A STUDY OF THE EFFICACY OF CHIROPRACTIC TREATMENT IN THE MANAGEMENT OF FUNCTIONAL NOCTURNAL ENURESIS.

by

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I, Nicola Grobler, do hereby declare that this dissertation is representative of my own work.

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to my mother and father, thank you

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ABSTRACT

A few studies have been conducted to investigate the efficacy of chiropractic treatment for enuresis viz: Gemmel et al. (1989), Leboeuf et al. (1991), Blomerth (1994), Reed et al. (1994) and Kreitz et al. (1994). The only controlled study was done by Reed et al. (1994), and even though it did indicate promising results it was not conclusive. Therefore, more evidence is needed to verify the success of chiropractic treatment for enuresis, especially in terms of spinal adjustments.

The purpose of this investigation was to evaluate segmentally specific spinal adjustments as compared with placebo treatment in order to determine the efficacy of the adjustments in the management of functional nocturnal enuresis.

It was hypothesized that chiropractic treatment and placebo would both be effective in the treatment of functional nocturnal enuresis. However, it was proposed that the chiropractic treatment would be more effective than the placebo or the natural remission rate of enuresis.

This study consisted of a single blind placebo controlled trial of a sample population diagnosed with functional nocturnal enuresis. Thirty subjects were randomly devided into two groups: the control group and the experimental group. The control group received

placebo treatment only whereas the entire experimental group received spinal adjustments to T11-L2, L5 and the SI joints.

Each subject was treated ten times over a period of four weeks preceded and followed by a two week baseline and a two week follow-up period.

The results were analyzed at a 95% confidence level as follows:

1. The average number of wet nights per week for each group was calculated.
2. The data obtained from the enuretic diary were statistically evaluated using the non-parametric Wilcoxon Signed Rank test. The groups were evaluated within themselves at weekly intervals.
3. Comparison of the results of the control group with the experimental group was statistically evaluated using the Mann-Whitney U test. The comparison was made at weekly intervals.
4. Improvement was calculated based on the percentage difference in number of wet nights between the baseline period, the final treatment and the follow-up treatment..

Thus the study was conducted over an eight week period for both groups.

The results indicated that there was a significant statistical improvement in the experimental group during the last two weeks of the study (the follow-up period) when compared to the baseline period ($p = 0.004$ and $p = 0.013$). There was no significant

improvement in the control group. The only significant difference in the efficacy when comparing the two groups was noted during week seven of the study ($p = 0.048$). However, in terms of the average number of wet nights, the experimental group showed a greater improvement than the control group (week 6: 32.11% - experimental group and 18.54% - control group; and week 8: 44.32% - experimental group and 26.42% - control group), but this did not demonstrate any significant statistical relevance.

There was 40% success (50% or more reduction in bedwetting frequency) in the experimental group. In the control group it varied from 13.3% (week 6) to 26% (week 8).

The results suggest a clinically significant effect of chiropractic manipulative therapy in the treatment of functional nocturnal enuresis. Thus the author concluded that the use of adjustments for functional nocturnal enuresis was relatively effective compared to placebo treatment.

There was sufficient clinical appraisal to conclude that both groups showed improvement but that that of the control group was no better than the natural remission rate of 15% per year.

A further study of larger sample size and longer duration is necessary to identify the long-term effect of the treatment and to add to the validity of the current results. The patient

characteristics (e.g. level of spinal fixations) should also receive greater attention in future studies.

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DEFINITIONS OF TERMS

Adjustment:

A spinal adjustment is a passive, manual manoeuvre during which an articulator element is suddenly carried beyond the usual, physiological limit of movement without however exceeding the boundaries of anatomical integrity. The usual, but not obligate, characteristic of an adjustment is the thrust which is a brief, sudden and carefully controlled minimal dose or impulse of force and amplitude delivered at the end of the normal passive range of motion and which can be accompanied by a cracking noise. (Bryner, 1988).

Chiropractic:

Chiropractic is a discipline of the scientific healing arts concerned with the pathogenesis, diagnostics, therapeutics and prophylaxis of functional disturbances, pathomechanical states, pain syndromes and neurophysiological effects related to the statics and dynamics of the locomotor system, especially of the spine and pelvis (Bryner,1988).

Chiropractic treatment:

For the purpose of this study it consisted of spinal adjustments to the thoraco-lumbar region and the lumbo-sacral region eg., T11-12, L5 and the SI joints.

Cure (Dry)

One or fewer wet nights per week (Leboeuf et al., 1991).

Enuresis

A lack of bladder control in a child who has reached an age when urinary control is usually expected. It may be nocturnal, diurnal, or both. Enuresis is primary if bladder control has never been completely present and secondary (acquired) if urinary incontinence has not occurred for a prolonged period (six months or more). It is considered as functional in the absence of any underlying cause. (Mekkelsen, 1980: Rushton, 1989; Toffler, 1991).
For the purpose of this study functional nocturnal enuresis was considered only if it was of the primary type.

Homeostasis

The level of well-being of an individual maintained by internal physiologic harmony (Haldeman, 1992: 623).

Fixation:

A state whereby a vertebra or pelvic bone has become temporarily immobilised in a position which it may normally occupy during any phase of physiological spinal movement (Bryner, 1988).

For the purpose of this study spinal fixation should be regarded as synonamous with bony subluxations, manipuble joint lesions and spinal joint dysfunction.

Joint dysfunction:

Joint mechanics showing area disturbances of function without structural changes; subtle joint dysfunctions affecting quality and range of joint motion. They are diagnosed with the aid of motion palpation, and stress and motion radiography investigation. (Haldeman, 1992: 623).

Subluxation:

An aberant relationship between two adjacent articular structures that may have functional or pathological sequelae, causing an alteration in the biomechanical and / or neurophysiological reflextions of these articular structures, their proximal structures, and / or body systems that may be directly or indirectly affected by them (Haldeman, 1992: 627).

Manipulation:

Spinal manipulative therapy broadly defined includes all procedures where the hands are used to mobilize, adjust, manipulate, apply traction, massage, stimulate, or otherwise influence the spine and paraspinal tissues with the aim of influencing the patient's health (Haldeman, 1992: 624).

Neurodystrophic:

The disease process within a nerve resulting from trauma, circulation disorders, or metabolic diseases, e.g., a neurodystrophic factor (diabetes and pernicious anaemia) (Haldeman, 1992: 625).

Placebo treatment:

A procedure with no intrinsic therapeutic value performed in controlled studies to determine the effect of the treatment (Dorland's, 1989).

Success

A reduction of 50% or more in the wet night frequency (Leboeuf et al., 1991).

CHAPTER 1

INTRODUCTION

The word "enuresis" is derived from the Greek word "enourein" - to void urine. Nocturnal enuresis, or bedwetting, has puzzled physicians for many centuries with medical literature dating back to the Papyrus Ebers of 1550 BC. (Glicklich, 1951).

Primary functional nocturnal enuresis can be defined as persistent wetting of the bed at night in the absence of neurological or urological pathologies such as diabetes, urinary tract infection or seizure disorders (Toffler et al., 1991).

Despite many attempts to pinpoint specific predisposing factors since that time, the cause remains unclear. Some of the more prominent theories implicate developmental delay or maturational lag; genetic factors; sleep disorders; psychological factors; anatomical abnormalities; or inadequate antidiuretic hormone secretion. (Rosenfeld et al. 1991).

Nocturnal enuresis is a clinical problem in which there is usually spontaneous resolution of 15% per year (Norgaard, 1991). It commonly affects the emotions and behaviour of both

the child and the parents. Nocturnal enuresis is not a "socially acceptable behaviour" and its significance is often magnified. (Warady et al. 1991).

Historically, the initial management of the bedwetting child emphasised punishment, humiliation and other negative feedback. Today it is understood that these responses are not only wrong but that they also compound the problem by diminishing the child's self-image. (Rosenfeld et al., 1991). Current trends in treating the condition are directed at the regime of allopathic drugs consisting of Imipramine hydrochloride (brand name Tofranil), an antidepressant; Oxybutynin chloride (brand name Ditropan), an antispasmodic agent; and Desmopressin acetate (DDAVP), a synthetic antidiuretic hormone. (Graham, 1986; Novello et al., 1987; Lovering et al., 1988; Toffler et al.,1991; Warady et al., 1991).

However, the use of allopathic medication is not without complications for the following reasons:

- The short term effectiveness of these drugs;
- The side effects produced by the long-term use of these drugs;
- The financial implication of the long-term drug therapy. (Rosenfeld et al., 1991; Warady et al., 1991; Steele, 1993).

There has been a lot of anecdotal evidence indicating that chiropractic manipulation is effective in treating bedwetting. According to Jamison et al. (1992) the rationale for the spinal intervention in the management of visceral conditions - such as enuresis - is based upon empiricism.

Single case studies by Gemmel and Jacobson (1989) and Blomerth (1994) both reported successful chiropractic intervention in treating nocturnal enuresis. However, a clinical study by Leboeuf et al. (1991) found that their results did not support the claims that chiropractic care is an effective therapy for nocturnal enuresis.

In a placebo controlled clinical trail Reed et al. (1994) concluded that although their results did not reach statistical significance, a trend toward the effectiveness of chiropractic treatment for primary nocturnal enuresis was suggested.

From the above studies a number of factors need to be highlighted:

- Both the studies by Blomerth (1994) and Gemmell and Jacobson (1989) were single case time series designs.
- Placebo, maturation and natural history cannot be ruled out in the study by Gemmell and Jacobson (1989).
- Criticism against the study by Lebouef et al. (1991) is that:
  * it was not placebo-controlled;
  * it did not direct its treatment to specific segments;
  * the baseline period was insufficient;
  * the follow-up periods was relatively brief in duration; and
  * it was based on a clinical rather than an experimental model.

- Neither Reed et al. (1994) or Lebouef et al. (1991) directed their treatment to specific spinal segments (related to the nerve supply to the bladder) and neither indicated which areas were treated and if these areas were consistent in the various subjects.

This study therefore proposed to investigate the effect of specific spinal segmental chiropractic adjustments with respect to the number of wet nights per week in order to determine the role chiropractic treatment plays in the management of functional nocturnal enuresis.

Chiropractic therapy may be a viable, effective and safe non-pharmacological alternative for the treatment of functional nocturnal enuresis.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

2.1 Introduction

The ensuing discussion focuses on the literature available at present regarding functional nocturnal enuresis, the physiology of this condition as it pertained to this study, and the current medical and chiropractic trends towards the management and treatment of the condition.

2.2 Medical background to enuresis

Enuresis can be defined as the lack of bladder control in a child who has reached an age when urinary control is usually expected (approximately 5 years of age) (Toffler et al., 1991). Primary enuresis refers to those children who have never achieved continence and the classification of secondary (or acquired) enuresis includes those children who have achieved continence for at least six months and have subsequently lost it. Diurnal refers to

urinary incontinence during the daytime, while nocturnal refers to voiding during sleep. Enuresis will be considered as functional in the absence of any underlying cause such as diabetes, urinary tract infection or seizure disorders. (Mikkelsen et al.,1980; Rushton,1989: Toffler et al.,1991; Blomerth,1994; Reed et al.,1994).

The normal development of urinary control follows a characteristic pattern in children, but at a somewhat individual rate. The attainment of the developmental "milestones" of urinary control appears to be the result of central nervous system mediation. In the infant, the process of elimination is reflexive and there is no conscious control or cortical involvement. Near the age of 1 to 2 years, the child begins to develop an awareness of the sensations that accompany bladder fullness. At approximately 3 years of age, the child is able to retain urine by voluntarily conscious control of his musculature. Micturition can usually be voluntarily initiated around 4 years, and by 6 to 7 years, the child can void at will with any amount of bladder distension. (Doleys et al., 1982).

2.3 Anatomy of the bladder

The urinary bladder is a muscular sac or vesicle for urinary storage. In the adult the empty bladder lies in the pelvis minor. In infants and children the bladder is in the abdomen even

when empty. The bladder begins to enter the pelvis major at about 6 years of age, but it is not entirely within the pelvis minor until after puberty.

The urinary bladder is a hollow viscous with strong muscular walls and is characterised by its dispensability. Its shape, size, position, and relations vary with the amount of urine it contains and with the age of the person. (Moore, 1985: 359).

The urinary chamber is a smooth muscle chamber composed of two principal parts:

(1) the body, which is the major part of the bladder, in which the urine collects, and (2) the neck, which is a funnel-shaped extension of the body, passing inferiorly to the urethra.

The smooth muscle of the bladder is known as the detrusor muscle. On the posterior wall of the bladder, immediately above the bladder neck, the two urethras enter the bladder.

The bladder neck muscle is known as the internal sphincter. Its natural tone normally keeps the bladder neck and posterior urethra empty of urine and therefore prevents emptying of the bladder until the pressure in the body rises above a critical threshold.

The external sphincter is a voluntary muscle in contrast to the muscle of the bladder body and bladder neck, which is an entirely smooth muscle. This external muscle is under voluntary control of the nervous system and can be used to prevent urination even when the involuntary controls are attempting to empty the bladder. (Guyton, 1992: 243-4).

2.3.1 Innervation of the bladder

The bladder receives its innervation via the visceral plexus, which has sympathetic fibres arising from T11-L2 and parasympathetic fibres arising from S2-S4. The parasympathetic nerve supply to the bladder is from the pelvic splanchnic nerve. They are motor to the detrusor muscle and inhibitory to the internal sphincter of the bladder. Hence when these fibers are stimulated by stretching, the bladder contracts, the internal sphincter relaxes, and urine flows from the bladder into the urethra. Parasympathetic fibres are thus exclusively responsible for emptying of the bladder.

The external sphincter of the bladder is innervated by motor fibers from the pelvic and pudendal nerves which are somatic to the skeletal muscle of the sphincter.

The sympathetic fibers to the bladder are derived from T11, T12, L1 and L2 nerves. These fibers are via the hypogastric nerve and are inhibitory to the bladder

The sensory fibers from the bladder are visceral and transmit pain sensations (e.g., from overdistension of the bladder). The nerves supplying the bladder from the visceral nerve plexus consist of both sympathetic and parasympathetic fibers. This plexus is continuous with the inferior hypogastric plexus. (Moore,1985: 361: Guyton, 1992: 244).

2.3.2 Micturition process

Micturition is the process by which the urinary bladder empties when it becomes filled. Basically the bladder progressively fills until the tension in its walls rises above the threshold value, at which time a nervous reflex called the micturition reflex occurs that causes micturition or, if it fails in this, at least causes a conscious desire to urinate. (Guyton, 1992: 243).

The reflex contraction of somatic muscle produced by the stimulation of visceral afferent nerves is called the viscerosomatic reflex or visceromotor reflex. Visceromotor reflexes commonly operate during the control of respiration and micturition and under several other physiologic conditions. (Sato, 1993: 93).

During regulation of micturition, afferent information from the stretch receptors of the bladder controls the contractility of the external sphincter muscle of the urethra, which is composed of striated muscle fibers. When the bladder is distended by urine, afferent information is transmitted into the spinal cord through the visceral system. This afferent activity triggers an increase in efferent nerve activity of the somatic pudendal nerve, thus contracting the external sphincter muscles of the urethra. This prevents incontinence. During micturition, the bladder contracts strongly, and as intravesical pressure increases, the sphincter muscle of the urethra relaxes, allowing passage of urine through the urethra.

There are centers for these bladder-urethral external muscle reflexes in both the brianstem and the spinal cord. (Sato, 1992: 93).

2.3.3 The micturition reflex

Micturition contractions are the result of a stretch reflex initiated by sensory stretch receptors in the bladder wall. Sensory signals are conducted to the sacral segments of the cord through the pelvic nerves and then back again to the bladder through the parasympathetic fibers in these same nerves.

Once a micturition reflex begins, it is self regenerative. That is, initial contraction of the bladder further activates the receptors to cause still further increase in sensory impulses from the bladder and posterior urethra, which cause further increase in reflex contraction of the bladder, the cycle thus repeating itself again and again until the bladder has reached a strong degree of contraction. Then, after a few seconds to more than a minute, the reflex begins to fatigue, and the regenerative cycle of the micturition reflex ceases, allowing rapid reduction in bladder contraction. Once a micturition reflex has occurred but has not succeeded in emptying the bladder, the nervous elements of this reflex usually remain in an inhibited state for at least a few minutes to sometimes as long as an hour or more before another micturition reflex occurs.

However, as the bladder becomes more and more filled, micturition reflexes occur more and more often and more powerfully, until still another reflex occurs, which passes through the pudendal nerve to the external sphincter to inhibit it. If this inhibition is more potent than the voluntary constrictor signals to the external sphincter from the brain, urination will occur. If not, urination will not occur until the bladder fills to a greater capacity and the micturition reflex becomes more powerful. (Guyton, 1992: 244-5).

2.3.4 Control of micturition by the brain

The micturition reflex is a completely autonomic cord reflex, but it can be inhibited or facilitated in the brain by means of: (a) strong facilitatory and inhibitory centers in the brain stem, probably located in the pons, and (b) several centers located in the cerebral cortex that are mainly inhibitory but can at times become excitatory.

The micturition reflex is the basic cause of micturition, but the higher centers normally exert final control of micturition by the following means:

- The higher centers keep the micturition reflex partially inhibited all the time except when micturition is desired.

- The higher centers prevent micturition, even if a micturition reflex occurs, by continued tonic contraction of the external bladder sphincter until a convenient time presents itself.
- When the time to urinate arrives, the cortical centers can (a) facilitate the sacral micturition centers to help initiate a micturition reflex and (b) inhibit the external urinary sphincter so that urination can occur. (Guyton, 1992: 244-5).

2.4 Prevalence

Nocturnal enuresis occurs in 15-20% of children at the age of five years and this decreases to 1-2% at the age of sixteen years. There is a natural remission rate of 15% per year. The incidence is higher in boys than girls and this indicates that girls generally obtain continence earlier than boys. (Norgaard, 1991).

In some studies the prevalence correlates with social class, and it is commonly found in institutionalised children (Warady et al., 1991). Enuresis also occurs more frequently in lower socio-economic populations and in larger families (Rushton, 1989). There is evidence of a genetic predisposition to bedwetting as it is more likely to occur in children whose parents were bedwetters than in those without the history (Bakwin, 1973: 74).

Numerous epidemiological studies of the prevalence of nocturnal enuresis have been conducted but a comparison of the different studies is difficult as no exact definition of nocturnal enuresis exists: a different number of wet nights per week or month has been used to define an enuretic child, and different methods of investigation have been used. The statistical reliability of the reported prevalence depends on the number of children in each survey. Moreover, there are variations of prevalence in different countries as the prevalence rates vary according to where the studies have been conducted. (De Jonge, 1973: 45). In and around the Durban region (South Africa) a prevalence of 28% was

found (Broughton, 1986) in comparison to a prevalence of 39% in Australia, 29% in the U.S.A. amongst whites, 12% in England, and 8% in Sweden (De Jonge, 1973:45-6).

TECHNIKON NATAL

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2.5 Aetiology

The exact cause of primary functional nocturnal enuresis is as yet unknown. However, several factors may singly or jointly, result in bedwetting.

Approaches to the pathophysiology thereof may be directed towards the following categories:

1. Developmental delay or maturation lag;
2. Psycho-social factors;
3. Genetic factors;
4. CNS (sleep) disturbances;
5. Anatomic abnormalities / Bladder-urethral-dysfunction; and
6. Endocrinology. (Norgaard, 1991; Rosenfeld et al., 1991).

At present, developmental delay is widely accepted as a cause of bedwetting. According to Rosenfeld et al. (1991), nearly 85% of bedwetting children demonstrate an infantile type pattern on urodynamic evaluation. It is suspected that delayed maturation of certain areas in the central nervous system reduces the effectiveness of night-time control of reflex bladder contractions and this leads to urinary incontinence during sleep.

It is thought that stress during critical times of learning and developing may affect normal development of bowel and bladder control. There does appear to be an increase incidence of bedwetting in children of broken homes and in children who have had traumatic separations from family members. Although stress does not appear to be the cause in the majority of patients, it should be considered as a possible contributing factor when a child reverts to bedwetting after attaining normal bladder control both by day and by night. Occasionally, in children with severe psychological or psychiatric problems, bedwetting is a part of the symptom complex. However, it is usually obvious in these children that bedwetting is only part of an overall problem. (Rosenfeld et al., 1991).

According to Bakwin (1973: 74) there is strong evidence for the genetic factor as enuresis is more likely to occur in children whose parents were bedwetters than in those without this history. He states that as many as 77% of children are enuretic when both parents have a similar history in contrast to the 15% incidence when neither parent was enuretic.

It is frequently noted in the bedwetter's history that he or she is a "deep sleeper". Rosenfeld et al. (1991) suggests that this hypothesis may be a facet of developmental delay being reflected as an immature sleep pattern that allows uninhibited reflex of the bladder during sleep. Various studies found and supported the fact that enuresis can take place in any sleep stage and is randomly distributed throughout the different sleep stages

proportional to the time the child spends in each stage (Mikkelsen et al., 1980; Norgaard et al., 1985). Also, the sleep pattern in enuretic children does not differ from that of aged matched control subjects (Kales et al., 1977). It is still not known why enuretics do not wake up but the recent publications seem to indicate that enuretics are normal sleepers (Norgaard et al., 1985).

Most children with nocturnal enuresis have neither an organic nor a psychiatric illness. Accordingly excessive investigations should be discouraged. A urinalysis should be performed in all enuretic children to rule out the presence of a urinary tract infection, diabetes mellitus, or an active urinary sediment that may suggest the presence of underlying kidney disease. Only when abnormal findings are noted from the history and physical examination or a urinalysis should imaging studies and a urodynamic evaluation be considered to exclude vesicoureteral reflux, bladder outlet obstruction, and hydroureteronephrosis associated with a thickened unstable bladder. (Rushton, 1989; Warady et al., 1991).

According to Rosenfeld et al. (1991) as many as 45% to 50% of children with documented urinary tract infection have episodes of night-time incontinence. He also states that vesicoureteral reflux occurs in 30% to 40% of all children with documented bacteriuria, whether they have urinary incontinence or not.

Bladder capacity is thought to play a role in the aetiology of enuresis. Children with enuresis tend to have a smaller bladder capacity than non enuretic controls or siblings (Starfield, 1967). It has been suggested that the actual difference is not in the size of the bladder (true bladder capacity) but rather in the ability of the bladder to hold urine without contracting (functional bladder capacity).

Norgaard et al. (1985) found that the bladder capacity of older children with nocturnal enuresis was normal, but that nocturnal urine output was markedly greater than daytime urine production and exceeded the functional bladder capacity. The aetiology of polyuria in some patients may be due to insufficient secretion of antidiuretic hormone (vasopressin) during sleep where the urinary volume does not decrease and the bladder essentially has more than it can handle. Of greater importance may be the presence of an abnormal diurnal increase in the night-time level of vasopressin and associated decrease urine production is not present. (Norgaard et al., 1985; Rittig et al., 1989). The result is the production of an excessive amount of poorly concentrated urine at night (Warady et al., 1991).

2.6 The effect of spinal adjustments on the autonomic function

The basic principle of chiropractic encompasses the primary role of the nervous system in the maintenance of homeostasis (health). Homeostasis depends on optimal communication between the brain and the rest of the organism. Nervous system dysfunction may result from a variety of stressors (e.g. genetic, psychological, environmental, mechanical). Optimising neurospinal relationships helps the organism to cope with psychological or environmental stressors. (Plaughter et al., 1993: 357).

The autonomic nervous system (ANS) - the self-regulating, visceral motor (efferent) and visceral afferent component of the nervous system - functions to a large extent in response to environmental stimuli that may originate from outside the body or from within a specific organ or tissue. These sensory signals are carried to the central nervous system (CNS) by afferent neural connections, where they are integrated with other somatic or visceral sensations. An appropriate regulatory efferent response is then transmitted through the autonomic nervous system to affect an alteration in visceral function if necessary. Therefore, sensations such as pain, temperature fluctuations, proprioception, touch, pressure, vibration, and stretch may reflexively elicit an autonomic response that functions to achieve and maintain homeostasis. (Cauwenbergs, 1995:235-7).

The sympathetic and parasympathetic divisions of the autonomic nervous system function to regulate and maintain the internal body environment. Although predominantly self regulatory, the autonomic nervous system is not limited to self-regulation but includes conscious control of external factors, such as somatic sensations, which in turn influence the regulatory activity of the autonomic nervous system. This is of particular clinical significance, as therapeutic intervention that alters somatic or visceral function may have effects in body systems apparently remote from the site of applied therapy. It appears that somatic and visceral functions are co-ordinated closely through somatovisceral and viscerosomatic reflex mechanisms involving the autonomic nervous system, peripheral nervous system, and central nervous system. Therapeutic interventions such as vertebral manipulation can therefore influence somatic sensations in such a way that visceral function may become altered. (Cuawenbergs, 1995:236-8).

"Although conservative medicine accepts the importance of the autonomic nervous system in achieving body homeostasis, it has yet to come to terms with the notion that spinal joint fixation can deleteriously influence normal body reflexes with predictable results" (Jamison et al., 1992).

The earliest of the chiropractic "somato-visceral disease" models were quite simplistic and based on the notion that misaligned (i.e. subluxated) vertebrae were capable of compressing both somatomotor and visceromotor nerve fibers where they exited their

respective intervertebral foramina. It was asserted that such nerve interferences might be expected to interrupt the flow of vital forces to innervated organs, thereby leading to their eventual demise. These theories are now considered inconsistent with concepts and principles of human anatomy and physiology. (Nansel et al., 1995).

The primary focus of chiropractic is based on the premise that nervous system dysfunction from vertebral subluxation will interfere with the brain's regulation of physiology. Aberrant somatovisceral reflexes may also be caused by spinal dysfunction. (Plaughter et al., 1993 :357). Spinal joint dysfunction (subluxation) may, according to Reed et al. (1994), disrupt the complicated integration of somatic, spinal, parasympathetic and sympathetic nerve pathways, thus contributing to the subject's enuretic condition.

According to Jamison et al. (1992) the hypothesis underlying chiropractic intervention in visceral disorders is based upon the postulation that spinal adjustment can modify autonomic nervous system balance and/or activity. Bony subluxations or "manipulable joint lesions" are believed to affect somato-somato, somato-visceral, viscero-somatic and viscero-visceral pathways. Correcting of bony subluxations is anticipated to modify the biological impact of such spinal dysfunction with a resultant clinical impact on pain generation and smooth muscle tone.

Coote (1978: 91-120) has proposed that visceral conditions could be associated with three possible somatosympathetic reflex pathways: the segmental, propriospinal and suprasegmental pathways. The segmental pathway involves an afferent nerve which excites preganglionic neurons over a single segmental pathway: in the propriospinal pathway, afferent nerves are excited by preganglionic neurons from adjacent or remote segments; and in the suprasegmental pathway, an afferent volley ascends to the brain stem and activates descending pathways in the lateral funiculus of the spinal cord. Segmental pathways are limited to a single segment. The propriospinal pathway is more widespread, but still somewhat localised; no effect can be demonstrated more than six segments away from the afferent stimulus. In contrast to the confined response of the segmental pathway and the localised effect of the propriospinal pathway, the suprasegmental pathway can excite a response independent of the location of the stimulus. (Jamison et al., 1992).

The spinal fixation as a clinical phenomenon has been the subject of clinical and experimental research. The afferent bombardment of dorsal horn cells, which is theoretically produced by the spinal fixation, may well affect various somatosomatic and somatoautonomic reflexes. (Leach, 1986: 105).

The hypothesis that spinal fixations could cause the somatic efferent bombardment of dorsal horn cells necessary to alter somatoautonomic reflexes, is termed the somatoautonomic reflex hypothesis. It appears that such reflexes can set into motion a

wide variety of abnormal pathological and functional processes including such conditions as asthma and gastrointestinal complaints. (Leach, 1986: 149-150).

The spine with its rich bed of afferent receptors may also receive stimulation during a chiropractic adjustment. Stimulation of these afferent nerve endings can trigger autonomic effector responses. This type of response is based on the anatomical distribution of the spinal afferent nerves. (Briggs et al., 1983).

The paired sympathetic trunks and their ganglia extend the length of the vertebral column (paravertebral) and are closely related to the antero-lateral aspect of vertebral bodies and intervertebral discs throughout their course (Moore, 1985: 280, 382, 1020). In a study on more than 1000 dissecting room cadavers, Lipschitz et al. (1988) concluded that conditions such as abnormal biomechanics, subluxations, bony spurs, and other pathologies at intervertebral and costovertebral joints may have a profound influence on sympathetic functions.

Sato (1992) demonstrated in an animal based study, that sensory stimulations - including cutaneous, muscle and articular sensory stimulation - can produce various autonomic reflex responses to visceral organs depending on the extend and level of somatic afferent nerve stimulation, e.g. a reflex increase in heart rate, decrease in blood pressure, inhibition or facilitation of gastric motility and reflex inhibition of micturition contractions. Some

responses are excitatory and others are inhibitory. Some responses have dominant sympathetic efferent involvement, whereas others have parasympathetic involvement. Some responses have propriospinal and segmental characteristics, whereas others have supraspinal and generalised characteristics in their reflex nature. Sato concluded that during spinal manipulative therapy in conscious humans, stimulation of various somatic afferents may produce the autonomic reflex responses principally similar to those observed in anaesthetised animals.

Briggs et al. (1983) studied the relationship between a cervical chiropractic adjustment, in subluxated vs. unsubluxated subjects, and the autonomic response monitored as change in pupillary diameter. Their results indicated that: (a) a successful adjustment elicits either a parasympathetic or sympathetic response - observed by looking for changes in the pupillary diameter; (b) the vertebral level at which the adjustment is administered has undetectable specificity for the parasympathetic or sympathetic input to the pupil; (c) unsubluxated subjects generally exhibit no change in pupillary diameter following a sham adjustment and (d) subluxated subjects exhibit variable preadjustment pupillary diameters, with significant pupillary diameter changes in response to an adjustment. They concluded that autonomic somatovisceral reflexes of a non-specific nature can be elicited following a chiropractic adjustment. The data obtained in their study suggest that a visceral reaction can be related to the presence or absence of subluxations, as well as being a consequence of the adjustment.

A non randomised pilot study by Pikalov et al. (1994) showed that the use of spinal manipulative therapy (SMT) resulted in pain relief and earlier clinical remission than traditional care did in the treatment of duodenal ulcers. Both the experimental and the control groups followed a standard dietary regime for ulcer disease. This study was based on the interrelationship between the musculoskeletal system and the visceral organs with the autonomic and central nervous system as mediator. The authors state that the possible role of stimulation of the endogenous opiate system by spinal manipulative therapy cannot be excluded as a probable healing mechanism in the healing process of duodenal ulcers. They suggest that manipulative treatment may be effective by normalising the action of the autonomic nervous system which influences both the cellular metabolism and the vasomotor dynamics of the stomach and duodenum.

"Based on the lack of predictability as to the nature of given visceral responses to an adjustment, it appears that the efficacy of the chiropractic adjustment rests in the removal of subluxations as opposed to being a treatment entity for specific symptoms associated with visceral organ systems." (Briggs et al., 1983).

2.7 Treatment

2.7.1 Introduction

Numerous theories and treatment modalities for enuresis have been introduced. Warady et al., (1991) state that the treatment of the child with nocturnal enuresis should, in all cases, emphasise education about the problem and the correction of misconceptions, as children are often punished for a disorder which is completely beyond their control. They feel that it is imperative for the care provider to understand the perceptions of the family and to correct these perceptions when necessary. The child requires and deserves reassurance about the problem and factual information as to its cause and likely course.

2.7.2 Conditioning therapy and behaviour modification

The most successful method of treatment that can be suggested to the family is the use of conditioning therapy (alarm system) or behaviour modification techniques (Ack et al., 1985). The findings of Iester et al. (1990) showed that behavioural therapy gave better results in functional enuresis than pharmacological therapy. They pointed out the usefulness of combining bladder retention training and behavioural therapy to improve the

general maturity and autonomous behaviour of children, which resulted in positive effects on their personalities.

In functional enuresis the bladder has a small capacity: consequently, exercises are useful and may improve the situation. Bladder stretching exercises are helpful to increase functional bladder capacity as well as to improve the child's control over the urination reflex. The procedure is based on encouraging the child to hold the urine as long as possible between voidings. Stream interruption exercises and increased fluid intake have also have been encouraged. (Novello et al., 1987).

Restricting fluids, particularly those with diuretic properties, prior to bedtime and encouraging urination may be of some value but seem to have had little effect in more problematic cases (Novello et al., 1987). There are no studies on this approach, but according to Norgaard (1991) general agreement is that fluid intake should be avoided.

Conditioning therapy centers on the use of a signal alarm device. The bell and pad system is one of the most successful therapies with a long-term cure rate of 50-60% (Norgaard, 1991). According to Wille (1986) the alarm system is the only treatment that has been proven to alter the natural history of enuresis. It usually involves attaching an electronic clip that is very sensitive to any wetness to the front of the child's underwear / pyjamas. When the child urinates even a drop, an alarm immediately beeps until disconnected. (Ack

et al., 1985). In this manner, the alarm teaches the child to become aware of the sensation of a full bladder and to awaken to void. Various alarms are available and NyTone and Wet-Stop are brand names of such alarms (Warady et al., 1991). According to Steele (1993) success with the alarm depends on the child's motivation and the parents' willingness to help waken the child during the initial nights of treatment. Controlled trials on the efficacy of the urine alarm have shown that it is superior to medication, hormone replacement, and behavioural therapy (Mikkelsen et al., 1980; Novello et al., 1987).

2.7.3 Pharmacological therapy

2.7.3.1 Imipramine hydrochloride

The most common method of treatment, although less successful than conditioning, has been the use of Imipramine hydrochloride (brand name Tofranil), a tricyclic antidepressant. It is thought to decrease the depth of sleep, allowing the child to wake up more easily. (Ack et al., 1985). The drug may work by altering sleep rhythms or by an andronergic or anticolinergic mechanism, though anticolinergic drugs prescribed alone are ineffective (Graham, 1986: 200).

Tricyclic drugs used in adults for treating depression have produced improvement in a significant number of enuretic children (Graham, 1986: 200). Reported cure rates range from 25% to 40% (Novello et al., 1987; Rusthon, 1989). Relapses usually occur when the drug is stopped, which has occurred in up to 90% of the cases (Warady et al., 1991). Most clinicians are reluctant to use drugs for this relatively benign condition. The drugs can be useful when it is important for the child to be dry for a short period, e.g. when going camping. (Graham, 1986: 200). Side effects are relatively frequent and often lead to the discontinuing of the medication. The most common reported side effects are dry mouth, blurred vision, mood alterations, lethargy, headaches, abdominal pain and mild sleep disturbances. (Novello et al., 1987).

2.7.3.2 Oxybutynin chloride

Oxybutynin chloride (Ditropan), an antispasmodic agent that exerts a direct effect on smooth muscle and inhibits the muscaranic action of acetylcholine on smooth muscle, is a useful drug for children with daytime incontinence and voiding dysfunction. However, several placebo controlled studies have failed to demonstrate a beneficial effect from Oxybutynin on nocturnal enuresis. Adverse reactions similar to any other anticholinergic drug have been noted. (Novello et al., 1987; Lovering et al., 1988; Warady et al., 1991).

2.7.3.3 Desmopressin acetate

Desmopressin acetate (DDAVP), a synthetic antidiuretic hormone (ADH), has shown promising results in the treatment of nocturnal enuresis. This treatment is based on the theory that enuretic children may possess an insufficient nocturnal secretion of antidiuretic hormone. (Norgaard et al., 1985; Novello et al., 1987; Rittig et al., 1989; Toffler et al., 1991). The proposed mechanism of action is a decrease in night-time urine production to a level less than that of the functional bladder capacity (Rusthon, 1989). The intranasal spray is applied directly to the nasal mucosa, with half of the dose sprayed into each nostril. The dosage should be adjusted according to the individual response.

Desmopressin has been found to have a success rate of 41%. Although the pharmacological effect of the drug ceases immediately on withdrawal, it appears to be a reasonable agent to use in those children needing fast results on specific occasions. (Novello et al.,1987). More resent studies have indicated persistent resolution in as many as 70% of patients continuously maintained on the drug with minimal side effects (Warady et al., 1991). Generally, in all studies with Desmopressin a significant relapse rate has been found after withdrawal of treatment. Side effects are usually mild and limited to mild mucosal irritation, epistaxis, headaches, nasal congestion and occasional gastrointestinal upset (Toffler et al., 1991).

Wille (1986) found that patients on Desmopressin became dry immediately after the onset of treatment, whereas patients on the bell and pad system had a slower onset of action but a smaller relapse after the end of treatment. Relapse rates with Desmopressin were found to be lower than those with Imipramine (Mann,1991).

2.7.4 Chiropractic treatment

Spinal joint dysfunction (subluxation) may disrupt the complicated integration of somatic, spinal, parasympathetic and sympathetic nerve pathways, thus contributing to a subject's enuretic condition (Reed et al.,1994). There is a lot of anecdotal evidence indicating that chiropractic treatment is effective in treating bedwetting (Leboeuf et al. 1991).

Gemmell and Jacobson (1989) did a single case time-series descriptive design study of a 14 year old boy with enuresis. A measurable treatment effect was observed with spinal manipulation. While the subject's enuresis was not cured, it was alleviated by the treatment program, suggesting that the enuresis may have been due, in part, to a dysfunctional L5/S1 facet joint. They stress the importance of not being misunderstood as suggesting that spinal joint dysfunction (subluxation) causes enuresis, as the presence of uncontrolled factors in the study did not permit cause-and-effect conclusions. They

insisted that more rigorous methodology would need to be incorporated into this single case study design to attribute the success of treatment to manipulation.

A clinical study to investigate the prospective outcome of nocturnal enuresis was done by Leboeuf et al. (1991). Treatment consisted of manipulation of the areas of aberrant spinal movement as detected by observation and palpation. Participation in other concurrent therapies was discouraged. Treatment continued until fewer than two wet nights over a two week period occurred, no alteration in night-time urinary frequency within eight visits occurred, or if the child exhibited no further response following some initial improvement. With a 15.5% 'cure' rate the results of the study did not support the claims that chiropractic care is an effective therapy for this condition. The cure rate was found to be within the limits of the natural remission rate.

Criticism against the study is that:

- It did not direct its treatment to specific segments (related to the nerve supply to the bladder);
- It was not placebo-controlled;
- The fact that fifth year chiropractic interns delivered the treatment may have diminished the effect of the manipulations;
- The baseline period was insufficient;

- The follow-up period was relatively brief in duration;
- It was based on a clinical rather than strict experimental model. (Johnson, 1991 and Kawchuk, 1991).

Blomerth (1994) discussed a patient (an 8 year old boy) with primary nocturnal enuresis whose symptoms resolved following manipulation. He concluded that the patient's improvement could not be attributed to a placebo effect as the patient did not know that he was being treated for this condition. This patient received long-term treatment and the author suggests that in this patient there was a causal relationship between lumbar segmental dysfunction and functional nocturnal enuresis.

Reed et al. (1994) conducted a clinical trail for 10 weeks preceded by and followed by a 2 week nontreatment period. Forty-six nocturnal enuretic children (31 in the treatment and 15 in the control group) participated in the trial. Chiropractic evaluation for segmental dysfunction consisted of using observation, static and motion palpation, and instrumentation (infrared or dual probe). Intervention was in the form of high velocity, short lever adjustments of the spine; or a sham adjustment using an Activator at a nontension setting administered to the examiner's underlying contact point. The post - treatment wet nights frequency of 7.6 nights / 2 weeks for the treatment group was significantly less than its baseline mean wet night frequency of 9.1 nights / 2 weeks. For the control group, there was practically no change in the mean wet night frequency from

the baseline to the post treatment. The mean pre- and post- treatment change in the wet night frequency for the treatment group compared with the control group did not reach statistical significance. Twenty-five percent of the treatment-group children had 50% or more reduction in the wet night frequency from baseline to post-treatment while none among the control group had such reduction. They concluded that although the results did not reach statistical significance, a trend toward the effectiveness of chiropractic treatment for primary nocturnal enuresis was observed. A larger study of longer duration with a 6-month follow-up is therefore warranted.

Kreitz et al. (1994) did a comprehensive review of the literature concerning the aetiology, diagnosis and the natural history of primary nocturnal enuresis. Contemporary treatment options were discussed in light of the documented annual remission rate of the disorder. They concluded that the success of each therapeutic option must, in part, be attributed to the natural history of enuresis, as well as to any educational or placebo aspects of treatment. Conditioning therapy utilising the urine alarm pad may be the most reasonable initial mode of intervention. Spinal manipulative therapy has been shown to possess an efficacy comparable to the natural history. They emphasised that no therapeutic option should be exclusive of another and that a combination of different therapeutic approaches may be the most beneficial.

2.7.5. Placebo

Placebo can be defined as a procedure of no intrinsic therapeutic value performed in controlled studies to determine the effect of the treatment (Dorland's, 1989: 471).

Chaput de Saintonge et al. (1994) classify placebos by considering them as a continuum ranging from the tangible to the intangible. It can be put under the following headings: Scars

Pills, tablets, injections

Appliances

Touch

Words

Gestures

Local ambience

Social intervention.

The placebo effect is mediated through central control mechanisms whose neurobiological details are poorly understood (Oh, 1994). On the other hand, the psychological and behavioural constructs which are high-level representations of these control mechanisms do offer some possibilities. Faith, conditioning, credulity, suggestibility, trust, and

optimism are all concepts associated with placebo reactivity and presumably are represented at a neurobiological level. (Chaput de Saintonge et al., 1994).

A control group can never be guaranteed treatment-free. Participation in a trail is itself a non-specific factor - even the completion of a questionnaire may have therapeutic significance. (Joyce,1994). Even so, untreated control groups are needed in clinical trials if we wish to be able to decide more rationally which interventions a health service should pay for. They are also needed in addition to placebo-treated group if we wish to know what proportions of the effect of an active intervention are caused by specific and non-specific factors. Without them we cannot conclude, as is current practice, that an intervention is ineffective if no better than placebo. (Gotzsche,1994).

2.8 Conclusion

From the body of literature discussed in this chapter, the following are highlighted:

- A large percentage of children (15-20%v at 5 years of age) suffer from nocturnal enuresis. This problem commonly affects the emotions and behaviour of both the child and the parents.
- Bedwetting has been a problem for many centuries, yet the aetiology of this phenomenon is unclear.
- Treatment options are vast and vary from punishment and humiliation to behavioural modification, conditioning therapy and the use of allopathic drugs.

Chiropractic therapy may be an effective and safe non-pharmacological alternative for the treatment of functional nocturnal enuresis.

Chapter 3

MATERIALS AND METHODS

3.1 The Objective

This single blind placebo controlled study proposed to evaluate the efficacy of chiropractic intervention in the treatment of functional nocturnal enuresis with respect to the number of wet nights per week, in order to assess the role this treatment plays in the management of this condition.

3.2 The data

The data utilised in this study were of two kinds: Primary data and secondary data. The primary data were indicated by the number of wet nights the patient presented with and the secondary data were obtained from current documentation and the available literature on enuresis.

3.3 The Research Methodology

3.3.1 Subjects

The sample of 30 patients entered into the study consisted of primary functional nocturnal enuretics diagnosed by a paediatrician before being accepted into the study.

The sample group was obtained by advertising in local newspapers and on the local radio stations. Local pre-primary and primary schools were contacted and parents were notified of the study, while some patients entered the program after hearing about it by word-of-mouth.

Before and during the study the parents / guardians of a total of 73 subjects were interviewed telephonically. Thirty three subjects were excluded at this stage due to the following reasons:

- 10 subjects: Secondary enuresis
- 3 subjects; Age related
- 3 subjects: Transportation problems / different town
- 3 subjects: Emigrated / moved towns / holiday
- 2 subjects: Child was sick / receiving other treatment at the time
- 5 subjects: Irregular wetting

- 7 subjects: Non-committed parent.

The remaining 40 subjects were interviewed at the Technikon Natal Chiropractic Day Clinic. Of this number, 32 were admitted into the study. The other eight were excluded for the following reasons:

- 3 subjects: transportation problem
- 2 subjects: excluded by paediatrician
- 2 subjects: non-committed patents
- 1 subject: neurological involvement.

During the run of the study two patients became ill and did not complete the study, leaving exactly 30 subjects.

During the study 11 of the subjects were on medication of some kind. The distribution was as follows:

Multivitamins: 8

Ritalen: 1

Flixonase: 2

Clarityn: 1

Cough mixture: 1

Homoeopathic remedies: 2.

3.3.2 Experimental Design

The following steps were followed in the execution of this study:

At the beginning of the initial consultation the aetiology, anatomy, neurology, pharmacology, and chiropractic treatment procedures were explained to the subject and his / her parent(s) / guardian as set out below. Once they felt that they understood the whole procedure the parent / guardian was required to sign the parent / guardian consent form (Appendix I).

At the initial consultation the full case history (Appendix II) of each subject was taken and a full physical examination (Appendix III) was done. This examination included a regional lumbar spine examination (Appendix IV). During these procedures the subjects were also screened and examined for infrequent or day time wetting, recurrent urinary tract infection and any anatomical or neurological abnormalities that might complicate or result in bedwetting.

At this stage the subject was given a diary (Appendix V) to fill in every day for the remainder of the study. It was assessed at each consecutive consultation by the examiner. The subject was referred for a paediatric examination. This included a urine specimen and culture to exclude any possible infection. After the initial examination the patient was observed for two weeks to determine the baseline number of wet nights per week. This

baseline period was followed by a period of four weeks during which the subject received 10 treatments. Following this the subject was once more observed for a period of two weeks without further treatment (the follow-up period) with a final consultation at the end thereof. Throughout this eight week period the examiner constantly kept record of the patient's diary. The 30 subjects were devided randomly into an experimental and a control group of 15 patients each. Both groups underwent the same examination procedures and received their treatments at the same time intervals (three times per week for the first two weeks and then twice a week for the next two weeks). This was a single blind study and the patients were not aware which group they were allocated to.

The entire experimental group received chiropractic adjustive techniques to the thoraco-lumbar junction, fifth lumbar vertebra and the sacro-iliac joints. These areas were decided on due to their neurological relation to the bladder as discussed in chapter 2. No other areas were adjusted. The same levels were adjusted on all ten occasions in the entire experimental group. The specific spinal findings did not influence the treatment received. Any of the following techniques were used depending on what suited the patient best:

- lumber roll
- upper sacro-iliac
- prone S.I. with lever leg
- spinous push or pull
- reverse roll
- Carver bridge (bilateral hypothenar)

- sitting rotation mobilisation (T/L junction) / sitting lumbar
- side posture counter rotation mobilisation. (Szaraz et al.,1990).

The control group received placebo treatment. This consisted of attaching the Vacotron unit (Vacotron 436 by Enraf Nonius) over the lumbar area and switching it on for a period of 5 minutes per session.

The admissibility of the subjects and the data obtained from each were governed by the following delimitations:

- Chiropractic treatment was limited to the application of chiropractic adjustments.
- Chiropractic adjustments were limited to the tharaco-lumbar (T11 - L2), lower lumbar (L5), and sacro-iliac joints only.
- Subjects were only considered for the study if they averaged a minimum of 2 wet nights per week.
- All subjects considered for this study had to be between 5 and 15 years of age.
- Only subjects presenting with primary functional nocturnal enuresis were accepted into the study.
- Subjects presenting with any other illness that may clinically contribute to their enuretic condition were not considered for the study.
- All subjects were screened for any contra-indications to adjustments such as inflammation and infection, degeneration, neoplasm, metabolic disturbances,

congenital malformation, trauma, and psychogenic disturbances / neourovetetative lability as discussed by Dvorak et al. in Haldeman (1992: 557-572).

- Subjects were only allowed to participate in the study once their parents / guardian signed the consent form.
- Only subjects attending the Technikon Natal chiropractic Clinic were considered for the study.

At the end of each week the data for each subject were plotted on a bar graph to indicate the progress (or lack of progress) made during the study. At the completion of the treatment period of the entire patient sample, the data as an entirety were collated, analysed and interpreted by means of statistical methods.

All examinations, special tests and treatments administered to the individual during this study were done free of charge.

3.3.3. The process of randomisation

The 30 subjects were randomly devided into two groups. This was done as follows: Thirty numbers were put into a hat. Every alternate number drawn from the hat was allocated to the experimental group. All the numbers with their corresponding treatments

were noted down on a sheet and as the patients entered the study they were allocated specific treatment in order from 1 to 30. Non-compliant patients were systematically replaced as and when new subjects entered into the study.

3.3.4 Measurements

Data were extracted from the following sources:

- Case history records;
- Physical examination records;
- Lumbar spine regional examination records;
- Dairy indicating wet nights.

3.4 The specific treatment of the data

3.4.1 The location of the data

- Primary data - the dairy kept by the subjects, the case history, the physical examination and the lumbar spine examination;
- Secondary data - the information contained in: books, journal articles and periodicals in the libraries on campus and other teaching institutions in South Africa or world-wide; and in CD-ROM MEDLINE.

3.4.2 The means of obtaining the data

Patients were required to complete the diary each day for the full duration of the study (8 weeks). The examiner assessed the progress on each consecutive visit.

3.4.3 The treatment of the data

The data in the diaries were recorded on bar graphs to indicate the progress of each patient on a weekly basis as the study progressed.

The body of data obtained was processed using the following statistical methods:

- The Mann - Whitney U test to compare the experimental and control groups;
- Wilcoxon's Signed Rank test to compare the groups within themselves;
- Summary statistics

3.4.4 Interpretation of the data

The results obtained as described in 3.4.3. were used to draw certain conclusions.

3.5 General remarks

This dissertation was done using the following programs:

Microsoft word version 6.0

Statographics version 6 plus

All the statistical analyses were performed at the Technikon Natal with the assistance of Mr Z.U. Worku.

Chapter 4

THE RESULTS

4.1 Introduction

This chapter covers the results obtained from the diary kept by the subjects.

The first set of data (Figures 1 + 2 and Tables 1 +2) presents the demographic data obtained from the patients' files.

The second set of data (Figures 1 + 2 and Tables 4 + 5) shows the average / median number of wet nights obtained for the experimental and the control groups at treatment intervals. The findings based on these data were also used as a baseline for comparison with results reported in past research studies.

The third set of results (Table 4-19) presents the statistical analysed figures comparing the intra-treatment and the inter-treatment data, to determine the efficacy of each treatment regime. The null and alternative hypotheses were either accepted or rejected based on the results.

4.2 The criteria governing the admissibility of the data

- Only data collected from compliant subjects were admissible and were statistically analysed.
- These data were collected from the diaries and forms mentioned before.
- The data were admissible only if the diary and indices were completed correctly and the data statistically analysed.
- Data collected from non-compliant subjects were not admissible to this study and were therefore disregarded.

4.3 Problem statement

This study proposed to evaluate the efficacy of chiropractic intervention in the treatment of primary functional nocturnal enuresis with respect to the number of wet nights per week in order to assess the role this treatment plays in the management of the condition.

4.3.1 Subproblem one

This subproblem proposed to evaluate the response of the experimental group to chiropractic adjustments in order to evaluate the role this treatment played in the management of Primary functional nocturnal enuresis.

4.3.2 Subproblem two

This subproblem proposed to evaluate the response of the control group to placebo treatment in order to evaluate the role this treatment played in the management of Primary functional nocturnal enuresis.

4.3.3 Subproblem three

This subproblem proposed to integrate the results of the control group and the experimental group in order to determine the efficacy of the of chiropractic treatment for the condition.

4.4 Demographic data obtained from the patients' files

Figure 1 Gender distribution of subjects

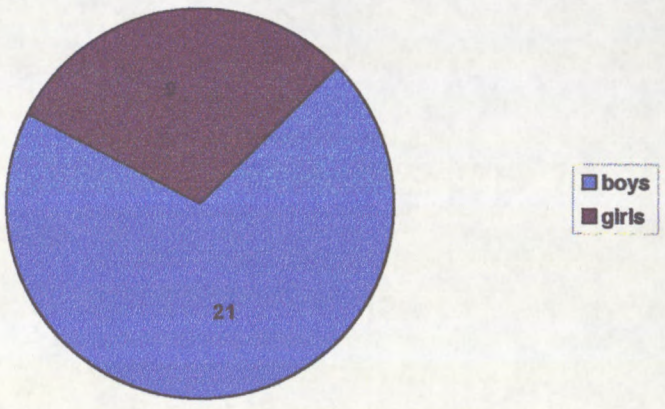


Figure 2 Age distribution of subjects

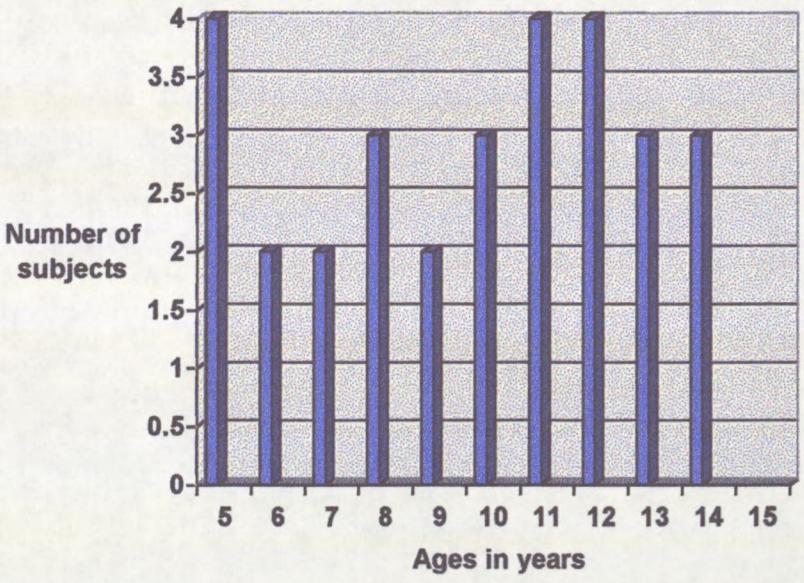


Table 1 **Race distribution of subjects**

	Total	Control	Experimental
Indian	4	3	1
White	24	11	13
Black	2	1	1

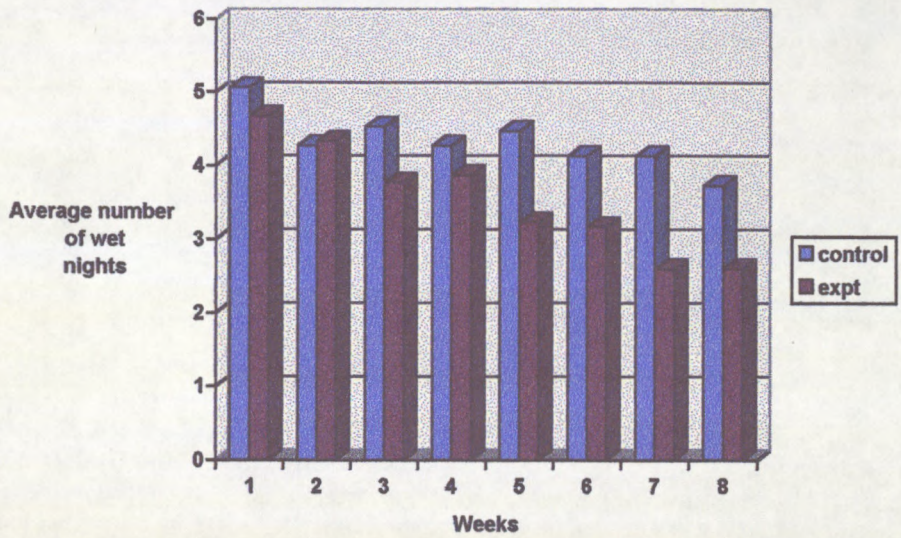
Table 2 **Age and sex distribution of subjects**

	Total number of subjects	Average age	Number of boys	Average age of boys	Number of girls	Average age of girls
exprt	15	10.1	9	9.72	6	10.66
control	15	9.53	12	9.63	3	9.17

Table 3 **Pre- and post treatment spinal motion palpation findings**

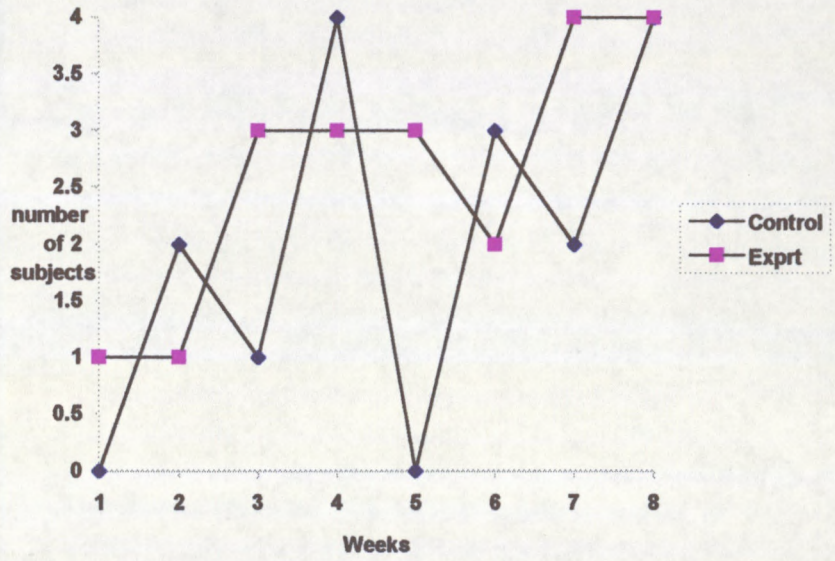
Spinal level	Initial examination Number of subjects with fixation	Follow up examination Number of subjects with fixation
T11	6	0
T12	11	5
L1	15	9
L2	14	5
L3	7	3
L4	3	1
L5	5	1
SI: unilateral	17	5
bilateral	2	0

Figure 3 **Comparison of the average number of wet nights per week in the control group and the experimental group**



The initial decrease in number of wet nights during the baseline period in both the groups can most likely be attributed to the initial placebo effect of starting the program. At the end of the treatment period (week 6) the wet night frequency decreased by 18.54% in the control group and by 32.11% in the experimental group. At the end of the follow-up period (week 8) the wet night frequency had decreased by 26.42% in the control group and 44.32% in the experimental group.

Figure 4 **Comparison of the number of "dry" subjects in the control group and the experimental group**



The graph reflects a pattern of improvement in the experimental group, whereas considerable fluctuation can be noted in the control group.

Table 4 **Comparison of the improvement in the control and experimental groups based on the percentage differences between the baseline period and the after treatment results (week 6).**

	neg. results	0-24% impr	25-49% impr	50-74% impr	75-100% impr	sample size
control	4	4	5	1	1	15
exprt	4	2	3	4	2	15

The data reflects that there was a 40% (6 out of 15) success rate in the experimental group and a 13.3% (2 out of 15) success rate in the control group. For the purpose of this study success was defined as 50% or more reduction in bedwetting frequency.

Table 5 **Comparison of the improvement in the control and experimental groups based on the percentage differences between the baseline period and the final consultation (week 8).**

	neg. results	0-24% impr	25-49% impr	50-74% impr	75-100% impr	sample size
control	5	3	3	1	3	15
exprt	1	4	4	2	4	15

The data reflect that the success rate in the experimental group remained at 40% (6 out of 15) during the two week follow-up period . An increase occurred in the control group with the success rate going up to 26% (4 out of 15).

4.5 The Analysed data

4.5.1 Abbreviations

P = two tailed probability of equalling or exceeding Z / 2

ns = no significant difference in the medians

s = significant difference in the medians

contr = control group

expt = experimental group

If P = < 0.05 = significant difference (5% level of significance)

If P = > 0.05 = no significant difference (5% level of significance)

Ho = Null hypothesis

Ha = Alternative hypothesis

wk = week

4.5.2 Non - parametric hypothesis testing

4.5.2.1 Subproblem one and subproblem two

Ho: It was hypothesised that the results would be of no significance on analysing the intra-group data, indicating that there was no improvement in the condition.

Ha: It was hypothesised that there would be a significant difference in results on analysis of the intra-group data, indicating that an improvement in the condition occurred due to the treatment.

Table 6 **A sample analysis of the control group's enuretic diaries comparing the average number of wet nights of the baseline period to each week of the study making use of the Wilcoxon Signed Rank test**

control	bsl vs wk3	bsl vs wk4	bsl vs wk5	bsl vs wk6	bsl vs wk7	bsl vs wk8
z value	0.579097	0.789264	1	0.267256	0.301698	0.301698
p value	0.2895485 ns	0.394632 ns	0.5 ns	0.133628 ns	0.150849 ns	0.150849 ns

The null hypothesis was accepted for weeks 3-8, because at a 5% level of significance there was no significant difference between these weeks and the baseline period, therefore there was no significant improvement in the subject's condition during the study.

Table 7 **A sample analysis of the experimental group's enuretic diaries comparing the average number of wet nights of the baseline period to each week in the study making use of the Wilcoxon Signed Rank test**

exprt	bsl vs wk3	bsl vs wk4	bsl vs wk5	bsl vs wk6	bsl vs wk7	bsl vs wk8
z value	0.227799	0.386474	0.301698	0.579097	0.0093748	0.0265001
p value	0.1138995 ns	0.193237 ns	0.150849 ns	0.2895485 ns	0.0046874 s	0.01325 s

The null hypothesis was accepted for weeks 3, 4, 5 and 6 because at a 5% level of significance there was no significant difference between these weeks and the baseline period. The null hypothesis was rejected for weeks 7 and 8, because at a 5% level of significance there was a significant difference in results, thus indicating an improvement in the subject's condition.

Table 8 **A sample analysis of the control group and experimental group comparing week three and week four within each treatment group**

The null hypothesis was accepted as it was concluded that at a 5% level of significance there was no significant improvement between weeks 3 and 4 in either of the groups.

week 3 vs week 4	z value	p value	
control	0.546491	0.273255	ns
experimental	1	0.5	ns

Table 9 **A sample analysis of the control group and experimental group comparing week four and week five within each treatment group**

week 4 vs week 5	z value	p value	
control	0.546491	0.273455	ns
experimental	1	0.5	ns

The null hypothesis was accepted as it was concluded that at a 5% level of significance there was no significant improvement between weeks 4 and 5 in either of the groups.

Table 10 **A sample analysis of the control group and experimental group comparing week five and week six within each treatment group**

week 5 vs week 6	z value	p value	
control	0.504983	0.2524915	ns
experimental	0.751826	0.375913	ns

The null hypothesis was accepted as it was concluded that at a 5% level of significance there was no significant improvement between weeks 5 and 6 in either of the groups.

Table 11 **A sample analysis of the control group and experimental group comparing week six and week seven within each treatment group**

week 6 vs week 7	z value	p value	
control	0.751826	0.375913	ns
experimental	0.579097	0.2895485	ns

The null hypothesis was accepted as it was concluded that at a 5% level of significance there was no significant improvement between weeks 6 and 7 in either of the groups.

Table 12 **A sample analysis of the control group and experimental group comparing week six and week eight within each treatment group**

week 6 vs week 8	z value	p value	
control	0.772826	0.386413	ns
experimental	0.546491	0.2732455	ns

The null hypothesis was accepted as it was concluded that at a 5% level of significance there was no significant improvement between weeks 6 and 8 in either of the groups.

Table 13 **A sample analysis of the control group and experimental group comparing week seven and week eight within each treatment group**

week 7 vs week 8	z value	p value	
control	1	0.5	ns
experimental	0.751826	0.375913	ns

The null hypothesis was accepted as it was concluded that at a 5% level of significance there was no significant improvement between weeks 7 and 8 in either of the groups.

4.5.2.2 Subproblem three

Ho: It was hypothesised that the results obtained with regard to the number of wet nights in the control group and the experimental group would be similar.

Ha: It was hypothesised that there would be a significant difference between the results obtained in the control and the experimental group, indicating that the treatment was effective.

All tests were done at a 5% level of significance. Thus p was accepted if $p > 0.05$.

Table 14 **A statistical comparison between the control and experimental groups for week one using the Mann - Whitney U test.**

	z value	p value
week no. 1	0.783448	0.391724 ns

The null hypothesis was accepted as at the 5% level of significance there was no statistically significant difference between the control and experimental groups for week 1.

Table 15 **A statistical comparison between the control and experimental groups for week two using the Mann - Whitney U test.**

	z value	p value
week no. 2	0.916418	0.458209 ns

The null hypothesis was accepted as at the 5% level of significance there was no statistically significant difference between the control and experimental groups for week 2.

Table 16 **A statistical comparison between the control and experimental groups for week three using the Mann - Whitney U test.**

	z value	p value
week no. 3	0.335034	0.167517 ns

The null hypothesis was accepted as at the 5% level of significance there was no statistically significant difference in the improvement between the control and experimental groups for week 3.

Table 17 **A statistical comparison between the control and experimental groups for week four using the Mann - Whitney U test.**

	z value	p value
week no. 4	0.600494	0.300247 ns

The null hypothesis was accepted as at the 5% level of significance there was no statistically significant difference in the improvement between the control and experimental groups for week 4.

Table 18 **A statistical comparison between the control and experimental groups for week five using the Mann - Whitney U test.**

	z value	p value
week no. 5	0.185032	0.092516 ns

The null hypothesis was accepted as at the 5% level of significance there was no statistically significant difference in the improvement between the control and experimental groups for week 5.

Table 19 **A statistical comparison between the control and experimental groups for week six using the Mann - Whitney U test.**

	z value	p value
week no. 6	o.378265	0.1891325 ns

The null hypothesis was accepted as at the 5% level of significance there was no statistically significant difference in the improvement between the control and experimental groups for week 6.

Table 20 **A statistical comparison between the control and experimental groups for week seven using the Mann - Whitney U test.**

	z value	p value
week no. 7	0.0976881	0.048844 s

The null hypothesis was rejected as at the 5% level of significance there was a statistically significant difference between the control and the experimental groups for week 7, indicating that there was a significant difference in the improvement of the experimental group when compared to the control group as a result of the treatment.

Table 21 **A statistical comparison between the control and experimental groups for week eight using the Mann - Whitney U test.**

	z value	p value
week no. 8	0.341724	0.170862 ns

The null hypothesis was accepted as at the 5% level of significance there was no statistically significant difference in the improvement between the control and experimental groups for week 8.

Chapter 5

DISCUSSION

Numerous treatment modalities for enuresis have been introduced during the past. The most successful of these has been the alarm system with a long-term cure rate of 50-60% (Norgaard, 1991). The most popular allopathic drug used is Imipramine hydrochloride (Tofranil) with a reported cure rate of 25% to 40%, but relapses usually occur when the drug is stopped - in up to 90% of the cases (Rusthon,1989; Warady et al.,1991). Side effects are relatively frequent and often lead to a discontinuation of the medication (Novello et al.,1987). Desmopressin acetate has been found to have a success rate of 41%. Although the pharmacological effect of the drug ceases immediately on withdrawal, it appears to be a reasonable agent to use in those children needing fast results on specific occasions. Side effects are usually mild and limited to mucosal irritation, epistaxis, headaches, nasal congestion and occasional gastrointestinal upset (Toffler et al.,1991).

Based on the definition that 50% decrease in bedwetting frequency defines "success", the results of this study indicated a clinically significant improvement with a 40% (6 out of 15) success rate. This is encouraging as both Leboeuf et al. (1991) and Reed et al. (1994) obtained only a 25% success rate.

The success observed in this study may have been due to the fact that the treatment was directed at the specific spinal levels innervating both the sympathetic and the parasympathetic supply to the bladder. The segments being stimulated were constant and all the subjects received the same treatment even if they were asymptomatic. This study was thus not restricted to the spinal findings. In both the above mentioned studies, treatment was directed at levels of spinal subluxations (aberant spinal movement), thus it was not always constant and not necessarily directed at the levels as treated in this study.

This study goes on to support the suggestion by Briggs et al. (1983) that a visceral reaction can be related to the presence or the absence of subluxations, as well as being the consequence of the adjustment. This goes against the chiropractic thought that only subluxated areas need treatment for autonomic stimulation.

In the experimental group the success rate (40%) was superior to the spontaneous cure rate which is 15% per year. The success of the control group (15% - 2 out of 15) was similar to the spontaneous cure rate and could be attributed to this factor. An increase of up to 26% success during the two week follow-up period was noted in the control group. The experimental group remained constant. The reason for this is not clear but the fluctuations noted in the control group, figure 3 and figure 4, could indicate inconsistency possibly due to the placebo effect. It must be kept in mind that the control group can never be guaranteed treatment-free (Joyce: 1994).

The average baseline frequency of bedwetting was 4.67 nights / week for the experimental and 5.07 nights / week for the control group during the first week (Figure 3). A slight decrease was noted during the second week of the baseline period with 4.33 nights / week for the experimental group and 4.27 nights / week for the control group. This difference between the average values during this period can most likely be attributed to the initial placebo effect of starting the program. When comparing these two groups with each other using the Mann-Whitney U test no significant difference was found between them. The subjects were randomly devided into their groups and this is a possible indication of equal distribution of the sample.

The average post-treatment (week 6) wet night frequency of 3.17 wet nights / week in the experimental group was less than the baseline wet night frequency, but it was not statistically significant ($p=0.2895485$). A similar decrease was noted in the control group with a post-treatment wet night frequency of 4.13 nights / week ($p=0.133628$). Expressed as a percentage, the wet night frequency decreased by 18.54% for the control group and by 32.11% for the experimental group.

The improvement of the experimental group continued into the follow-up period with a wet night frequency of 2.6 nights / week during both the seventh and eighth week of the study. These values were significantly less than the baseline wet night frequency ($p=0.0046874$ for week 7 and $p=0.01325$ for week 8). This improvement could be an indication of the long-term effects of the spinal adjustments, suggesting that extended

treatment is required over a longer timespan to allow for optimal effectiveness of the treatment. There was no significant improvement in the control group. Expressed as a percentage, the overall wet night frequency decreased by 26.42% for the control group and by 44.32% for the experimental group. The only statistical significance between the two groups was noted during week 7 (the beginning of the follow-up period) ($p=0.048844$).

The cure rate in this study (26.67 % - 4 out of 15 for the experimental group) was not impressive. Even though it was better than that found by Leboeuf et al. (1991), it was similar to the control group for week 8. Despite this, a consistent improvement were noted in the experimental group as opposed to the control group (Figure 4).

Considering the short duration of chiropractic intervention, these results suggest a clinically significant effect of chiropractic manipulative therapy in the treatment of primary functional nocturnal enuresis. No long term study has been done to determine the long-term effect of this treatment option. The onset of improvement by means of chiropractic manipulation might not be as fast as that of allopathic drugs (e.g. Imipramine or Desmopressin), but the former does not have the toxicity and side effects associated with these drugs.

It was the impression of the author that most parents were frustrated due to the child's condition and that they were looking for an instant cure. Most of them had already tried

various treatment therapies before entering into the study. It was not uncommon to hear that they were trying it as a last resort. Seventy six point six percent (76.6%) of the subjects had received some sort of drug therapy (including homeopathic and "over the counter" drugs) for the condition prior to entering the study. Sixty percent (60%) of these children used allopathic drugs, e.g. Tofranil, Eglonyl and Ditropan. Only one of them had tried the alarm system, but had found that it did not wake her up. Two of the subjects had had a bladder stretch operation respectively 2 and 3 years prior to the study, - the one in the control group showed an 33.33% improvement and the one in the experimental group improved by 85.71% during the study.

A family history of bedwetting was noted in 50% of the subjects. In 16.6% of the cases at least one of the other children in the family had had the same problem. Five of the children accepted into the study (16.6%) suffered from some form of learning disability. There had been some form of family disruption in 7 cases (23.3%).

The parents were encouraged to continue with the treatment after the study, but only a few made use of the opportunity and these visits were irregular. Even though most of the parents felt that their children did benefit from the study, the author was given the impression that they found it too time consuming to bring the child for any more treatments.

This study was conducted over a relatively short period. The author feels that the baseline period was not adequate to determine accurate and reliable data. A study of longer duration as far as baseline, treatment and follow-up periods is warranted to determine the long-term effects of chiropractic treatment for bedwetting.

Due to the nature of the sample size constraints this study sets a basis for further studies on a larger scale

In this study chiropractic treatment was limited to adjustments directed at the specific areas related to the nerve supply of the bladder as specified in chapters 2 and 3. As all subjects received the same treatment regardless of their spinal findings, not much attention was paid to these findings. It is being suggested that the spinal constraints should be considered more carefully in follow-up studies.

As it is difficult to eliminate all emotional or psychosocial factors which might contribute to the problem, it might be feasible to combine chiropractic adjustive techniques with other therapies, e.g. behaviour modification therapy.

Chapter 6

CONCLUSION

This single blind placebo controlled study showed promising results in the conservative care of functional nocturnal enuresis. With a success rate (a reduction of 50% or more in bedwetting frequency) of 40% of subjects in the experimental group the results suggest a statistically clinical significant effect of chiropractic manipulative therapy in the treatment of functional nocturnal enuresis. It can be concluded that the use of adjustments for functional nocturnal enuresis was relatively effective compared to placebo treatment. It is suggested that chiropractic treatment can be used as a safe non-pharmacological alternative for the treatment of this condition.

It is also suggested that a combination of chiropractic adjustments combined with other treatment therapies, e.g. behaviour modification, might be more effective than either on its own.

Further investigation is necessary to search for correlations with vertebral correction, aetiology, clinical manifestation and dynamics of this condition with other forms of treatment.

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APPENDIX I

PARENT / GUARDIAN CONSENT FORM

I ..... the undersigned, as parent /guardian, being fully aware of the constraints and delimitations placed on the subject, give my consent for ..... to enter into this research program.

I accept that the data collected during this period will be used for research purposes.

I have had the nature of the study explained to me which I clearly understand and have had any questions satisfactorily answered.

I am free to withdraw from the study by notifying Nicola Grobler of my intention.

.....

Signature of parent/guardian

.....

Signature of witness

Date: .....

APPENDIX III

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:_____ Date#:

_____

File#:_____ X-Ray #:_____

Age:_____ Sex:_____ Occupation:_____

Intern_____

Signature:_____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: Signature:

Case History:

Examination:

Previous: TN Current: TN

Other Other

X-Ray Studies:

Previous: TN Current TN

Other Other

Clinical path. lab.:

Previous: TN Current TN

Other Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's case history

1. Source of history:

2. Chief complaint: (patient's own words)

3. Present illness:

Location

Onset

Duration

Frequency

Pain (Character)

Progression

Aggravating factors

Relieving factors

Associated signs and symptoms

Previous occurrences

Past Treatment and outcome

4. Other complaints:

5. Past history:

General health status

Childhood illnesses

Adult illnesses

Accidents / injuries

Surgery

Hospitalizations

6. Current health status and lifestyle:

Allergies

Immunizations

Screening tests

Environmental hazards

Safety measures

Exercise and leisur

Sleep Patterns

Diet

Current medication

Tobacco

Alcohol

Social drugs

7. Family history:

Immediate family: age, health, cause of death

DM, heart disease, TB, HBP, stroke, kidney disease, CA, arthritis, anaemia, headaches, thyroid disease, epilepsy, mental illness, alcoholism, drug addiction, other.

8. Psychosocial history:

Home situation

Daily life

Important experiences

religious beliefs

9. Review of systems:

General

Skin

Head

Eyes

Ears

Nose / sinuses

Mouth / throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurological

Haematologic

Endocrine

Psychiatric

APPENDIX III

PHYSICAL EXAMINATION

Patient: _____ File#: _____

Clinician: _____ Signature: _____

Intern: _____ Signature: _____

Date: _____

Height:

Weight:

Temp:

Heart rate:

Pulse rate:

Respiration rate:

Blood pressure:

General appearance:

STANDING EXAMINATION

Minor's sign

Skin changes

Posture - erect

- Adam's

Ranges of motion: T/L spine: flexion: 90 fingers to floor

extension: 50

R.lat.flex.: 30 fingers down leg

L.lat.flex.: 30 fingers down leg

Rot.to R.: 35

Rot.to L.: 35

Flex.

L.Rot. R.Rot.

L.Lat flex. R.Lat. flex.

Ext.

/=pain-free limitation //=painful limitation

Romberg's sign

Pronator drift

Trendelenberg's sign

Gait: rhythm, balance, pendulousness, on toes, om heels, tandem

Half squat

Scapular winging

Muscle tone

Spasticity / Rigidity

Shoulder:

skin

symmetry

ROM: glenohumeral

scapulo-thoracic

acromioclavicular

elbow

wrist

Chest measurement: inspiration

expiration

Visual acuity:

Breast examination: inspection

palpation

SEATED EXAMINATION

Spinal posture

Head: sculp, skull, face, skin

Eyes: conjunctiva, sclera, eyebrows, eyelids, lacrimal gland, nasolacrimal duct, alignment, corneal reflex, ocullar movement, visual fields, accomodation, iris, pupils, red reflex, optic disc, vessels, general background, macula, vitreous, lens.

Ears: auricle, ear canal, drum, auditory acuity, Weber test, Rinner test.

Nose: external, internal, olfaction

Sinuses (frontal & maxillary): tenderness, translumination.

Mouth and pharynx: lips, buccal mucosa, gums and teeth, roof, tongue, pharynx.

Neck: posture, size, swelling, scars, discoloration, hair line.

ROM: Flexion: 45 chin to larynx

		chin to sternum
Extension:	55	forehead parallel to floor
L.lat.flex.:	40	
R.lat flex.:	40	
L.rot.:	70	
R.rot.:	70	

Flex

L.Rot. R.Rot.

L.Lat. R.Lat.
flex. flex.

Ext.

Lymph nodes

Trachea

Thyroid

Carotid arteries (thrills, bruit)

CN V

CN VII

CN VIII

CN IX

CN XI

TMJ: Inspection: ROM, deviation.
Palpation: crepitus, tenderness

Neurological:

Dermatones: C5; C6; C7; C8; T1.

Tendon reflexes: Biceps; Triceps; Brachioradialis.

Muscle strength: C5; C6; C7; C8; T1.

Coordination: point-to-point, dysdiadochokinesia.

Thorax:

Chest:

Inspection: skin, shape, respiratory distress, rhythm, depth, effort, intercostal / supraclavicular retaction.

Palpation: tenderness, masses, respiratory expansion, tactile fremitus.

Percussion: lungs, diaphragmatic excursion, kidney punch.

Auscultation: breath sounds: vesicular,bronchial

adventitious sounds: crackles, wheezes

voice sounds: broncophony, whispered pectoriloquy, egophony.

Cardiovascular: auscultation, Allen's test.

SUPINE EXAMINATION

JVP

PMI

Auscultation heart (left lat. recumbent)

Respiratory excursion

Percussion chest

The Abdomen:

Inspection: skin, umbilicus, contour, peristalsis, pulsations, hernias.

Auscultation: bowel sounds, bruit.

Percussion: general, liver, spleen.

Palpation: Superficial reflexes, cough, light, rebound tenderness, deep, liver, spleen, kidneys, aorta, intra-/retro-abdominal wall mass, shifting dullness, fluid wave.

Peripheral vasculature:

Inspection: skin, nail beds, pigmentation, hair loss.

Palpation: pulses: radial, brachial, femoral, popliteal, post. tibial, dorsalis pedis.

lymph nodes: epitrochlear, femoral

temperature (feet & legs)

Manual compression test

Retrograde filling test

Arterial insufficiency test.

Musculoskeletal:

ROM: hip:	flex.	90/120	
	ext.	15	
	abd.	45	
	add	30	
	int.rot.	40	
	exr.rot.	45	
knee	flex.	130	
	ext	0/15	
ankle	plantar flex.	45	
	dorsiflex		20
	inversion	30	
	eversion		20

Leg length:

Neurological:

Dermatomes: L1; L2; L3; L4; L5; S1.

Muscle strenth: hip flexion; knee flexion; ankle dorsiflexion; plantar flexion.

Tendon reflexes: patellar, achilles, plantar reflex.

MENTAL STATUS

Appearance and behaviour:

level of consiousness

posture and motor behaviour

dress, grooming, personal hygiene

facial expression

affect

Speech and lanquage:

quantity

rare

volume

fluency

aphasia

Mood

Thought processes (logical, relevant, organised)

Memory and attention:

orientation

remote memory

recent memory

new learning ability

Higher cognitive functions:

information and vocabulary (general and specialised knowledge)

abstract thinking

APPENDIX IV

REGIONAL EXAMINATION - LOW BACK

Standing:

Minor's sign

posture

skin

muscle tone

spinous percussion

Shober's test

treadmill

ROM flex

L.rot R.rot

L.lat. R.lat

flex flex

ext

Gait:

rhythm

on toes

on heels

half squat on one leg

Sitting:

Posture

Dermatomes: T12; L1; L2; L3; L4; L5; S1; S2; S3.

Reflexes: patellar; achilles; medial hamstring

Myotomes: hip flexion; hip int. rot.; hip ext. rot.; knee ext.; knee flex.; hip abd.; hip add.; ankle dorsiflex.; ankle plantar flex.; ankle eversion; ankle inversion; ext. hallucis long..

Tripod test

Kemp's test

Motion Palpation:

Supine:

skin, hair, nails

observe abdomen

fasciculations

abdominal reflexes

auscultate abdomen / groin

palpate abdomen / groin

pulses (abd / ext)

SLR

Braggard's test

bowstring

sciatic notch

plantar reflex

circumference (thigh, calf)

leg length: (actual, apparent)

Patrick FABER

Gaenslin's

gluteus max stretch

hip medial rotation

psoas test

Thomas' test: hip joint, rectus femoris

Lateral recumbent:

S-I compression

Obers test

femoran nerve stretch

myatomes: QL; glut. med.

Prone:

gluteal skyline

skin rolling

iliac crest compression

facet joint challenge

S-I tenderness

Erichsen's test

Pheasant's test

myatomes: glut. max.

trigger points: QL;glut. med.; glut. max.; piriformis; hamstrings; TFL

Non - organic signs:

pin - point pain

axial compression

trunk rotation

Burns's bench test

flip test

Hoover's test

ankle dorsiflexion test

pin - point pain

APPENDIX V

ENURETIC DIARY

WEEK 1	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN:
WEEK 2	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN:
WEEK 3	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN:
WEEK 4	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN:
WEEK 5	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN:
WEEK 6	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN:
WEEK 7	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN:
WEEK 8	MON:	TUES:	WED:	THUR:	FRY:	SAT:	SUN: