatment interval. At this first meeting no treatment took place. After a period of six weeks the treatment interval started. The children received four treatments. Every treatment comprised 45 minutes. The treatment sessions were spaced at intervals of two weeks. The treatment involved osteopathic techniques according to the black-box principle. Six weeks after the end of the treatment interval the bedwetting frequency in the period without treatment was again recorded.

6.5.1. First contact

All children and parents received the necessary information about the study and all their questions were answered and discussed. If the parents agreed to the participation in the study, they signed a written declaration of consent. The participants were also informed that the data would be treated absolutely confidential and anonymous.

In the subsequent case history the family situation, pre- and post-natal complications, particularities of development, diseases, accidents, operations, previous treatments and the frequency of bedwetting were documented (cf. annex).

The first appointment did not involve a treatment. The parents were asked to record the wet nights until the start of the treatment interval.

6.5.2. Treatment interval

The first treatment took place six weeks after the first contact. The bedwetting frequency since the first contact has been documented.

The treatments followed the principles of the osteopathic concept. Detailed information regarding the examination and the findings can be found in the annex.

No specific technique was used for all treatments. Instead, the treatment involved the whole range of osteopathic techniques at the disposal of the therapist.

Overall four treatments were carried out within a period of six weeks. On the occasion of the fourth treatment session, the bedwetting frequency during the treatment interval was documented. The parents were also asked to record the wet nights in the following six weeks.

6.5.3. Interview by phone six weeks after the treatment interval

Six weeks after the end of the treatment interval the parents of the test persons were contacted by phone to find out about the bedwetting frequency in the treatment-free period. The sustainability of the treatment success was evaluated on the basis of a comparison with the documented frequency immediately after the fourth treatment. If the bedwetting frequency had not increased again, the treatment success was considered sustainable.

7. RESULTS

7.1. Evaluation of the study participants

26 children participated in the study. 20 boys (77%) and 6 girls (23%).

The average age at the moment of first contact was eight years and five months. The youngest child was five years and two months old and the oldest child was 13 years and nine months old.

13 children were aged 5 to 7, which corresponds to a share of 50%, 9 children were aged 8 to 10 (34.6%) and four children (15.4%) were older than 11 years at the moment of the first case history.

In the case of 18 children (69%) a bedwetting frequency of five to seven nights per week could be observed before the course of the treatments. Six children (23%) wet their beds three to four times per week. In the case of two children (8 %) the bedwetting frequency was one to two times per week. The average bedwetting frequency of the overall group was 4.9 nights per week.

Five children (19.2%) also suffered from encopresis with or without constipation. In the case of 13 children (50%) a predisposition in the family could be detected: five fathers and six mothers and in two families both parents were bedwetters. Brothers or sisters who also wet their beds were mentioned in two cases.

In four (16%) families the parents are separated and the children live with the mother. Seven children (27 %) were diagnosed with an attention deficit problem (ADHD).

22 of the children (84.5%) were described as difficult to wake up.

17 children (65.3%) had positive findings in the case history regarding birth difficulties, low birth weight, delayed motoric development and perceptual disturbances.

Four boys were operated by a urologist because of a wandering testicle, ureter shortening or lengthening. According to the attending physicians there was no connection with the nocturnal enuresis. Seven (27%) children had polyps removed – without an influence on the bedwetting.

Eight had not undergone any attempt of conventional treatment so far. In 16 cases the method of waking the child up and leading him/her to the toilet was tried. In six cases the alarm-signal-method was used. In 12 cases the therapeutic effort involved medication – in four cases with tricyclic antidepressants (Imipramin) and in eight

cases with an ADH-correlate (Desmopressin). In all cases no sustained reduction of the bedwetting frequency could be achieved after the therapeutic efforts were discontinued. The parents regarded the administration of medication as a considerable strain.

In 17 cases a complementary treatment approach was attempted – homeopathy in seven cases, osteopathy in two cases, kinesiology in two cases and foot reflex zone therapy, Dorn, Bach Flower Essences, respiration therapy and TCM in one case each. In all cases no persisting reduction of the bedwetting frequency could be achieved.

Age of the participants		
	N	in %
5-7 years	13	50%
8-10 years	9	34.60%
11-14 years	4	15.40%
	26	100%

Degree of severity at first contact		
	N	in %
1-2 times/week	2	8%
3-4 times/week	6	23%
5-7 times/week	18	69%
	26	100%
Average bedwetting frequency		
/week: 4.9		

7.2. Bedwetting frequency at the first osteopathic treatment

Two children became dry within the six weeks between the first contact and the first treatment session. Thus they dropped out of the study. The average bedwetting frequency of the remaining 24 children was 4.9 nights per week.

Degree of severity at first treatment		
	N	in %
1-2 times/week	2	8%
3-4 times/week	6	21%
5-7 times/week	16	71%
	24	100%
Average bedwetting frequency		
/week: 4.9		
2 children dry		

7.3. Bedwetting frequency at the fourth osteopathic treatment

Five children became dry in the period between the first and the fourth osteopathic treatment (responder). 12 children were non-responders (cf. definition 4.1.1.), while seven children were partial-responders. The average bedwetting frequency of the remaining 19 children was 3.0 nights per week.

Degree of severity at fourth treatment		
	N	in %
1-2 times/week	6	32%
3-4 times/week	6	26%
5-7 times/week	7	42%
	19	100%
Average bedwetting frequency		
/week: 3.0		
5 children dry		

7.4. Bedwetting frequency six weeks after the last treatment

Among the children who became dry during period B (treatment interval) no relapse could be observed. Two other children became dry in the period after the last treatment. The frequency of 3.0 wet nights per week remained stable.

Six weeks after last treatment		
	N	in %
1-2 times/week	5	29%
3-4 times/week	5	29%
5-7 times/week	7	42%
	17	100%
Average bedwetting frequency/week:		
2,8		
7 children dry		

7.5. Statistical Methodology

Data on nocturnal enuresis were classified in a categorical scale at each time point:

0 = No nocturnal enuresis per week

1.5 = 1 to 2 times nocturnal enuresis per week

3.5 = 3 to 4 times nocturnal enuresis per week

6 = 5 to 7 times nocturnal enuresis per week,

to test following hypothesis using a Fisher's exact test:

H_0 : there is no difference between the baseline (time of first treatment) frequency of nocturnal enuresis compared to the frequency of nocturnal enuresis after four treatments.

$$P_{\text{base}} = P_{\text{6weeks}}$$

H_A : there is a difference between the baseline (time of first treatment) frequency of nocturnal enuresis compared to the frequency of nocturnal enuresis after four treatments.

$$P_{\text{base}} \neq P_{\text{6weeks}}$$

7.6. Statistical Analysis

For the statistical analysis in Table 1 the distribution of the children within the categories is described.

Table 1: Frequency / mean of nocturnal enuresis at each time point				
(Total Number of Children = 24)				
	Clinical Diagnosis N (%)	Prior to 1st treatment N (%)	After 4th treatment N (%)	six weeks after last treatment N (%)
0 times	0	0	5 (20.8%)	7 (29.2%)
1 – 2 times	2 (8,3%)	2 (8,3%)	6 (25.0%)	5 (20.8%)
3 – 4 times	6 (25%)	6 (25%)	6 (25.0%)	5 (20.8%)
5 – 7 times	16 (66.7%)	16 (66.7%)	7 (29.2%)	7 (29.2%)
Mean (SD)				
	4.9 (1.67)	4.9 (1.67)	3.0 (2.31)	2.8 (2.44)
N: Number of children in respective category				
% = N / 24				
SD: Standard deviation				

At the time of the clinical diagnosis as well as prior to the first treatment 16 children (66.7%) had a frequency of nighttime enuresis of five to seven nights per week, for six (25%) children a frequency of three to four nights per week and for two (8,3%) children a frequency of one to two nights per week was reported. The mean nocturnal enuresis was 4.9 nights (SD = 1.67) per week at the time of clinical diagnosis (see Table 1).

After four treatments seven children (29.2%) had a frequency of nocturnal enuresis of five to seven nights per week, for six (25.10%) children a frequency of three to four nights per week and a frequency of one to two nights per week, respectively was reported. For five (20.8%) children no nocturnal enuresis was reported. The mean nighttime enuresis was 3.0 nights (SD = 2.31) per week after four therapies (see Table 1).

Six weeks after the last treatment seven children (29.2%) had a frequency of nocturnal enuresis of five to seven nights per week, for five (25.10%) children a frequency of three to four nights per week and a frequency of one to two nights per week, respectively was reported. For seven (29.2%) children no nocturnal enuresis was reported. The mean nighttime enuresis was 2.8 nights (SD = 2.44) per week after six weeks after the last treatment (see Table 1).

There is a statistical significant difference in the frequency of nocturnal enuresis at the time before the first treatment compared to the frequency of nocturnal enuresis after four treatments by using the Fisher`s exact test ($p < 0.001$). Meaning the osteopathic treatment has a statistically significant influence on lowering the frequency of nocturnal enuresis.

As the mean wet nights six weeks after the last therapy is about the same than at the time of the fourth therapy and no relapse occurred, the osteopathic treatment of primary nocturnal enuresis can be described as sustainable.

8. DISCUSSION

The objective of this study is to evaluate the effectiveness of osteopathic treatment in the case of children with monosymptomatic primary nocturnal enuresis.

Five children became dry within the treatment period, while two children became dry in the observation period. The bedwetting frequency could be reduced from an average of 4.9 wet nights per week to 3.0 wet nights per week. None of the children relapsed after the end of the course of treatments and also the reduced bedwetting frequency remained stable.

The results correspond to those obtained by Kargl (2008), who also describes a reduction of the number of wet nights with a low incidence of relapses.

Since the number of treated children was only small and since it cannot simply be assumed that the results would be the same among a larger group of participants, further studies are necessary to confirm or deny this positive tendency. Nevertheless, the present study illustrates how important and necessary a holistic treatment approach is. In the Cochrane Database of Systematic Reviews further studies regarding alternative treatment approaches can be found. Their common conclusion is that alternative treatment approaches like acupuncture, chiropractic, homeopathy, hypnosis and traditional Chinese medicine can possibly have a positive influence on the problem but that the evidence for that is too small.

It has to be pointed out that in all the cases only a few, small studies are available and some of them were implemented with a questionable methodology.

To make the study more objective it would have been of advantage if a colleague had carried out the case history, examination and treatment. Since I have extensively studied the related anatomy and physiology before the beginning of the study, it cannot be excluded that I have attributed more importance to the findings which could be directly related with the bladder function.

Since psychic disorders are not very frequently mentioned as possible causes in the literature (cf. 3.2.6), this aspect was not considered in the case history. Only the cases of a comorbidity with ADHD was documented. In practice, however, again and again my suspicion was raised in the communication with the parents and the children and in the observation of the interaction with between the children and their

that they were suffering quite some psycho-emotional strain. In one case, for instance, I learned that the child regularly wets the bed when staying overnight at the place of the not so much liked grandmother. One child started to wet the bed again every night after the parents announced that they are going to separate. Maybe it would have made sense in these cases to integrate more psychological dynamics in the treatment to support the parent-child relationship.

Since nocturnal enuresis often occurs in combination with ADHD, it would surely be interesting to compare frequent osteopathic findings in the cases of these two diagnoses.

In the study group 65,3% showed a history of premature birth, birth trauma, low birth weight and/or delayed development of motor skills which could be in alliance with the known delayed maturation of the central nervous system concerning to obtain full bladder control.

50% of the children in the study had a family history of nocturnal enuresis which fits to the numbers in the literature.

What was particularly interesting was that during the treatment interval six children started to sometimes wake up during the night when their bladder was full. It seems thus that the treatment also had an influence on the structures which so far have impaired the transition into a phase of lighter sleep until the waking up. It would be worthwhile to follow-up this observation in further studies. However, the children who became dry within the framework of this study slept through the night without waking up.

Considering the facts that only eight children had not undergone any attempt of treatment before the study, that 18 children wet their bed five to seven times per week and that 50% of the participating children were eight years or older, it seems likely that the degree of severity of the problem influences the success of the treatment.

Since causes of monosymptomatic primary nocturnal enuresis are multi-faceted and despite a large number of scientific studies they are not completely understood to date, makes it hard to find successful treatment options with high sustainability and less undesirable side effects.

9. SUMMARY

Various studies on the problem of bedwetting identified a whole range of complex problems of the children which involve a lack of understanding, the feeling of humiliation, guilt and embarrassment, the avoidance of social activities, the feeling of being different, bullying and the loss of their self-esteem (Anon 1987; Butler 1994, 1998, 2007).

The objective of this study is to evaluate the effectiveness of osteopathic treatment in the case of children with monosymptomatic primary nocturnal enuresis.

The causes of monosymptomatic primary nocturnal enuresis are multi-faceted and despite a large number of scientific studies they are not completely understood to date. A common trait of the affected children is that they do not feel the full bladder during the night and thus do not wake up to go to the toilet. Another etiological precondition is that the bladder reaches its filling capacity during the night (Nijman et al, 2002; Järvelin et al., 1988; Norgaard, Rittig, Djurhuus, 1998).

Even though the rate of spontaneous healing is about 15% per year, about 1-3 % of the affected persons are still bedwetters at the age of 20 (Forsythe & Redmond 1974).

There are different treatment approaches for the problem. The instrument-based behavioural therapy (alarm trousers or -mat) and the administration of Desmopressin are the most successful among them, with the first being the most effective but requiring a lot of motivation of the children and their parents (Glazener et al., 2005). All the treatment methods have in common that the relapse rate is quite high (Glazener et al., 2005).

Methodology

26 children received four osteopathic treatments spaced at two-week intervals after a waiting period of six weeks. The bedwetting frequency was recorded by the parents. Six weeks after the end of the course of treatments the bedwetting frequency was documented again.

The statistical analysis shows that the bedwetting frequency could significantly be reduced and that among the children who became dry no relapse could be observed. The reduction of the frequency of wet nights among the remaining children remained stable.

Conclusion

The bedwetting frequency of children with monosymptomatic primary nocturnal enuresis could be significantly reduced and no relapses observed.

Outlook

Further studies on other forms of enuresis should be implemented.

In how far the bedwetting frequency continued to change could not be observed in this study. Therefore, the long-term success after the last treatment should be further observed.

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11. APPENDIX

A. Figures

I. Involuntary and voluntary opening and closing loops of the urinary bladder and the urethra. Rauber/Kopsch (1987): Anatomie des Menschen, Lehrbuch und Atlas Band II: Innere Organe. Georg Thieme Verlag: 422

II. Diaphragma pelvis from cranial. Netter (1997): Anatomie des Menschen, Novartis-Verlag: Tafel 339

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B. Questionnaire

Medical History Enuresis nocturna

Date:

CHILD NR.:

Date of birth:

Boy:

Girl:

1. How many nights is the bed wet?

Every two weeks 1x: 1-2x per week: 3-4x per week: 5-7x week:

2. Are there any problems with soiling/obstipation?

Yes:

No:

3. Is there a history of bladder infections?

Yes:

No:

If yes, how often?

4. How many siblings, how old, have they been enuretics?

5. Are there enuretics among close relatives, e.g. father, mother, uncle..?

6. Interventions until now?

awakening: electronic waking system: ADH: Imipramin:

results?

Alternative therapies, which results?

7. Is the child a deep sleeper?

Yes: No:

7. Is the child snoring ? Polypenop?:

8. Is the child living together with both parents?

Yes: No:

9. Is there a positive diagnostic of ADAD (ADHS)?

Yes: No:

10. Has there been an exception during pregnancy, delivery, premature delivery?

11. Has there been bigger accidents, injuries, operations ?

C. Osteopathic examination

Visual examination of the statics of the children in **standing**. Every asymetrie of the body, blockings in the vertebrae, the pelvis, findings in the areas of the hips, knees and the position of the feet had been documented.

In sitting on the treatment table the findings from the examination in standing were checked again, in addition the diaphragm, the liver and its structural connections via the urachus to the bladder had been tested for tension. **In supine** there was a mobility test for the hip-, knee- and feetjoints. The muscles of the pelvic floor and the membrana obturatoria were tested on tension. Also the segmental mobility of the lumbar and thoracic spine, the ilia, ossa pubis, the symphysis, the os sacrum and the os coccygis were examined. The urinary bladder was tested in position and mobility in relation to its surrounding organs and structures.

Finally the cranium was examined concerning distinct osteopathic lesions.

D. Osteopathic conclusions concerning the treatment of children with monosymptomatic primary nocturnal enuresis

Even if the osteopathic findings and treatment techniques are not analysed statistically I would like to show some interesting results and links. In the study group of 26 there were 10 children which had either a prolonged delivery or a mechanical intervention, i.e. forceps or sectio during birth. From the osteopathic point of view it is important in the treatment of these children to address the remaining pattern of tension. (Frymann, 2007; Liem, 2001). Of these 10 children, seven showed a lesion in the cranial base which was treated.

A common finding was an anterior torsion of one pelvisbone. This would be found in 15 children. The os pubis had been blocked in 13 cases. Osteopathic dysfunctions or reduced mobility in the spine was diagnosed 22 times, most common in the area L2/3 and D5-8. The iliosacral joints were limited in movement in five children and the hip mobility was restricted at the end in six children. An osteopathic dysfunction in a foot was found four times.

The pubovesical ligament was on tension in 16 cases and the membrana obturatoria was positive regarding tension in eight children. Six had a visceral finding.

The examination findings indicated a treatment of the spine, the pelvic area and lower extremities, visceral and ligamental surrounding of the urinary bladder and a treatment of the cranium.

A detailed description of each treatment would go beyond the scope of this thesis, but like reviewed in chapter 5 was the main approach on balancing the tension in the structures surrounding and affecting the urinary bladder and linked to that getting also better mobility. Through improving hemodynamic and the neuro-somatic regulation it should get supported in gaining regular function.

Einnässhäufigkeit bei:

Bettnässer unter Verwandten:

Kind Nr	Alter bei	M	W	Befund	vor 1. Be-	vor 3. Be-	4 Wochen		Enkopresis		Mutter	Vater	beide	Geschwister
	Befund				handlung	handlung	nach 4. Beh.							
1	12	1	0	5 bis 7	5 bis 7	1 bis 2	Trocken		0		1	0	0	0
2	10,75	1	0	3 bis 4	3 bis 4	3 bis 4	3 bis 4		0		0	0	0	1
3	8,5	1	0	3 bis 4	3 bis 4	Trocken	Trocken		1		0	0	0	0
4	5,25	1	0	5 bis 7	5 bis 7	Trocken	Trocken		0		0	1	0	0
5	11,25	0	1	5 bis 7	5 bis 7	5 bis 7	1 bis 2		0		0	1	0	0
6	7	1	0	5 bis 7	5 bis 7	1 bis 2	1 bis 2		0		0	1	0	0
7	12,75	1	0	3 bis 4	3 bis 4	3 bis 4	3 bis 4		0		1	0	0	0
8	9	0	1	5 bis 7	5 bis 7	Trocken	Trocken		0		0	0	0	1
9	6,5	0	1	5 bis 7	5 bis 7	5 bis 7	5 bis 7		0		0	1	0	0
10	9	0	1	1 bis 2	1 bis 2	1 bis 2	1 bis 2		0		1	0	0	0
11	10	0	1	5 bis 7	5 bis 7	1 bis 2	1 bis 2		1		1	0	0	0
12	5	1	0	5 bis 7	5 bis 7	5 bis 7	5 bis 7		0		1	0	0	0
13	6,75	1	0	3 bis 4	3 bis 4	Trocken	Trocken		0		0	0	0	0
14	6	0	1	5 bis 7	5 bis 7	3 bis 4	3 bis 4		0		0	0	0	0
15	9	1	0	3 bis 4	3 bis 4	3 bis 4	3 bis 4		0		0	0	1	0
16	7,75	1	0	5 bis 7	5 bis 7	5 bis 7	5 bis 7		0		0	0	0	0
17	7,5	1	0	3 bis 4	Trocken	Trocken	Trocken		0		1	0	0	0
18	5,5	1	0	5 bis 7	5 bis 7	5 bis 7	5 bis 7		0		0	0	0	0
19	5,5	1	0	5 bis 7	5 bis 7	Trocken	Trocken		0		0	0	0	0
20	13,75	1	0	1 bis 2	1 bis 2	1 bis 2	Trocken		1		0	0	0	0
21	9,5	1	0	5 bis 7	5 bis 7	5 bis 7	5 bis 7		1		0	0	1	0
22	9	1	0	5 bis 7	5 bis 7	5 bis 7	5 bis 7		1		0	0	0	0
23	8	1	0	5 bis 7	5 bis 7	5 bis 7	5 bis 7		0		0	0	0	0
24	7	1	0	5 bis 7	Trocken	Trocken	Trocken		0		0	1	0	0
25	5,5	1	0	1 bis 2	1 bis 2	1 bis 2	1 bis 2		0		0	0	0	0
26	6	1	0	5 bis 7	5 bis 7	3 bis 4	3 bis 4		0		0	0	0	0
	213,75	20	6						5		6	5	2	2

bisherige Interventionen:

Kind Nr	Wecken	Klingel	Imipramin	ADH	Sonstige	schwer Erweckbar	Eltern getrennt	ADHS	Operationen
1	1	1	0	1	Homöopa./Frz	1	1	0	
2	0	0	0	0	Bachblt./Autog.tr	1	0	0	
3	0	1	0	0	Tcm	1	1	0	Op Blasenklappe
4	0	0	0	0		1	0	0	
5	0	0	1	1	Kinesiologie	1	0	1	
6	0	0	0	0		1	0	0	
7	0	0	0	0	Osteo	1	0	0	Harnröhrenschlitzung, Phimose
8	1	1	0	1		1	0	1	Polypenop
9	0	0	0	0	Homöopa./Kines	0	0	0	
10	1	0	0	1		1	0	0	
11	1	1	0	1		1	0	0	
12	0	0	0	0		1	0	0	Polypenop
13	1	0	0	0		1	0	1	
14	1	0	0	0	Homöop.	1	0	0	Polypenop
15	1	0	0	0	Homöop./Dorn	0	1	1	Polypenop
16	1	0	1	1		1	0	0	Polypenop, Pendelhoden, Harnleiterkürzung
17	1	0	0	0	Homöop.	0	0	0	
18	0	0	0	0		1	0	1	
19	1	0	0	0		1	0	0	
20	1	1	1	1	Homöop.	1	0	0	Polypenop
21	1	0	0	0	Homöop.	0	1	0	Op Harnröhrenverlängerung 2 x
22	1	0	0	0		1	0	1	
23	1	1	1	1	Osteo/ Atemth.	1	0	0	
24	1	0	0	0		1	0	0	
25	1	0	0	0		1	0	1	
26	0	0	0	0		1	0	0	Polypenop
	16	6	4	8		22	4	7	

Kind Nr	Sonstiges
1	
2	
3	Frühchen
4	
5	Saugglocke
6	Zwilling, Sektio
7	Zangengeburt
8	
9	Entwicklungsverz.
10	Saugglocke
11	Lese-Schreib-Schwäche
12	Frühchen, hypoton
13	
14	Entwicklungsv.
15	Entwicklungsv.
16	
17	Frühchen
18	Sprache spät, auditive Wahrnehmung schlecht
19	Entwicklungsverz.
20	Frühchen
21	
22	Entwicklungsverz.
23	Frühchen/Saugglocke
24	
25	
26	Beckenendlage, Sectio