Osteopathy with Enuresis

Doris Kargl

Abstract

Background

Enuresis is a socially disruptive and stressful condition which affects around 15 to 20% of five year olds, and up to 1 - 2% of young adults. Bed-wetting is associated with a lot of pressure for both parents and, especially, for children.

Objectives

The study investigates whether osteopathic treatments have a positive influence on the recovery of children with enuresis, and then compares this to children who only receive medical treatment for the condition.

Selection criteria

All children between the ages of five to thirteen were included in the study, apart from those who suffered from underlying organic diseases, like epilepsy, diabetes, neurological incontinence, psychological disabilities and enuresia with a large psychological component (e.g. with sexual abuse).

Method

Ten children, roughly divided into those who were incontinent during the day, and those who were incontinent during the night received osteopathic treatment, and were then compared to a control group of children of a similar age.

Main results

Medical treatment turned out to be less sustainable than osteopathic treatment of incontinence during the night.

Medical therapy failed both in patients from the control group, and in the study group, but osteopathic treatment did not fail in any of the three patients with incontinence during the day.

Conclusion

Osteopathic treatment results in similar improvements of enuresis compared to medical therapy. The main advantage of osteopathic therapy is its higher sustainability.

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Hintergrund

Enuresis ist ein stressvoller und von der Gesellschaft verpönter Zustand, der rund 15 – 20% der Fünfjährigen und 1 - 2% der Jugendlichen betrifft. Beim Bettnässen lastet sehr viel Druck auf den Kindern und den Eltern.

Ziele

Es wurde beurteilt, ob osteopathische Behandlungen einen positiven Einfluss auf die Genesung bei Kindern mit Enuresis haben und dann verglichen mit Kindern, die nur medikamentös versorgt wurden.

Auswahlkriterien

Grundsätzlich waren alle Kinder von 5-13 Jahren in der Studie inkludiert, außer die, die unter einer organischen Grunderkrankung litten, wie Epilepsie. Diabetis, neurologische Inkontinenz, geistige Behinderung und Enuresia mit einer großen psychischen Komponente (z.B. bei sexuellem Missbrauch).

Methode

10 Kinder, grob eingeteilt in Tages und Nachteinässer wurden osteopathisch behandelt und verglichen mit einer altersgleichen Kontrollgruppe.

Ergebnis

Bei den Nachteinnässern stellte sich heraus, dass medizinische Behandlungen weniger nachhaltig sind als osteopathischen Behandlungen.

Bei den Tageseinnässern konnte nur die Osteopathie Erfolge aufweisen.

Conclusio

Verglichen mit der medizinischen Behandlung erzielte die Osteopathie eine ähnliche Verbesserung der Enuresis. Der Hauptvorteil der osteopathischen Therapie liegt an der höheren Nachhaltigkeit

Contents

1 Introduction

1.1 Relevance

„*Enuresis is one of the most common disorders affecting children and young people, and is linked to a high level of subjective suffering for those affected by it*." [1] Although the WHO (World Health Organisation) officially recognises enuresis as an illness, the children affected by it are often still stigmatised, with the condition seen as abnormal. In our society, the topic of bed-wetting remains a taboo.

For parents too, the pressure on them increases from the time the children have to go to nursery school and to school. In some nursery schools, incontinent children are not accepted, and in schools, teachers are needed who understand and empathise with the situation, and the fact that the child constantly has to urinate.

The long-held opinion that a child is deliberately incontinent to provoke or annoy, or that the problem could be the cause of a family issue is already very firmly rooted. As evidence that bed-wetting is not necessarily linked to intelligence, there are two very famous authors who suffered from enuresis and expressed their feelings and experiences in autobiographical books, namely the English writer George Orwell and the Austrian author Thomas Bernhard.

1.2 Central Question

This study is dedicated to the question: ‚Can osteopathy help with enuresis?'

Although many paediatricians, child psychologists and child urologists have engaged themselves with this topic, and their work has succeeded in giving a greater and greater understanding into the problem, the estimated number of unknown cases of incontinent children is still high. A universal cure for bed-wetting has still not been found, despite many medical studies and research.

Many parents do not conform to the classical medical treatment methods, as in giving medicine over a long period of time and using incontinence trousers which require a great deal of motivation from the children. This means that they are therefore not very successful. As a result of all these points, there comes the

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[1] Gontard/ Lehmkuhl, 2002: Introduction.

question: „Can osteopathy offer an alternative to existing treatments?“ The goal of this study is to show that using osteopathy can significantly improve the clinical picture.

1.3 Facts

It is necessary to divide enuresis into different forms, to get a better overview of the complexity of bed-wetting. Unfortunately, this study cannot go into every different form, because there are no trials available for all of them.
Ten participants aged between six and thirteen years old were studied and treated with osteopathy. The control group was only treated medically. In a time frame of twelve weeks, the children were treated five times. The frequency of incontinence was measured as a way of testing the different methods. Gender specific differences could not be dealt with, due to a lack of participants. The data found in the statistics gives details about the results of the study.

2 Basic Research

2.1 Classification

According to the clinical criteria in the ICD-10 Manual of the World Health Organisation (WHO), enuresis is defined as an involuntary bladder release in children from a chronological age of five and an intellectual age of four years old. Underlying organic diseases like epilepsy, neurological incontinence, structural changes in the urinary tract and medical illnesses must be excluded. The minimum time period for the symptoms is three months, with an incontinence frequency of two times per month under the age of seven and once a month in older children (ICD-10 research criteria).
The terminology for this is divided according to the time of day, with enuresis nocturna, diurna, and nocturna er diurna. However, according to ICD-10, a precise division into primary and secondary forms of enuresis must be foregone after a long dry period.
The important differentiation between enuresis and bladder incontinence is also not made by the ICD-10 definition. Enuresis denotes a normal, full emptying of the bladder in the wrong place and at the wrong time. It occurs mainly during the night,

and is rare during the day. Urinary incontinence is characterised by an unwanted release of urine and a bladder disorder. This can be structurally, neurologically or functionally dependant.[2]

2.2 Division of the sub-groups

2.2.1 Enuresis nocturna

2.2.1.1 Primary isolated (monosymptomatic) enuresis nocturna

Primary monosymptomatic enuresis nocturna is defined by incontinence during the night, without a long interval of dryness (six months) and without signs of bladder function disorders (like urge symptoms, delay or discoordination). It does not deal with a bladder disorder, but instead with a retardation of the central nervous system.
A typical clinical characteristic is incontinence where a large amount of urine is released (polyuria). Furthermore, it is also typical that children affected by it are deep sleepers, who are difficult to wake up. There are no abnormalities in urination during the day. Children normally go to the toilet a lot (between five to nine times a day), and the amount of urine that they pass during the day is age-dependant, they do not complain about an urge to urinate, they do not hold themselves back, and they can empty the bladder without problems.[3]
„Children who are incontinent during the night, but do not show any further signs of a bladder disorder during the day, point to a lower rate of accompanying psychological problems.“[4] Psychological problems are generally seen as a result of the illness – not the cause of it.
This form of incontinence can also occur more frequently in one family, and is genetically determined. In enuretic families (where more than one generation is affected by the problem), the enuresis gene (ENUR1, ENUR2, ENUR3), on the

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[2] Cc. Gontard, Lehmkuhl, 2002,pp.2f und cc. http://www. uni-duesseldorf. de. Stand: 20.07.2007.

[3] Cc. Gontard/ Lehmkuhl, 2002, pp.4f.

[4] Gontard/ Lehmkuhl, 2002, pp.14.

chromosomes 12, 13 and 22 can be used as evidence, pointing to a dominant autosomal inheritance.[5]

The anti-diuretic hormone (ADH, Vasopressin) plays an important role in incontinence during the night, as it controls water retention in the body and therefore affects the filling of the bladder. Normally, this hormone is secreted from the pituitary gland (hypophysis), in a rhythm dependant on the time of day, which ensures that the bladder does not fill up as much during the night. This hormone regulation can still be disrupted in enuresis nocturna.

However, the central issue is that the reflexes that empty the bladder are not pressurised adequately enough, and that a full bladder does not cause the child to awaken. In neuropsychological studies, functional disorders in the pontine micturition centre in the brain stem and in the Locus Coeruleus, which is responsible for arousal from sleep can be proven.[6]

2.2.1.2 Primary non – monosymptomatic enuresis nocturna

This form is defined by incontinence during the night without a long interval of dryness (six months), yet with typical signs of a bladder disorder, as children who are incontinent during the day also show. It principally deals with a weaker version of urine incontinence. With these children, there is often a higher rate of accompanying psychological symptoms.[7]

2.2.1.3 Secondary enuresis nocturna

Secondary enuresis is defined as a relapse after a dry period of six months, whereby the psychological component is clearly higher. These children have clear monosymptomatic forms with deep sleep and large amounts of urine, like children with a typical bladder disorder.[8]

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[5] URL: http://www.kidsdoc.at/kinderchirurgie/bettnaessen_bettnaesser.html(20.07.2007).

[6] Cc. Gontard/ Lehmkuhl, 2002,pp. 21f.

[7] Cc. Gontard/ Lehmkuhl, 2002, pp. 5.

[8] Cc. Gontard/ Lehmkuhl, 2002, pp. 5.

2.2.2 Functional Urinary Incontinence (Incontinence during the day or during the day and night)

2.2.2.1 Idiopathic Urge Incontinence

Idiopathic urge incontinence is defined as an unwanted excretion of urine with an overly strong urge to urinate. It normally deals with hereditary bladder disorders. The problem lies in the fact that the bladder does not fill itself passively, but instead already begins to contract whilst it is being filled. This leads to a strong urge to pass urine, and in turn to frequent toilet trips (over seven and up to twenty times a day) where a small amount of urine is passed each time. In order to suppress the strong urge to pass urine, manoeuvres to stop this happening are applied. These include tensing the base of the pelvis, pressing the upper thighs together, hopping from one leg to the other, and squatting or crouching down to hold in the urine flow as long as possible. Despite these various manoeuvres, incontinence occurs repeatedly during the day, especially in the course of the afternoon and in the evening, when tiredness starts to set in. Because the underpants are almost always moist, this can lead to redness and inflammation in the genital areas, and also to frequent urinary tract infections. Most of the psychological symptoms accompanying the illness result as a secondary cause of the main problem.[9]

2.2.2.2 Urinary Incontinence with Delayed Micturition

This form is characterised by urine retention and the failure of micturition, and despite manoeuvres to hold the urine in, incontinence still occurs during the day. It is not the result of a hereditary bladder disorder, but is instead developed, in the sense of an acquired behaviour or as part of a problem in social behaviour, with oppositional behaviour. Typical of this form are only occasional trips to the toilet (less than five times a day). Because of repeated, delayed micturition and the use of manoeuvres to stop incontinence, the bladder is forced to retain a higher volume than normal. A widening of the bladder wall and remaining urine after passing water are typical. [10]

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[9] Cc.Gontard/ Lehmkuhl, 2002, pp.7.

[10] Cc. Gontard/ Lehmkuhl, 2002, pp.7.

2.2.2.3 Detrusor-Sphincter-Discoordination

During micturition, the base of the pelvis fails to relax and there are uncoordinated contractions in the external sphincter. The detrusor therefore has to empty with increased pressure against the resistance of the sphincter. Typical characteristics are spontaneous passing of water and clear compression with micturition. In addition, this does not succeed in one stream, but is delivered in a series of interrupted streams. The rate of medical complications, such as vesicoureteral reflux, is the highest in this form. Sphincter-detrusor-discoordination deals with an acquired coordination disorder, in the sense of an acquired behaviour. It can also develop out of urge incontinence or urine incontinence with delayed micturition.[11]

2.2.2.4 Rare Forms

With stress incontinence, urine is released with coughing or sneezing, because of a weakness in the base of the pelvis. This form is extremely rare in children.
With laughing incontinence, the bladder is completely emptied when a person laughs, triggered by a reflex. This problem is genetically inherited.[12]

2.3 Prevalence

2.3.1 Enuresis nocturna

Incontinence during the night is two to three times more frequent than incontinence during the day. The gender ratio is 1.5 to 2 boys to 1 girl. The prevalence is comparable worldwide and across cultures. Of the five year olds, 15.7% are affected, of the six year olds 13,1%, of the seven year olds 10.3%, of the eight year olds 7.4%, of the nine year olds 4.5%, of the ten year olds 2.5%, of young people 1-2% and, finally, of adults affected, 0.3-1.7%. It is clearly shown that those who are incontinent during the night have a high spontaneous retrogression rate, even without therapy. The spontaneous remission rate is 13% per year (according to Gontard & Lehmkuhl, 1997a,b; Wille, 1994a; Hellström et al., 1990Fergusson & Horwood, 1994; Järvelin et al., 1988; de Jonge et al., 1973; Krantz et al., 1994)

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[11] Cc. Gontard/ Lehmkuhl, 2002, pp.7f.

[12] Cc. Gontard/ Lehmkuhl, 2002 pp.8.

2.3.2 Functional Urinary Incontinence

The gender ratio is 1 to 1.5 girls to 1 boy. There are clear trans-cultural differences. Of the five year olds, 2% are affected, of the six year olds, 2.9%, of the seven year olds, 3.6%, of the eight year olds, 4.0%, of the ten year olds 3%, and of young people, under 1% are affected. Incontinence during the day reduces as people become older, so 12-18% of 25 to 64 year olds are incontinent, and 9-23% of 65 year olds.[13]

3 Anatomy und Physiology

3.1 Development of Normal Bladder Control

Infants pass small amounts of urine up to twenty times a day. The emptying of the bladder is a result of a sphincter reflex in the region of the sacrum, which then appears, as soon as the corresponding filling of the bladder is achieved. The emptying of the bladder follows involuntarily. With increased age, the micturition centre plays a greater role, the bladder stabilises and its capacity increases. The frequency of emptying the bladder decreases. At the age of two, children begin to develop their feel for filling the bladder. At the age of four, an age-related bladder capacity has developed in the course of an ever growing pattern of emptying the bladder.

A third of all bed-wetters show signs not only of limited bladder capacity, but also of an instability in the bladder muscles, especially during the night. The detrusor vesicae muscle is especially affected in this case. The so-called detrus over-activity during sleep leads to reaching the maximum bladder capacity for incontinence to occur. [14]

3.2 Structure of the Bladder

The bladder is a concave muscle (**detrusor vesicae**). Its walls are made up of reticulated, long, smooth muscle cells. The **trigonum vesicae** is located at the base

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[13] Cc. Gontard/ Lehmkuhl, 2002, pp. 9f.

of the bladder and is made up of smooth muscle fibres. The upper, outer corners of it join to the urethra and run intramural into the bladder wall; in this way, urine cannot retrograde back into the urethra when pressure inside the bladder is increased. At the top of the trigonus is the exit of the bladder to the urine duct, with the **sphincter versicae internus** muscle. The emptying of the bladder cannot be independently controlled by the detrusor vesicae; when the bladder muscles are contracted, instead of stretching the muscle cells in the urethra, it leads to a shortening of these, and to the opening of the internal sphincter. In addition, the urine tract is closed by the **sphincter urethrae externus,** which consists of diagonal, striped muscles in the base of the pelvis.

3.3 Osteopathic und Anatomical Connections

The ligamentum umbilicale medianum (urachus) stretches from the top of the bladder to the navel and then to the ligamentum falciforme and over the vena umbilicalis and the ligamentum teres hepaticum. From an osteopathic perspective, the structure of the ligaments is linked to that of the liver. The ligamentum umbilicale mediale is situated on both sides of the urachus and serves to support it.

The Lamina SRGP (Lamina Sacro-recto-genito-pubicale) serves as a lateral suspension and is made up of three strands in women (Ligamentum pubovesicale, Ligamentum vesicouterina, Ligamentum sacrouterina) and two strands in men (Ligamentum pubovesicale, Ligamentum sacrogenitale). It ensures the centring of the organs and through this exist direct connections to the os pubis and os sacrum, as well as indirect ones to the lumbar vertebra, sacroiliac joint, os coccygis and hips.

The pelvic floor is made up of the levator ani muscle, the coccygeus muscle and the diaphragma urogenitale (diaphragma pelvis). The muscles piriformis, ligamentum sacrotuberale, ligamentum sacrospinale and the ligamentum sacrococcygeum close at the back of the pelvis.

There is a link between the piriformis muscle, the levator ani muscle and the obturatorius internus muscle. This means that there can be interaction in the bladder between the hips, the os sacrum, the sacroiliac joint, the lumbar vertebra and the os coccygis.

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[14] URL: http://www.kidsdoc.atkinderchirurgie/bettnaessen-bettnaesser.html (20.7.2007).

3.4 Innervation

The control and functional coordination of the lower urinary tract in the storage and release of urine is achieved through a complex neurological mechanism. The muscles are stimulated by parasympathetic fibres, which run in the nervus splanchnicus pelvinus and originate in the 2-4 sacral segment. This innervation is the requirement for normal control of bladder release. The sympathetic innervation (nervus hypogastricus) of the bladder slows down the detrusor and speeds up the muscle activity in the trigonums vesicae and the sphincter vesicae internus. It comes from the upper lumber medulla and the lower thoracic medulla (Th 12-12). Its job is to improve continence in the bladder. The sphincter urethrae externus is innervated by motoaxone in the nervus pudendus (s2-s4). The central nervous system is alerted of the bladder capacity rate by expansion sensors in the bladder wall, with afferent axons in the nervus splanchnicus pelvinus. [15]

3.4.1 Neurological Regulation of Micturition

The more the bladder wall is stretched, the stronger the irritation of the existing expansion sensors. Through the reflex arc, this leads to stimulation of the parasympathetic neurones, to detrusor vesicae, to the suspension of activity in the sacral motoneurones and to sphincter urethrae externus. As a result of this, the detrusor vesicae contracts. Because of the arbitrary control of the pelvis by the nervus pudendus, it is possible to choose whether water remains where it is, through the slackening of the outer sphincter, or whether water is released through a tightening of the muscles in the pelvis.

The reflex arc is linked to the whole of the frontal pons region (mediales pontines Miktionszentrum) in the brain stem. The neurones in the lateral pontine micturition centre, which stimulate the motoneurones in the sphincter urethrae externus muscle, are inhibited by the medial micturition centre. In this way, the sphincter opens itself. [16]

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[15] Cc. Schmidt/Lang/Thews, 2005, pp. 445.

[16] Cc. Ebenda, pp.446.

3.4.2 Neurological Regulation of Continence

The stimulation of the motoneurones on the sphincter urethrae externus is supported by the lateral pontine micturition centre. Neurons in the medial micturition centre, that stimulate the preganglionic neurons in the bladder, are inhibited by the lateral micturition centre. Sympathetic neurons in the lower urinary tract are stimulated by sacrolumbal reflex paths and produce an inhibition of the detrusor and a contraction in the sphincter vesicae internus and the trigonum.[17]

3.4.3 Central Controls

The most important coordination centres for micturition lie in the brain stem, especially in the formatio reticularis of the pons. Stimulation of this area causes a contraction of the detrusor.

The cerebellum is responsible for the coordination between the reflectory muscle contractions of the detrusor and the slackening of the periurethral striates, which means with the suppression of a muscle contraction that starts in the detrusor and goes to the bottom of the pons.

The job of the limbic system is to control the emotional answer. The limbic system could possibly relieve as well as pressurise a reflectory contraction of the detrusor.

The thalamus carries impulses from the autonomes as well as from the somatic receptors in specific areas of the brain cortex.

The areas of the brain cortex are the frontal brain cortex, which is responsible for the detrusor, and the motor cortex, which is responsible for the pelvis.[18]

3.5 Hormonal Influences

Adiuretin (ADH, Vasopressin) serves primarily to regulate bodily fluids; it is released when the intra – and/or extra-cellular volume is reduced, and produces a reduction in renal water excretion.

It is cultivated in the hypothalamus, stored in the hypophosis posterior lobe, and its release increases with hyperosmolarity, hypovolaemia or with stress. Osmolarity is registered in the hypothalamus itself and in the liver.[19]

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[17] Cc. Schmidt/Lang/Thews, 2005, pp. 447.

[18] Cc. Van da Berg(Hg), 2000, pp. 252.

Through the nightly secretion of ADH, the amount of urine at night is reduced. During the night, only half the amount produced during the day is produced. An ADH-secretion deficiency results in a nightly flood of urine, which exceeds the normal bladder capacity. A large amount of enuresis sufferers have a low ADH-speculum in their blood and nightly urine with a low concentration. It is therefore often said that bed-wetters have a delayed development of the circadian rhythms of ADH. [20]

3.6 Classical Forms of Therapy

3.6.1 Electronic Waking Systems

Electronic waking systems have to be applied over a period of months and require persistence. There are various types, such as ‘ringing mats’, ‘ringing shorts’ and mini waking systems with feelers, that can be worn in underpants or pyjamas. Each device registers when urine has been released, and then sets off an alarm to wake up the child. Waking systems are the most effective way to help with bed-wetting, and also have clear long-term success. Out of ten children who used a waking system, five remained regularly dry for some months after. The biggest disadvantage of this treatment is that when the reason that a child wets the bed is that they are a deep sleeper, it is possible that they even sleep through the alarm. In this case, the nightly alarms can disturb their brothers and sisters or parents, without having any effect in the actual child who needs help. Waking systems require a lot of motivation and are more time consuming than medication.[21]

3.6.2 Desmopressin

Desmopressin is simlilar to Vasopressin, that is secreted from the brain at night to reduce urine production. Desmopressin is available in tablet form and has a 20% success rate. That means that around two in ten children no longer wet themselves for 14 days in a row during their treatment. The effects do not always continue once the treatment is stopped.

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[19] Cc. Schmidt/Lang/Thews, 2005, pp. 473

[20] URL: http://www.kidsdoc.at/kinderchirurgie/bettnaessen- bettnaesser.html(20.7.2007).

[21] URL: http://www.gesundheitsinformation.de/index.34.de.html(20.7.2007).

In total, between five and one hundred children (5%) must reckon with side effects whilst taking Desmopressin. It thereby has fewer side effects than using tri-cyclical anti-depressants to treat bed-wetting. In contrast, here, 17 out of 100 children (17%) have side effects.
The side effects of Desmopressin are due mainly to the fact that children retain too much water in their body. The symptoms include headaches and nausea. Because these side effects are more distinct by using Desmopressin nasal spray than Desmopressin tablets, Desmopressin nasal spray should no longer be used in the treatment of bed-wetting. This was decided by the European Licensing Authority in May 2007.[22]

3.6.3 Tri-cyclic Antidepressants

The second group of medication for bed-wetting is tri-cyclic antidepressants. Their main operational area is actually in the treatment of depression. It is not known why they also help against bed-wetting in children without depression.
It is possible that they reduce the production of urine or influence the transmission of nerve signals to the muscles involved. The success rate is, at 20%, similar to that of Desmopressin, as in two out of ten children remain dry for a period of at least 14 nights. However, tri-cyclic anti-depressants are not a long-term solution, because many children start to wet the bed again once the medication stops.
The disadvantage of using tri-cyclic anti-depressants is their side effects, which affect approximately every sixth child (17%). Included in the side effects of normal usage are: lower blood pressure, dryness in the mouth, constipation, sweating, heartburn, nausea, tiredness and disturbed sleep. Medical companies in the USA and Europe are currently testing the drugs for their safety, and to see which anti-depressant should be used for which health problem in children and young people.[23]

3.6.4 Further Methods without Proven Results

It has also been debated for a long time whether various forms of psychotherapy, including cognitive behavioural therapy, could be of use. Again and again, various

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[22] URL: http://www.gesundheitsinformation.de/index.34.de.html (20.7.2007)

[23] URL: http://www.gesundheitsinformation.de/index.34.de.html (20.7.2007).

techniques to improve bladder control are also recommended, such as control training and bladder training. Until now, however, it is unknown whether these exercises really do help in the fight against bed-wetting.
There is also a great deal of complementary and alternative medicine available in conjunction with bed-wetting, for example chiropracy, homeopathy, hypnosis and acupuncture. Some of these therapies are now being studied. However, the results of these studies are not clear, which means that until now there is no sound argument to prove that complementary medicine can help against bed-wetting.[24]

4 Method

The study was conducted in the Federal Hospital in Steyr, in collaboration with Dr Ludwig Dorninger (paediatrician and leader of the Enuresis Section)
Intensive literary research was conducted, whereby a German work was found to be especially efficient. The author conducted many German as well as English studies. His book is also the complete work of many international books. Many scientific abstracts were also found on the internet, but only a few of these were suitable for the study.

4.1 Therapist

The researcher is a fully qualified physiotherapist. She completed her six-year training at the Vienna School of Osteopathy two years ago and has, since last year, been training to become a paediatric osteopath in the Osteopathic Centre for Children in Vienna. The researcher works in the Federal Hospital in Steyr, Upper Austria, as a physiotherapist, and also part-time as an osteopath in the paediatric ward.

4.2 Selection of Participants

Ten patients suffering from enuresis and allotted by Dr. Ludwig Dorninger, a paediatrician at the Federal Hospital in Steyr, were integrated in the study group. The

[24] Cc. Ebenda.

members of this group received osteopathic treatment only. The same doctor was responsible for diagnosing the participants, and he established contact to another ten patients, who were integrated into the control group and received state of the art medical treatment (drugs).
To begin with, the children underwent classical check-ups like:

- Anamnesis and status, which give information about family disabilities and possible genetic background. Questions included those about previous operations, bladder tract infections, hematuria, neurological problems, and congenital anomalies, like questions about bladder and stool movements.
- Micturition protocol, which gives information about the frequency of micturition, the relationship between daily urine amount and nightly urine amount, the functional and maximum bladder capacity, and drinking habits.
- Micro-biological findings/urine analysis that clarifies whether a urinary tract infection exists or not.
- Sonography, which reviews the kidneys, the urinary tracts, and the bladder using residue urine samples.
- Laboratory findings, to specify the ADH-levels in the blood.

4.2.1 Study Group

Ten participants between the ages of five and thirteen were studied and treated. Of these ten, six were female and four were male. The participants came directly from the bed-wetting outpatient department, where they had already been medically cleared. From this emerged three primary monosynaptic enuresis sufferers, four primary non-monosynoptic enuresis sufferers and three children with idiopathic urge incontinence.
The following criteria for disqualification in the study were defined.

- Epilepsy
- Structural changes in the bladder tract
- Neurological Incontinence
- Serious psychological dysfunctions
- Medical illnesses like diabetes mellitus

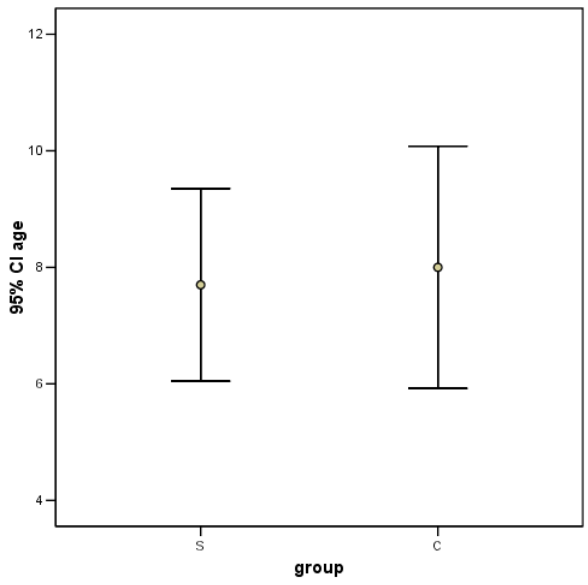
The participants were treated in the child therapy room in the Institute for Physical Medicine. Whilst the study was taking place, they were not allowed to take medical substitutions of ADH or other medication to affect the bladder.

4.2.2 Control Group

This group consisted of ten participants between the ages of five and thirteen. Of these ten, five were female and five were male. In this case, there was a medical clarification given, and they were divided into special groups, i.e. three primary monosynaptic enuresis sufferers, four primary non-monosynaptic enuresis sufferers and three with idiopathic urge incontinence. The treatment for these children was through medication.

Thus, the therapist had no influence on randomization. Nevertheless, the two groups are comparable in age and severity of enuresis during the night time. The mean age of the patients in the study group is 7.7 years, and in the control group 8.0 years (cf. Ill. 1). An independent samples t-test results in t=0.26 and p=0.80. Thus, there are no significant group differences in age. Mean severity of enuresis, described by the days per week with night time incontinence of the patients is 5.8 days in the study group and 5.3 in the control group. An independent samples t-test results in t=0.590 and p=0.56. That means that group differences in this variable are low.

On the contrary, distinct group differences can be observed in the severity of enuresis during the day time. The mean severity of enuresis, described by the days per week with incontinence during daytime is 6.3 days in the study group and 3.5 in the control group. An independent samples t-test results in t=4.25 and p=0.051. That means that the groups differ distinctly in this variable (cf. chapter 5.1). Additionally, the number of individual diagnoses is different in both groups.



Ill. 1: Mean age (+/- 95%-confidence) intervals in the study and control group.

4.3 Treatment

4.3.1 Time Frame

The children received five treatments. Each of these treatment times lasted one hour. The time period between each treatment was three weeks.

4.3.2 Treatment

The treatment was in accordance with the osteopathic concept.

- Anamnesis

  In an initial survey, severity of enuresis before the treatment period was assessed. The parents estimated the number of nights and days that their children were incontinent during the last week. Additionally, parents were asked about former medical treatment and its results. Parents of the control group were queried via telephone.

- Examination

  Detailed information about this can be found in the findings in the appendix.

- Therapy

  There was no special technique used, but instead all osteopathic techniques available to the therapist were used.

4.3.3 Measurements

The incontinence frequency was measured, in the sense that with the first anamnesis, the incontinence frequency was noted, and with the use of a sun and rain calendar that was completed in conjunction with the mother, the end result was registered.

4.4 Schedule of the Study

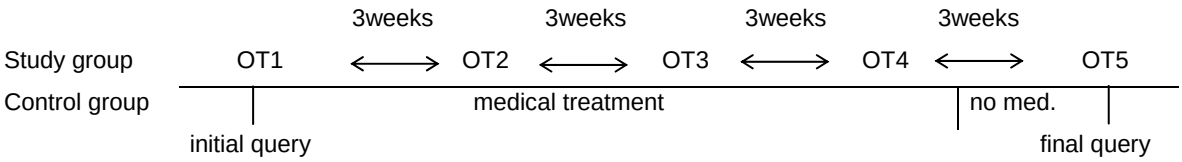
The patients in the study group received five osteopathic treatments in three-week intervals (time table cf. Ill. 2). According to the inclusion criteria, the patients in the

study group did not receive medical (or other) treatment during this period of twelve weeks.

At each treatment, the parents of the patients were asked about the number of days with involuntary micturition of their children during the last week for day time as well as night time, individually.

The last treatment was given in order to stay in contact with the patients until the very end of the study, when weekly frequency of micturition was queried the last time for assessment of the total efficacy of the four osteopathic treatments. Sustainability of treatment effects was evaluated by a comparison of the data of the fourth and fifth treatment. If frequency of involuntary urination did not increase again, treatment was considered as being sustainable.

Patients of the control group received medical treatment over eleven weeks and their parents were asked twice (in twelve-week intervals) about the number of days with involuntary micturition during the last week for day time and night time, separately. The parents were asked to note the final status before the last week of the study and then to cease medical treatment in order to test its sustainability.



Ill. 2: Time table (OT… osteopathic treatment).

4.5 Assessment of the Severity of Enuresis after the Treatment Period

At the fifth osteopathic treatment (twelve weeks after the first treatment), parents were asked again to estimate the number of nights and days per week that their children were incontinent. Parents of the control group were queried via telephone twelve weeks after the initial survey. These parents were also asked about the sustainability of the treatment effect.

4.6 Variables used for Evaluation

Dependent variables

Since parent's estimations of the number of nights and days per week when their children were incontinent are approximate (± one day) rather than precise values, the mean value of these ranges is calculated for each infant for the initial status and the period after the last treatment, individually.

Afterwards, differences in the data gained before and after the treatment period are calculated (cf. Table 1). Improvements (less days with day time or night time incontinence) result in negative values. Variables used for statistical evaluation are written in bold letters.

original data		**mean values**		**calculated values**	
1_npw	2_npw	**1_npw_n**	**2_npw_n**	**ch_npw_n**	= 2_npw_n - 1_npw_n
1_dpw	2_dpw	**1_dpw_n**	**2_dpw_n**	**ch_dpw_n**	= 2_dpw_n - 1_dpw_n

Table 1: Calculated data used for evaluation and corresponding original variables.

Since these variables might be error prone and thus too precise for assessing the real changes in enuresis, two additional variables are introduced (**ch_npw_d, ch_dpw_d**). In these variables, the changes of enuresis between the first and second interview are loosely classified as "improvements" and "no improvements".

Reversibility of medical therapy (i.e. if symptoms occur again in the same or higher frequency after ceasing medical therapy in the last week of the therapy period) are considered in two other variables (**ch_npw_d_rev, ch_dpw_d_rev**), by classifying these cases as "not sustainable". For the study group, sustainability of therapy effects are evaluated by a comparison of the number of days per week when patients are incontinent at the fourth and fifth osteopathic treatment. If there is an increase of these days with time, therapy is classified as "not sustainable".

Independent variables

Due to the low number of participants, the group variable is the only independent variable for statistical tests. Nevertheless, for additional information, mean values and other descriptive data, grouped by diagnosis, will be added in chapter 5.5.

4.7 Statistical Methods

First of all, deviations from normal distribution were tested by Kolmogorov-Smirnov tests.

In case of normal distribution, for significance testing of group differences, independent t-test samples were applied. Changes in the severity of enuresis were tested by paired t-test samples.

Additionally, Fisher's exact tests were used for testing group differences in case of nominal data.

4.8 Hypotheses

Hypothesis 1: Osteopathic treatment results in an improvement of enuresis.

Null hypothesis 1: There is no difference in the severity of enuresis before and after osteopathic treatment.

This null hypothesis will be tested by means of paired sample-t-tests (level of significance α= 0.05, two-tailed) for day and night time incontinence, separately:

$H_{01\text{-}1}$: m(2_npw_n - 1_npw_n) =0

$H_{01\text{-}2}$: m(2_dpw_n - 1_dpw_n)= 0

Hypothesis 2: Osteopathic treatment is more effective for treatment of enuresis than medical therapy.

Null hypothesis 2: There is no difference in mean efficacy of medical and osteopathic therapy.

This null hypothesis will be tested by means of independent sample-t-tests (level of significance α= 0.05, two-tailed) for day and night time incontinence, separately.

The group variable is used as an independent variable (study group (S)/ control group (C)).

$H_{02\text{-}1}$: $m(ch\_npw\_n)_S = m(ch\_npw\_n)_C$

$H_{02\text{-}2}$: $m(ch\_dpw\_n)_S = m(ch\_dpw\_n)_C$

Additionally, a Fisher's exact test (level of significance α= 0.05, two-tailed) will be performed for day and night time incontinence, separately with the dependent variables ch_npw_d and ch_dpw_d and the independent group variable.

The according null hypothesis is (rf…relative frequency):

$H_{02\text{-}3}$: $rf(ch\_npw\_n)_S = rf(ch\_npw\_n)_C$
$H_{02\text{-}3}$: $rf\ (ch\_dpw\_n)_S = rf(ch\_dpw\_n)_C$

Hypothesis 3: Improvement of enuresis by osteopathic treatment is more sustainable than by medical therapy.
Null hypothesis 3: There is no difference in sustainability of improvements of enuresis after medical and osteopathic therapy.
This null hypothesis will be tested by means of Fisher's exact tests (level of significance α= 0.05, two-tailed) for day and night time incontinence, separately (rf… relative frequency):

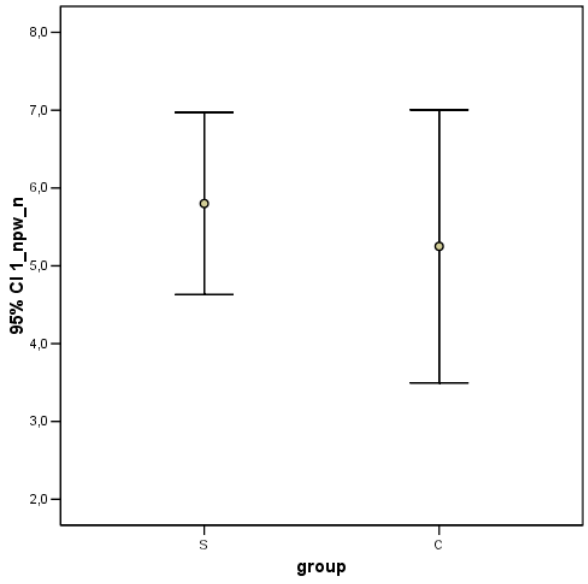
$H_{02\text{-}1}$: $rf(ch\_npw\_d\_rev)_S = rf(ch\_npw\_d\_rev)_C$
$H_{02\text{-}2}$: $rf(ch\_dpw\_d\_rev)_S = rf(ch\_dpw\_d\_rev)_C$

5 Results

5.1 Status before Treatment

Night time

As already mentioned in chapter 4.2, there are no differences in the initial severity of enuresis during night time. Mean frequencies of the days per week with night time incontinence (+/- 95%-confidence intervals) are presented in Ill. 3.



Ill. 3: Severity of enuresis during night (nights per week with incontinence) before the treatment period.

Descriptive data about the severity of enuresis during night time, before treatment, are summarized in Table 2.

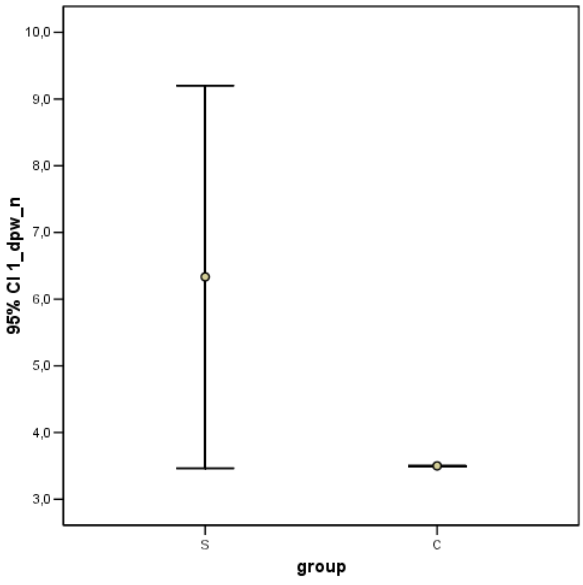
Group	var	mean	N	SD	SE (mean)
S	1_npw_n	5.8	10	1.64	0.52
C	1_npw_n	5.3	10	2.45	0.78

Table 2: Severity of enuresis during night (nights per week with incontinence) before the treatment period.

Before treatment, parents of the children of the study group described involuntary micturition of their children in 5.8 nights per week (npw), on average (SD: 1.64 npw) . Data for the patients of the control group are similar (mean value: 5.3 npw), but standard deviation is higher (2.45 npw). An independent sample t-test with 1_npw_n as dependent and group as independent variable results in t= 0.590 and p= 0.56. Thus, the two groups do not differ significantly.

Day time

As already mentioned in chapter 4.2, there is a distinct difference in the initial severity of enuresis during day time. Mean frequencies of the days per week with daytime incontinence (+/- 95%-confidence intervals) are presented in Ill. 4.



Ill. 4: Severity of enuresis (days per week with incontinence during daytime) before the treatment period.

Descriptive data about the severity of enuresis during day time before treatment are summarized in Table 3.

Group	var	mean	n	SD	SE (mean)
S	1_dpw_n	6.3	3	1.15	0.67
C	1_dpw_n	3.5	2	0	0

Table 3: Severity of enuresis (days per week with incontinence during daytime) before the treatment period.

In total, there are only five children who are incontinent during day time, three in the study group and two in the control group. Before treatment, parents of the three children in the study group described involuntary micturition of their children in 6.3 days per week (dpw) on average (SD: 1.15 dpw). Both members of the control group were incontinent three to four times per week during day time. An independent sample t-test with 1_dpw_n as dependent and group as independent variable results in t= 4.25 and p= 0.051. That means that the two groups differ distinctly.

5.2 Status after Treatment and Changes

Descriptive data about the severity of enuresis during night time after the treatment period are summarized in Table 4. The according data for day time is listed in Table 5.

group	var	mean	n	SD	SE (mean)
S	2_npw_n	2.2	10	2.6	0.8
C	2_npw_n	2.6	10	3.4	1.1

Table 4: Severity of enuresis during night time (nights per week with incontinence) after the treatment period.

After treatment, the parents of the children of the study group described incontinence of their children in 2.2 nights per week (npw) on average (SD: 2.6 npw). The mean value for the control group is slightly higher (2.6 npw, SD: 3.4 npw).

group	var	mean	n	SD	SE (mean)
S	2_dpw_n	3.0	3	1.3	0.8
C	2_dpw_n	3.5	2	0	0

Table 5: Severity of enuresis during day time (days per week with incontinence during day time) after the treatment period.

After treatment, parents of the three children in the study group described incontinence during day time of their children during three days per week (dpw) on average (SD: 1.3 dpw). Two members of the control group were still incontinent three to four times per week during the day time.

Results of the paired sample t-tests for the differences 2_npw_n - 1_npw_n (night time enuresis) are presented for both groups individually in Table 6, the according data for the differences 2_dpw_n - 1_dpw_n (day time enuresis) in Table 7.

Night time

Results of the paired sample t-tests for the differences 2_npw_n - 1_npw_n (night time incontinence) are presented for both groups individually in Table 6.

Group	Paired Differences:	mean	SD	SE mean	95% CI (diff)	t	df	Sig. (2-t.)
S	2_npw_n - 1_npw_n	-3.65	2.20	0.70	-2.08 - -5.22	5.25	9	<0.001
C	2_npw_n - 1_npw_n	-2.65	2.74	0.87	-0.69 - -4.61	3.06	9	0.014

Table 6: Results of the paired samples t-tests for the differences between the nights per week, when children were incontinent, before and after the treatment period.

Night time enuresis is significantly improved in both groups. Mean differences are higher in the study group (-3.65 nights per week) than among the members of the control group (-2.65 nights per week).

Day time

Results of the paired samples t-tests for the differences 2_dpw_n - 1_dpw_n (day time incontinence) are presented for both groups individually in Table 7.

Group	Paired Differences:	mean	SD	SE mean	95% CI (diff)	t	df	Sig. (2-t.)
S	2_dpw_n - 1_dpw_n	-3.33	1.04	0.60	-0.75 - -5.92	5.55	2	0.031
C	t cannot be computed because the standard error of the difference is 0.							

Table 7: Results of the paired samples t-tests for the differences between the days per week when daytime incontinence occurs, before and after the treatment period.

In the study group, a significant improvement can be observed in day time enuresis, too (t= 5.55, p= 0.031). Since standard error of the difference is 0, and no changes of enuresis in the control group can be observed, no statistics can be computed.

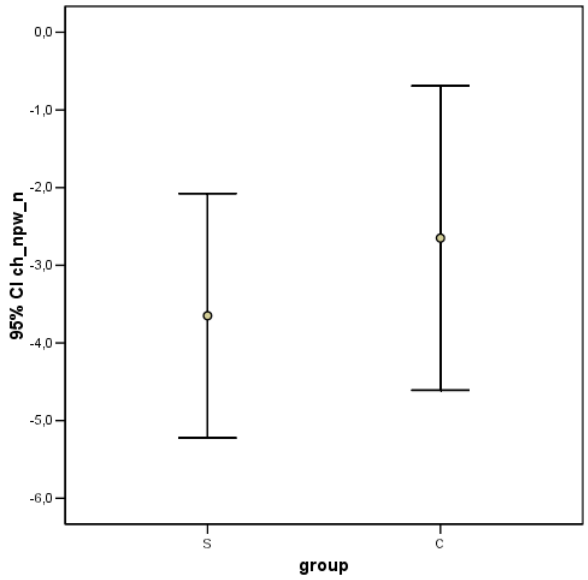
5.3 Comparisons of the Efficacy of Osteopathic and Medical Treatment

Night time

As described in chapter 5.2, significant improvements of night time enuresis could be observed in both groups. An overview of this data is given in Table 8. Changes in night time incontinence (days per week) are presented in Ill. 5. The results of the independent samples t-tests of the changes of the numbers of nights per week when the children were incontinent (ch_npw_n) in the two groups can be observed in Table 9.

	ch_npw_n			
group	n	mean	SD	SE (mean)
S	10	-3.65	2.199	0.695
C	10	-2.65	2.739	0.866

Table 8: Mean changes of nights per week when patients were incontinent in the two groups.



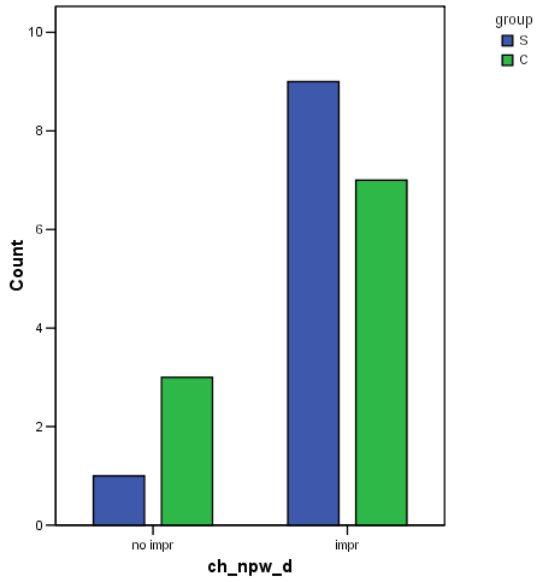
Ill. 5: Changes in the number of days per week with night time incontinence.

	F	Sig.	t	df	Sig. (2-tailed)	mean diff.	SE (diff.)	95%-CI (diff.)
ch_npw_n	1.1	0.32	-0.9	18	0.380	-1.000	1.111	-3.33 - 1.33

Table 9: Results of the independent samples t-test for nights per week with involuntary micturition in the two groups.

The number of days per week when the patients were incontinent during night time decreased in both groups. A higher mean decrease can be observed in the study group. The mean difference between the groups is one day. Nevertheless, this difference is not significant.

The same accounts for the results of the Fisher's exact test with the number of patients treated successfully or not in both groups (cf. Table 10). The number of nights per week with involuntary micturition are lower after treatment for 90% of the patients of the study group (impr), the according data of the control group is 70% (cf. Ill. 6). Fishers exact tests result in p= 0.58. The differences are not significant.



Ill. 6: Number of patients of each group, whose enuresis improved (or did not improve) during treatment period (night time).

ch_npw_d		S		C	
n	no impr	1		3	
	impr	9		7	
%	no impr	10.0		30.0	
	impr	90.0		70.0	
95% CI		l	u	l	u
	no impr	1.8%	40.4%	10.8%	60.3%
	impr	59.6%	98.2%	39.7%	89.2%

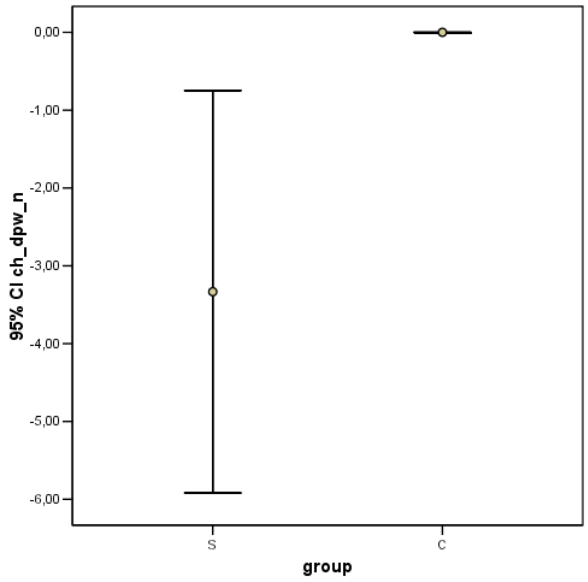
Table 10: Cross tabulation of the number of patients with improved and unimproved enuresis in each group.

Day time

As described in chapter 5.2, an improvement of day time enuresis could be observed in the study group only. Changes in day time incontinence (days per week) are presented in Ill. 7. Descriptive data are summarized in Table 11. The results of the independent samples t-tests of the changes of the frequency of days per week with involuntary micturition (ch_dpw_n) for both groups can be observed in Table 12.

	ch_dpw_n			
Group	n	mean	SD	SE (mean)
S	3	-3.33	1.041	0.601
C	2	0	0	0

Table 11: Mean changes of day times per week when patients were incontinent in the two groups.

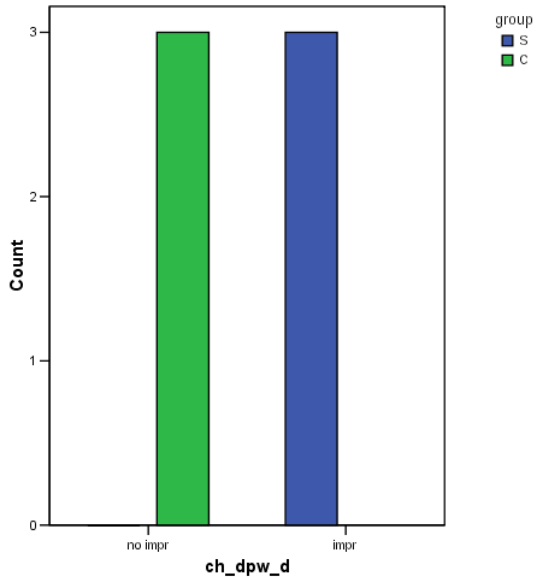


Ill. 7: Changes in the number of days per week with day time incontinence.

	F	Sig.	t	df	Sig. (2-tailed)	mean diff.	SE (diff.)	95%-CI (diff.)
ch_dpw_n	6.19	0.09	-5.55	2	0.031	-3.33	0.60	-5.92 - -0.75

Table 12: Results of the independent samples t-test for days per week with involuntary micturition for the two groups.

Improvements can only be observed in the study group (cf. Ill. 8). Group differences are significant, but the test has limited validity due to the low number of patients with day time enuresis.



Ill. 8: Number of patients of each group, whose enuresis improved (or did not improve) during treatment period (daytime).

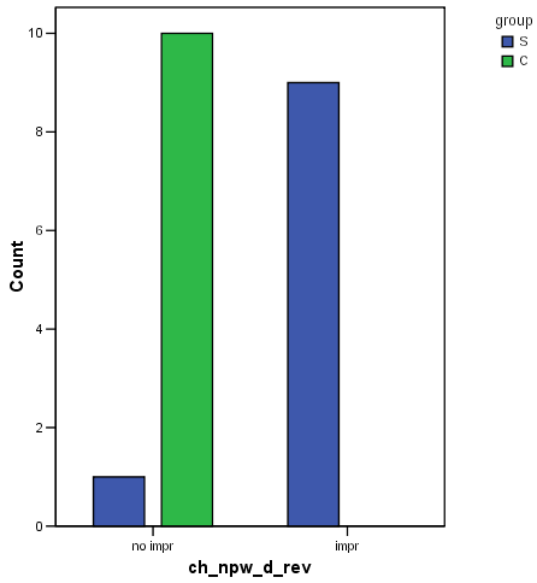
Data for Fisher's exact test with the number of patients treated successfully in both groups is presented in Table 13. The number of days per week with involuntary micturition is lower after treatment for all of the patients of the study group (impr.), and equal for all of the patients of the control group (no impr.). Fisher's exact test results in p= 0.10. The differences are not significant.

ch_dpw_d		S		C	
n	no impr	0		3	
	impr	3		0	
%	no impr	0.0		100.0	
	impr	100.0		0.0	
95% CI		L	u	l	u
	no impr	0.0%	56.2%	43.8%	100.0%
	impr	43.8%	100.0%	0.0%	56.2%

Table 13: Cross tabulation of the number of patients in each group with improved and unimproved enuresis.

5.4 Sustainability of Therapy

Under consideration of the cases where success of therapy is reversible after seizing medical treatment or between the fourth and fifth osteopathic treatment, sustainable improvements can only be observed in the study group (cf. III. 9).



III. 9

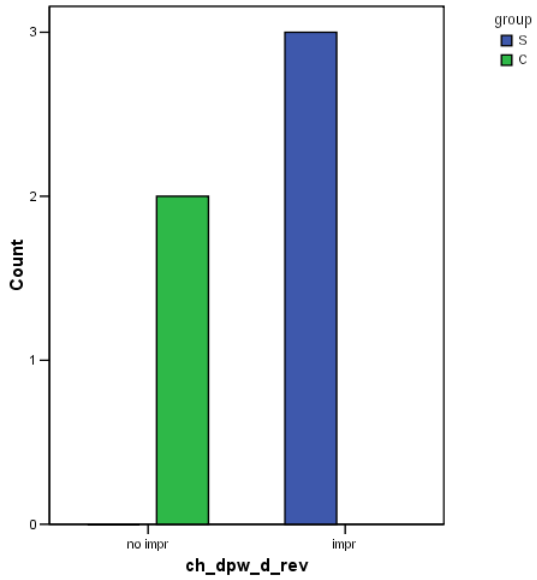
III. 9: Number of patients with sustainable improvements and not sustainable improvements of night time enuresis.

Data for Fisher's exact test with the number of patients treated successfully in both groups is presented in Table 14. The number of nights per week with involuntary micturition is lower after treatment for 90% of the patients of the study group (sust. impr.), and equal for all of the patients of the control group. Fisher's exact test results in $p < 0.001$. The differences are significant.

ch_npw_d_rev		S		C	
n	no sust. impr.	1		10	
	sust. impr.	9		0	
%	no sust. Impr	10.0		100.0	
	sust. impr.	90.0		0.0	
95% CI		l	u	l	u
	no sust. impr.	1.8%	40.4%	72.2%	100.0%
	sust. impr.	59.6%	98.2%	0.0%	27.8%

Table 14: Cross tabulation of the number of patients in each group with sustainable improvements and not sustainable improvements of night time enuresis.

Under consideration of the cases where success of therapy is reversible after seizing medical treatment or between the fourth and fifth osteopathic treatment, sustainable improvements can only be observed in the study group (cf.III.9).



III. 10: Number of patients with sustainable improvements and not sustainable improvements of day time enuresis.

Data for day time with the number of patients treated sustainably in both groups are presented in Table 15. The number of days per week with day time incontinence is lower after treatment for all of the patients of the study group (sust. impr.), and equal for all of the patients of the control group (no sust. impr.). Fisher's exact test results in p= 0.10. The differences are not significant.

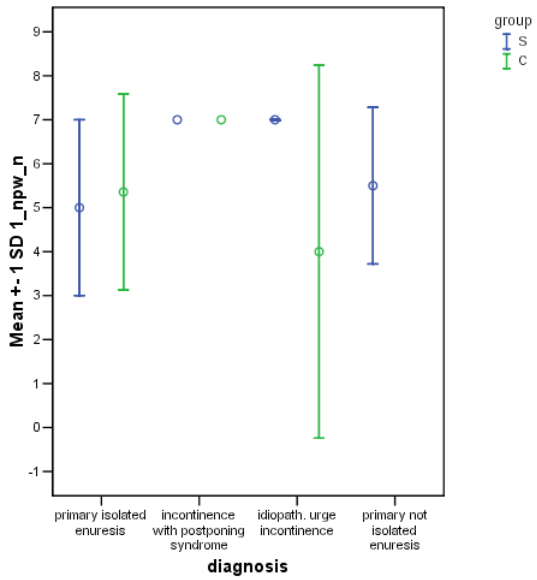
ch_dpw_d_rev		S		C	
n	no sust. impr.	0		2	
	sust impr	3		0	
%	no sust. impr.	0.0		100.0	
	sust impr	100.0		0.0	
95% CI		l	u	l	u
	no sust. impr.	0.0%	56.2%	34.2%	100.0%
	sust impr	43.8%	100.0%	0.0%	65.8%

Table 15: Cross tabulation of the number of patients in each group with sustainable improvements and not sustainable improvements of day time incontinence.

5.5 Efficacy of Therapy depending on Medical Diagnosis

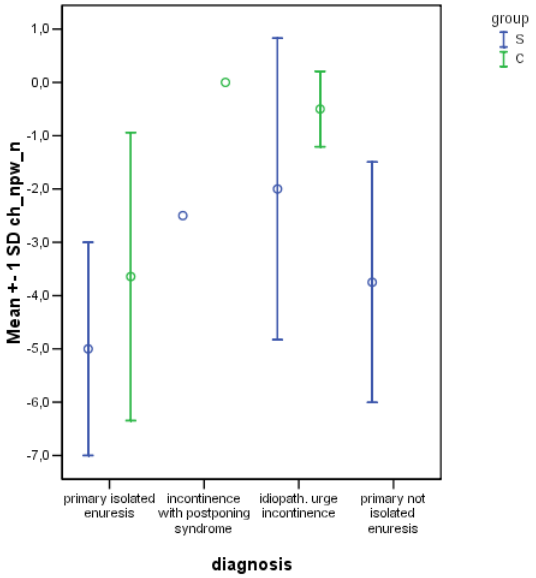
Night time

Patients with primary non-isolated enuresis can be found in the study group only. In Ill. 11, it can be seen, that the highest group differences can be observed in patients with idiopathic urge incontinence. Patients with other diagnosed diseases do not differ in the weekly frequency of night time incontinence.



Ill. 11: Mean number of days per week with night time incontinence grouped by diagnosis.

Independent from diagnosis, in the study group more distinct improvements can be observed compared to the control group (cf. Ill. 12). Variability of data is again highest among patients with idiopathic urge incontinence.



Ill. 12: Mean change (+/- SD) of the number of days per week with night time incontinence grouped by diagnosis during the therapy period.

Most distinct improvements can be observed among the patients of both groups with primary isolated enuresis.

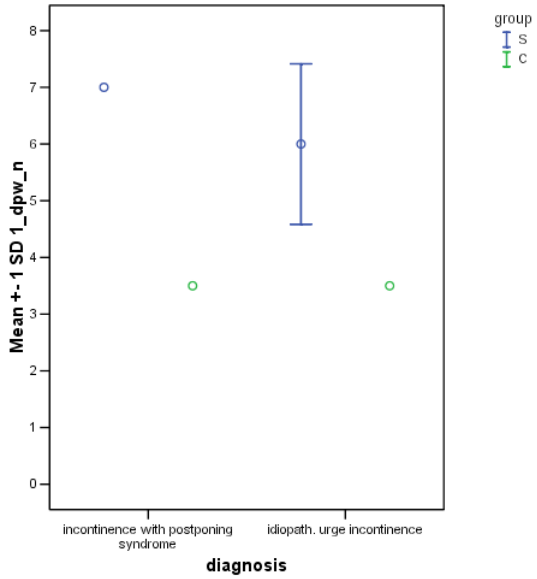
The number of patients with different diagnosis, and exact mean values and standard deviations can be taken from Table 16.

Gr	Diagnosis	Primary isolated enuresis			Incontinence with postponing syndrome			Idiopath. urge incontinence			Primary not isolated enuresis		
	Variable	Mean	n	SD	Mean	n	SD	Mean	n	SD	Mean	n	SD
Initial state													
S	1_npw_n	5.0	3	2.0	7.0	1	-	7.0	2	0.0	5.5	4	1.8
C		5.4	7	2.2	7.0	1	-	4.0	2	4.2	-	0	-
Percent of patients with improvements after therapy													
S	ch_npw_d	100%	3	0%	100%	1	-	50%	2	71%	100%	4	0%
C		86%	7	38%	0%	1	-	50%	2	71%	-	0	-
Mean improvement (nights/week less)													
S	ch_npw_n	-5.0	3	2.0	-2.5	1	-	-2.0	2	2.8	-3.8	4	2.3
C		-3.6	7	2.7	0.0	1	-	-0.5	2	0.7	-	0	-
Percent of patients with sustainable improvements after therapy													
S	ch_npw_d_rev	100%	3	0%	100%	1	-	50%	2	71%	100%	4	0%
C		0%	7	0%	0%	1	-	0%	2	0%	-	0	-

Table 16: Summary of the variables grouped by medical diagnosis.

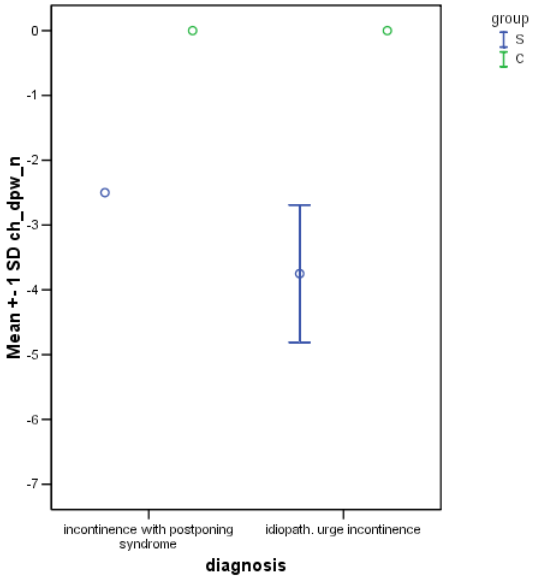
Day time

Initial status of day time incontinence of patients suffering from incontinence with postponing syndrome as well as idiopathic urge incontinence is worse in the study group than in the control group (cf. Ill. 13).



Ill. 13: Mean number of days per week with day time incontinence grouped by diagnosis.

Improvements can be observed among patients with both diagnoses in the study group, only (cf. Ill. 14).



Ill. 14: Mean change (+/- SD) of the number of days per week with day time incontinence grouped by diagnosis.

The biggest improvements can be observed among patients with idiopathic urge incontinence. The number of patients with different diagnoses, and exact mean values and standard deviations can be taken from Table 17.

Gr	Diagnosis	incontinence w. postponing syndrome			idiopath. urge incontinence		
	Variable	Mean	n	SD	Mean	n	SD
Initial state							
S	1_dpw_n	7.0	1	-	6	2	1.4
C		3.5	1	-	3.5	1	-
Percent of patients with improvements after therapy							
S	ch_dpw_d	100%	1	-	100%	2	0
C		0%	1	-	0%	2	0
Mean improvement (days/week less)							
S	ch_dpw_n	-2.5	1	-	-3.8	2	1.1
C		0	1	-	0	1	-
Percent of patients with sustainable improvements after therapy							
S	ch_dpw_d_rev	100%	1	-	100%	2	0
C		0%	1	-	0%	1	-

Table 17: Summary of the variables grouped by medical diagnosis.

5.6 Summary of the Results

5.6.1 Incontinence during Night Time

There are significant changes in the numbers of days/week with incontinence during night time, independent of which treatment was applied. In the study group the mean number of days per week, when the patients were incontinent during night time was reduced from 5.8 to 2.2 days per week (Δ=3.6 days (SD: 2.2 days, $p< 0.001$). In the control group reduction is Δ= 2.7 days/week on average (SD: 2.74, $p= 0.014$). The initial status in this group was 5.3 days/week, the status after treatment 2.6 days/week. That means that osteopathic treatment is more effective than medical treatment in the actual sample. Nevertheless, a comparison of the two groups by independent sample t-tests results in $p= 0.38$. Thus, group differences are not significant and generally said; both methods are equivalent in efficacy. The same can be observed in the number of patients treated successfully in the two groups. Therapy failed only once in the ten patients from the study group, and in the control group in three out of ten cases. These differences in percentage are not significant, either ($p= 0.58$).

Medical treatment turned out to be less sustainable than osteopathic treatment (i.e. patients became incontinent again, after medical treatment stopped). In the study group, no deterioration could be observed between the fourth and fifth treatment in the patients whose conditions had improved during treatment. On the contrary, all of the patients from the control group were incontinent more frequently again after stopping the medication. This group difference is significant ($p<0.001$).

5.6.2 Incontinence during Day Time

There are significant changes in the numbers of days/week with incontinence during day time in the study group where the mean number of days was reduced from initially 6.3 to 3.0 days per week (Δ=3.3 days (SD: 1.04 days, $p= 0.031$). The initial status in the control group was 3.5 days/week, and remained the same after twelve weeks of medical treatment. That means that osteopathic treatment turned out to be more effective than medical therapy in the actual sample. The comparison of the two groups by independent sample t-tests results in $p= 0.031$. In connection to this, it has to be stressed that in total there were only five patients who were incontinent during day time. Therefore no generalisation of this significant result should be made.

Medical therapy failed in both patients from the control group, but in the study group osteopathic treatment did not fail in any of the three patients. Nevertheless, due to the low sample number, these differences are not significant (p= 0.10). Data for sustainability of the two methods are exactly the same.

6 Discussion of the Method

6.1 The Sample

The number of individual diagnoses is different in both groups. Therefore, it has to be considered that group differences might be influenced by this fact. Since sample size is low, no reasonable classifications depending on diagnosis could be made.

6.2 Osteopathic Check up

No osteopathic check up was performed with the patients from the control group. It is possible that there might be differences between the two groups in osteopathic characteristics.

6.3 Possible Exterior Influences

The development of bladder control is dependent on several exterior influences on the children (e.g. age, psyche), which are unknown to the patients (except age) and cannot be considered in this study.

6.4 Variables used

The number of days per week when the patients were incontinent is an estimation by the parents and might differ from real conditions due to psychological reasons. Therefore, data were simplified and classified as "improvement" and "no improvement". Nevertheless, even this loose distinction might be error prone.
A specific journal concerning the micturition behaviour would have been more appropriate and would possibly have delivered more reliable data.

6.5 Sustainability of Therapy

For control group patients, treatments were considered to be sustainable, if recurrence of the symptoms did not result in a worse severity of enuresis after ceasing medical therapy in the last week before the final survey of the parents. For study group patients, treatment was sustainable when symptoms did not become worse between the fourth and fifth osteopathic treatment. That means that sustainability is granted for three weeks in the study group and for one week in the control group.

While data of the study group is rather objective (except possible errors in estimating frequencies), a higher error must be assumed in the control group, since it could not be controlled, if parents really ceased medical treatment for the whole week.

6.6 Conclusions

Osteopathic treatment results in similar improvements of enuresis compared to medical therapy. The main advantage of osteopathic therapy is its higher sustainability.

7 Discussion

The central question of this study was if osteopathy could have a positive influence on the treatment of children with enuresis.

With the monosynaptic and non-monosynaptic enuresis sufferers, six out of seven children were clear. In contrast to the control group, where six out of eight children with primary isolated enuresis were clear whilst taking medicine, but five of those began to wet the bed again once medication stopped, none of the children in the other group relapsed after a period of three weeks. An improvement in the incontinence frequency was also achieved in those who were incontinent during the day and night, in contrast to the control group who, despite medication showed little or no signs of the problem being alleviated. It must, however, be critically noted that only ten children were used for this study. It cannot be established from this, that the same success would be guaranteed if a larger number of children were involved in the study.

Unfortunately, there were no similar osteopathic studies available to support the findings of this study, or indeed to bring them into question. There are a great deal of medical studies that deal specifically with bladder capacity, the ADH and Desmopressin. Alternative medicine focuses on acupuncture, herbal medicines, Chinese medicine, hypnosis, kinesiology and manual therapies to deal with this issue. However, this is on a much smaller scale than standard forms of medicine. In a study of the Cochrane Database of Systematic Reviews, alternative studies were summarised and from these was a search for the best treatment. The best treatment against enuresis, according to this study, is the alarm waking system and the substitution of Desmopressin. It was critically noted with the other methods, that they could possibly help, but that the evidence for this is limited. [25]

The more one tackles the subject of enuresis, the more questions appear, that can not yet be answered. It is known that the problem is partly due to a genetic cause, and that for some children it is a result of acquired behaviour, that leads to a bodily dysfunction. It is interesting that in all cases of treatment the same osteopathic somatic disorder was found, namely in a lesion chain, the L5/S1, the sacrum, the right side of the bladder, and sometimes also on the right hip. The biggest osteopathic success was shown in children where the problem was not the result of an acquired bladder disorder. In conclusion, it can be said that osteopathy can be applied to treatment, but that further studies should still be conducted, to obtain more precise findings, and thus manifest success of the treatment.

8 Summary

8.1 Introduction

Enuresis is one of the most common illnesses in children and young people and is linked to a high level of subjective suffering for those involved. Despite our modern society, these children are, as before, stigmatised as being abnormal. Not many realise that it is a clearly defined illness that can start in a variety of forms. The

[25] URL: http://www.mrw.intersience.wiles.com/cochrane(6.4.2008)

central question in this study focuses on whether osteopathy can have a positive influence on the treatment of enuresis.

One can roughly distinguish between enuresis nocturna and functional urinal incontinence. These in turn are divided into sub-groups, from which comes primary isolated enuresis nocturna, primary non-isolated enuresis nocturna, secondary enuresis nocturna, and from this comes idiopathic urge incontinence, urine incontinence with micturition delay, and Detruser-Sphincter-Discoordination. The first group deals primarily with incontinence during the night and in the second group with incontinence during the day and night. The causes of bed-wetting are varied, whereby genetic causes are especially common, like a missing circadian rhythm in the ADH-excretion, linked to difficult awakening from sleep and a hereditary functional defect in the bladder (where it already starts to contract whilst it is being filled) or because of a bladder disorder. Unfortunately, this study could not deal with every group, so it concentrates on children with primary isolated enuresis, non-isolated enuresis and children with idiopathic urge incontinence.

With incontinence during the night, there is a spontaneous remission rate of 13% per year and amounts to approximately 1% more in adults, whereas incontinence during the day clearly reduces with age.

There are different possibilities for therapies to treat this illness. Ringing trousers and the substitution of Desmopressin have been the most successful in the struggle against incontinence, whereby it must be noted that the waking system has been shown to be the most effective in the battle against incontinence. It is however noteworthy that the waking system is very time consuming and requires a lot of motivation, and that Desmopressin can have side effects such as headaches and nausea, and that when the medication is stopped, many children become incontinent again.

8.2 Method

Ten children received osteopathic treatment five times every three weeks. The frequency of incontinence was measured using a sun and rain calendar. The control group were given medicine and for the final treatment session, the tablets were stopped for one week.

The statistics show that there was very little difference between the osteopathic treatments and Desmopressin for those who were incontinent during the night, but

after the treatment stopped, most of the children who received osteopathic treatment remained permanently dry, whilst almost all of those in the control group became incontinent again. The children who were incontinent during the day could often not be helped with medicine, whilst in contrast those receiving osteopathic treatment showed a vast improvement in their condition. However, it must be critically noted that as a result of the small number of children, there is, statistically, no significant difference.

8.3 Conclusion

Seven of the ten children remained dry for a long period because of the osteopathic treatment, whereby these cases dealt mostly with primary isolated enuresis nocturna. It was also striking that the children with the least psychological burdens were the easiest to treat. Six out of the seven children who were treated with medicine were also clear. However, once the medication stopped, five of those started to wet the bed again.
It can positively be noted that osteopathy helps with the treatment of enuresis, and the long-lasting effectiveness of this treatment is especially high compared to medical treatment.

9 Overview

Further studies should include patients with one and the same diagnosis in each group.
Parents should keep a journal concerning their child’s micturition behaviour, instead of estimating the number of days when their child was incontinent.
Long term sustainability should be checked by monitoring for a longer time after the last treatment.

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11 Appendix