THE EFFICACY OF CHIROPRACTIC MANIPULATIVE THERAPY IN THE MANAGEMENT OF ATTENTION DEFICIT HYPERACTIVITY DISORDER IN CHILDREN.

BY

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A dissertation presented to the faculty of Health at the Durban Institute of Technology in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic.

I, Lara Cawood do hereby declare that this dissertation represents my own work in both conception and execution.

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DEDICATION

To my loving husband Shane,

for your inspiration, love, patience and encouragement.

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ABSTRACT

The purpose of this study was to evaluate the efficacy of Chiropractic Manipulative Therapy in the management of Attention Deficit Hyperactivity Disorder in children.

It was hypothesized that, in terms of subjective and objective clinical findings, the chiropractic manipulation would be an effective treatment as part of a multidisciplinary approach in the overall management of children with ADHD.

This randomized, controlled placebo study, and consisted of twenty patients between the ages of 6 and 12 years, whom all were previously diagnosed with ADHD. Once selected, these patients were screened according to inclusion and exclusion criteria and randomly divided into two groups. Group 1 received manipulation of the spinal column and Group 2 received placebo ultrasound. The treatment included six treatments over a three-week period. Objective readings were taken at the initial consultation and again at the final consultation, and subjective readings were taken after each treatment session.

Statistical analysis of the data was performed using the SPSS version 9.0 package and recorded in the form of graphs and tables. Non-parametric statistical analysis was used. Inter-group analysis of data consisted of the Mann-Whitney U-Test, in order to detect any differences between the two treatment

groups from the initial to the final consultation. Intra-group analysis of data consisted of the Wilcoxon Signed Ranks Test and the Friedman Test in order to detect any improvement within each individual group from the initial to the final consultation. A 5 % level of significance was set for all tests.

Inter-group data analysis showed that neither one of the two groups benefited more that the other in terms of their respective treatments between the initial and final consultations

Intra-group data analysis showed that in group 1(chiropractic group), there was a significant change in the data from treatment one to treatment six, showing that there may have been improvement over the period from the initial to the final consultation. This may have shown that Chiropractic treatment could have had an effect in the treatment of ADHD. Group 2 (placebo group) showed no improvement whatsoever. Although group 1 showed some improvement and group 2 showed no improvement, in terms of subjective and objective findings, the improvement in the CMT group was not statistically significant.

In conclusion, the results of this study were inconclusive, as the tests used yielded contrasting results and thus no sound conclusion can be drawn to whether CMT was effective in treating children with ADHD.

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DEFINITIONS

(1) Attention Deficit Hyperactivity Disorder (ADHD)

Attention deficit hyperactivity disorder (ADHD) is a medical diagnosis that is applied to children and adults who are experiencing significant behavioural and cognitive difficulties in important aspects of their lives whether it is familial or personal relationships, at school or at work. These difficulties can be attributed to problems of impulse control, hyperactivity and inattention (Cooper and Ideus, 1996:1)

(2) Inattention

Inattention is the absence of attention, which refers to the ability to maintain effort or concentration over time while performing a monotonous task (Schain, 1978).

(3) Impulsivity

Impulsivity manifests itself as impatience, difficulty waiting one's turn, frequently interrupting others, blurting out answers before questions have been completed and making comments about things out of turn (APA 1994, Serfontein 1990).

(4) Hyperactivity

Hyperactivity is excessive or exaggerated muscular activity, for example, aimless and haphazard running or fidgeting (Coleman, Butcher and Carson, 1980).

(5) Placebo

A dummy treatment administered to the control group in a controlled clinical trial in order that the specific and non-specific effects of the experimental treatment can be distinguished (Dorland and Newman, 1988: 1299).

Note: - for the purpose of this study, the placebo therapy will be the application of a de-tuned ultrasound head placed over and along the paraspinal musculature of the upper, middle and lower spine.

(6) Chiropractic Therapy

This is any treatment that is performed by a person that is qualifies as a Chiropractor, more traditionally referring to manipulation or adjustment.

(7) Adjustment

The chiropractic adjustment is a specific form of direct articular manipulation utilizing either long or short leverage techniques with specific contacts. It is characterized by a dynamic thrust of controlled velocity, amplitude and direction (Bergmann et al. 1993: 754).

(8) Subjective Changes

These changes are those personally perceived by the patients. i.e. how they feel with regards to pain and disability.

Note: - for the purpose of this study, the subjective responses will be those of the child's parent or guardian as the child cannot respond in questionnaire form about his / her behaviour.

(9) Objective Changes

The practitioner or someone else dealing in the study of the patient, notes these changes.

Note: - for the purpose of this study, the child's schoolteacher will note the objective changes.

CHAPTER ONE

1.1 INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is recognised as the most common neurobehavioral disorder of childhood and affects children from early infancy through school and into adult life (Shaywitz and Shaywitz, 1991).

The prevalence of ADHD is estimated at 5-10% of school-aged children, accounting for half of the childhood referrals to diagnostic clinics (The Merck Manual, 1999: 2256). In South Africa, between 7 and 10% of children suffer with ADHD (Taljaard, 2000).

ADHD is a condition characterised by impulsivity, inattention and hyperactivity due to a variety of aetiologies and is classified as a disruptive behavioural disorder in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). The diagnosis of ADHD is made using the criteria as set out in the DSM-IV. These criteria restrict the symptoms of ADHD to three areas, namely: attention, impulsivity and hyperactivity (American Psychiatric Association, 1994).

Ritalin (Methylphenidate Hydrochloride), a psychostimulant, has been extensively used in the treatment of ADHD and other related disorders. Psychostimulants are the most commonly used drugs in ADHD. Although the effects of Ritalin have shown to improve attention, impulsivity and behavioural

processes, the side effects are marked and include symptoms such as decreased appetite, weight loss, hypertension, tachycardia, headaches and insomnia (Brown, 1991; Rostain, 1991).

Studies have shown that Chiropractic Manipulative Therapy (CMT) has a significant effect on hyperactivity, by reducing the levels thereof and improving the attention span of children. These studies however were inconclusive and in that light, a controlled placebo-based study needs to be carried out to conclude whether CMT has the potential to become an important non-drug intervention in the management of ADHD in Children.

1.2 AIM

This placebo-controlled study proposes to investigate the efficacy of Chiropractic Manipulative Therapy in the management of Attention Deficit Hyperactivity Disorder (ADHD) in children, in terms of the patient's subjective response to the treatment as well as the objective clinical findings.

1.3 OBJECTIVES OF THIS STUDY

1.3.1 The first objective is to evaluate the efficacy of Chiropractic Manipulative Therapy in the management of ADHD, in terms of subjective clinical findings.

1.3.2 The second objective is to evaluate the efficacy of Chiropractic Manipulative Therapy in the management of ADHD, in terms of objective clinical findings.

1.3.3 The third objective is to determine the relative effectiveness of Chiropractic Manipulative Therapy compared to placebo ultrasound in the management of ADHD.

1.4 STATEMENT OF HYPOTHESES

1.4.1 It is hypothesised that the integrated data from the patient's subjective and objective responses will indicate that Chiropractic Manipulative Therapy (CMT) is an effective therapy that can be used in the multidisciplinary approach to the management of Attention Deficit Hyperactivity Disorder (ADHD).

1.4.2 It is hypothesised that Chiropractic Manipulative Therapy will be more effective than placebo ultrasound in the management of Attention Deficit Hyperactivity Disorder in Children.

CHAPTER TWO

2.1 INTRODUCTION

The aim of this study was to investigate the efficacy of Chiropractic Manipulative Therapy (CMT) in the management of Attention Deficit Hyperactivity Disorder (ADHD) in school children, in terms of subjective and objective findings.

A German physician, Heinrich Hoffmann, first described the hyperactive child syndrome more that 150 years ago. Since then many authors have outlined the syndrome, which begins early in life and presents as hyperactivity, impulsivity and inattention. It has been variously known as hyperkinesis, minimal brain dysfunction, hyperactivity and most recently, Attention Deficit Hyperactivity Disorder (ADHD) (Campbell and Werry, 1986: 115-155).

Attention deficit hyperactivity disorder (ADHD) is recognized as the most common neurobehavioural disorder of childhood and affects children from early infancy through school and into adult life (Shaywitz & Shaywitz, 1991). It is a medical diagnosis that is applied to children and adults who are experiencing significant behavioural and cognitive difficulties in important aspects of their lives whether it is familial or personal relationships, at school or at work. These difficulties can be attributed to problems of impulse control, hyperactivity and inattention (Cooper and Ideus, 1996:1). Children presenting

with inattention, impulsivity and hyperactivity constitute a large portion of the behavioural problems seen in paediatric practice (Rostain, 1991).

Hyperactivity or ADD is a significant deficit in attention, impulse control and behaviour (compliance, self-control and problem solving) that arises in infancy or early childhood, but is not the direct result of general intellectual retardation, severe language delay or emotional disturbances (Barkley, 1981).

The symptoms of what is today referred to as ADHD were first recorded many hundreds of years ago. These difficulties can be attributed to problems of impulse control, hyperactivity and inattention (Picton, 1997:3). In the 1950's ADHD was thought to be associated with minimal brain injury/dysfunction. Then between 1970 and mid-1980, the cause shifted to the term “over-activity” with the emphasis being placed on poor concentration shared by these children.

In the past “*Attention Deficit Disorder”* (ADD) focused on poor concentration, and “*Hyperactivity”* was the overactive child. These 2 terms are interchangeable and ADD is now regarded as the "umbrella" or overall condition.

2.2 INCIDENCE AND PREVALENCE

The Diagnostic and Statistics Manual (American Psychiatric Association, 1994: 82) states that 3-5% of all school children in the U.S.A have ADHD. ADHD affects 5-10% of school-aged children, accounting for half of the childhood referrals to diagnostic clinics (The Merck Manual, 1999:2256). More boys seem to be affected by this disorder than girls, at a ratio of approximately 10:1 (The Merck Manual, 1999:2256). In South Africa between 7 and 10% of children suffer with ADHD (Taljaard, 2000).

2.3 CHARACTERISTICS OF ADHD / DESCRIPTION

2.3.1 Primary Symptoms

ADHD is characterised predominantly by developmentally inappropriate inattention and/or impulsivity and/or hyperactivity (Woods and Ploof 1997, Warner-Rodgers 1998).

2.3.1 (a) Inattention

The child with ADHD has difficulty in sustaining attention in exercises or play activities, and they find it very difficult to persist with an activity until completion (Serfontein, 1990:19). Thus, there may well be frequent shifts from one uncompleted activity to another, thus failing to complete chores, schoolwork and tasks (APA 1994, Warner-Rodgers 1998).

ADHD children tend to be easily distracted, restless and fidget a lot and they make themselves noticed by responding to the slightest noise in the classroom, thus distracting other children (Serfontein, 1990:31).

2.3.1 (b) Impulsivity

According to Serfontein (1990:40), children with ADHD definitely have a problem with impulsivity. They have difficulty waiting their turn in activities, they frequently interrupt others and in school, they blurt out answers before the question has been completed.

These children act before considering the consequences, and as a result ultimately something is destroyed and someone is hurt and it is too late to correct the situation (Reichenberg-Ullman, 1996:6). At school, children are hasty and do not read their test papers properly as they are in a hurry to get started with the paper quickly, which results into assumptions being made about the test paper and inappropriate answers are given, resulting in incorrect deductions and judgements being made later on (Serfontein, 1990:40). These children interrupt and intrude on others, grab objects from their peers and touch things that they are not supposed to (Warner-Rodgers 1998, APA 1994).

2.3.1 (c) Hyperactivity / Overactivity

Hyperactivity / Overactivity is the most noticeable symptom and probably the most annoying in ADHD (Warner-Rodgers, 1998). Hyperactivity may manifest as a child not remaining seated when told to, by excessive climbing or running where it is inappropriate to do so, by having difficulty playing quietly and by appearing to often be “on-the-go” (Green and Chee, 1997). Overactivity however, can take many forms but it is especially apparent as excessive vocalizations and body movements (Green and Chee, 1997). Children will constantly touch things and are always fiddling with something. These children have little ability to sit still for a period of time and frequently get up and walk around (Serfontein, 1990:35-36). The overactive child has difficulty engaging in group activities and almost always prefers to do his own thing, thus leading to poor interaction with others (Serfontein, 1990: 36).

From babyhood, the child will have been restless, been a difficult feeder and a poor sleeper. The child tends to be more mobile once it starts walking and is therefore prone to having more falls and minor accidents. As the child gets older he cannot settle down to any activity for a long period of time. Puzzles, toys and picture books do not attract his attention and he is very fidgety (Campbell and Werry, 1986:111-115).

At school, the child is suddenly expected to conform and to cope with more structured expectations and a problem then arises. Because this child has problems with attention, organisation skills, goal orientation and following oral

instructions, at school and in the school environment, he will oppose the idea of learning and the learning environment (Graham, 1986).

Aggression and disobedience is shown in 80% of hyperactive children also showing misconduct. They battle to get along well with their peers. As the child progresses to adolescence, hyperactivity usually becomes less of a problem, but defects in attention and concentration may persist (Rostain, 1991). However, ADHD may persist during adolescence as well as adulthood. This may become a problem to society as antisocial behaviour and criminality may arise (Cadonet and Stewart, 1991).

2.4 AETIOLOGY

The exact aetiology of ADHD is unknown but various causative factors are thought to be of importance:

There have been reports that the presence of various additives and colourants in food has been related to hyperactivity (Rowe, 1988). However, well-controlled studies have consistently failed to show that dietary sugar is a significant cause of ADHD. Additive free diets are often shown to be of success in ADHD children (Kaplan et al., 1989). Commonly involved foods are cocoa derivatives (chocolate and cola drinks), as well as food colourants, preservatives and salicylates (Serfontein, 1990:105).

Another possibility is that a child's hyperactivity is thought to be merely an attempt to illicit a response from the mother, as the mothers are often unresponsive to the child's demands (Graham, 1986).

If children are active from day one, they are likely to remain so. Therefore the child's temperament and personality play an important part in the development of ADHD syndrome (Graham, 1986).

Serfontein (1990:21) suggests that ADHD children appear to have an inflexible personality. Their attitude is dogmatic and resistance to any change in their routine or their environment is frequent. Their reluctance to accept change leads to temperamental outbursts and mood swings. They have a low threshold for dealing with frustration, thus elevating their inflexible nature.

O'Shea (2000) suggests that hyperactive symptoms, which may have resulted from upper neck trauma from minor accidents and falls, may be resolved through biomechanical corrective adjustments.

Barkley (1995), found that heredity is a factor in ADHD and that 25% of parents of ADHD children have too been diagnosed with ADHD when they were children. According to Serfontein (1990:25), the genetic material is inherited by the child, often through the male line of the family, due to the male predisposition of the disorder.

Serfontein (1990:27) explains that in children with ADHD, there appears to be insufficient key neurotransmitters (namely norepinephrine and dopamine) manufactured, thus causing a decrease in the transfer of messages between the cells. He also suggests that the enzymes between the cells destroy the neurotransmitter substances, leading to a reduced amount of the

neurotransmitter thus resulting in a breakdown in the transmission between the cells.

Bain (1991:54) suggests that imbalances of the key neurotransmitters are responsible for ADHD, learning disorders and tic disorders.

The frontal lobes of the brain are involved in the regulation of behaviour and intellectual activities. Photon Emission Tomography (PET) scans of ADHD children show underactivity of the frontal lobes. This suggests that there is a reduction of the higher brain centers association with impulse control, memory, attention and reasoning (Picton, 1997).

Abnormal Brain development results from trauma, disease, foetal exposure to alcohol and tobacco, and early exposure to high levels of lead (Barkley, 1995).

Lead, which is a strong neurotoxin, can be found in chipping and peeling paint in older homes that were painted with a lead-base paint, as well as high polluted areas where gasoline containing lead has contributed to high airborne lead levels (Bain, 1991:57).

2.5 DIAGNOSIS

In order to diagnose ADHD, there are three categories that need to be assessed. In each category, the child must display a certain amount of criteria in the list of symptoms:

Innattention - three out of the five symptoms

Impulsivity - three out of the six symptoms

Hyperactivity - two out of the five symptoms

INATTENTION: - at least 3 of the following

i) easily distracted

ii) often doesn't seem to listen

iii) often fails to finish things started

iv) difficulty concentrating

v) difficulty maintaining a play activity

IMPULSIVITY: - at least 3 of the following

i) difficulty in organizing work

ii) needs lots of supervision

iii) shifts excessively from one activity to another

iv) often acts before thinking

v) frequently calls out in class

vi) difficulty in waiting turn

HYPERACTIVITY: - at least 2 of the following

i) difficulty sitting still

ii) difficulty staying seated

iii) moves around excessively in his/her sleep

iv) runs around and climbs on things excessively

v) always "on the go"

The onset of the above criteria needs to be before age 7 and for the duration of at least 6 months.

2.6 TREATMENTS

ADHD is caused by numerous factors and the treatment is therefore multifactorial. Treatment includes behavioural modification, occupational therapy, dietary intervention and medication (Green and Chee, 1997). No one treatment can claim to benefit every child that has ADHD.

2.6.1 Ritalin (Methylphenidate Hydrochloride)

Ritalin (Methylphenidate) was developed in the 1960's and rapidly became the most widely used treatment for hyperkinesis, now called hyperactivity (Bain, 1991:93).

Ritalin is a psychostimulant and has been extensively used in the treatment of ADHD and other related disorders (Brown, 1991). Psychostimulants are the most commonly used drugs in ADHD and have shown to be effective in improving academic work, behaviour and social adjustments in 50 - 90% of ADHD children (Barkley, 1995). It seems illogical to use a stimulant drug to treat hyperactivity, but as they are prescribed in low doses, these drugs enhance attention and therefore decrease overactivity, in contrast to stimulants given at high doses, which would increase activity (Bain, 1991:93). Ritalin is a schedule 7 drug and therefore needs to be administered with great caution. It functions to enhance the action of certain neurotransmitters by inducing their release from the presynaptic neuron, blocking their uptake and inhibiting the action of monoamine oxidase (Donelly and Rapport, 1985). Ritalin is a short acting drug and works within 30 minutes and remains active for three to four hours.

Ritalin appears to stimulate the reticular activating system, the limbic system, striatum and other regions of the brain which are presumed to function in controlling attention, inhibitory processes and arousal (Evans, Gualiltiera and Hicks, 1986). Ritalin has a paradoxical calming effect on motor and cognitive function (Medifile, 1999).

The role of Ritalin with regard to scholastic achievement is controversial but studies show that Ritalin shows improvement in reading ability (Cooter, 1988), and arithmetic performance (Carlson et al., 1991).

Buhrmester et al. (1992) found that Ritalin can reduce social engagement, i.e. sharing, talking to and helping other children whilst interacting socially, and found that children on Ritalin were observed to be more sad, nervous or withdrawn.

2.6.1.1 Side effects of Ritalin

The side effects of Ritalin include decreased appetite, anxiety, weight loss, insomnia, headache, stomachaches, tics, depression, blurred vision and hypertension (Reichenberg-Ullman, 1996:42). Overmedication can cause irritability, oversedation, lack of spontaneity and heightened anxiety (Rostain, 1991).

Studies show that Ritalin decreases the rate of growth in the child, but once the child comes off the medication, his growth rate catches up with his peers and no growth problems occur (Klein et al., 1988). With the decreased rate of growth, there is no demonstration of a clinically significant decrease in height and body weight, and does not persist into adulthood (Medifile, 1999). A drug holiday may be recommended during weekend and school holidays, meaning that no medication for ADHD will be taken during this time (Medifile, 1999).

Ritalin is now available in time-release capsules, which prolong the effect of the medication for up to 10 hours.

2.6.2 Other Treatments

- Mineral therapy
- Drugs: - (Beta-blockers, tricyclic antidepressants, centrally acting drugs)
- Psychological counselling
- Diet: - Dr. Feingold, in the early 1970's, devised a diet for his patients suffering from allergies. The diet avoided synthetic flavours and colourants, some preservatives and certain natural foods. It was noted that the behaviour of many hyperactive children improved dramatically when put on the same diet (Green and Chee, 1997). It has also been found that unrefined and unprocessed foods are preferable.
- Behaviour modification
- Occupational Therapy

2.6.3 Chiropractic Treatment

Chiropractic is a branch of the healing arts, specialising in the correction biomechanical disorders of the spinal column by spinal manual therapy. Chiropractic Manipulative Therapy (CMT) is characterised by the implementation of specific short-lever, high-velocity, low amplitude thrusts directed at specific joints or articulations (Gatterman, 1990: xv).

According to Leach (1994:175), early chiropractic investigators observed a significant improvement in children with hyperkinetic behaviours, as well as in

children with other learning and behavioural impairments, after they were treated with chiropractic adjustments. Walton investigated twelve ADHD students (primary school through to high school) who were receiving stimulant medication, who were compared with a group of twelve ADHD students receiving CMT. It was shown that initially, medication seemed effective in nine out of twelve children in controlling hyperactivity and improving attention span. However, high dosages of stimulant medication were required. This caused alteration in personality, appetite loss and insomnia in 50% of the subjects on medication. In the group that received Chiropractic care, improvement in hyperactivity was noted as well as improvement in a wider range of thirteen problem areas assessed by the investigators, than did the students receiving medication. It was shown that improvement in attention span and reduction in hyperactivity were sustained in the CMT group and CMT was 20-40% more effective than medication (As cited by Leach, 1994:175).

In 1989, a multiple-baseline study was done to evaluate seven consecutive previously diagnosed ADHD children of school-going age, before and after CMT. All seven children were subjected to four principle tests including placebo, CMT, electrodermal testing and a unique wrist-type watch for measuring hyperkinetic behaviour. The placebo treatment used involved an activator instrument set in the off position, thus applying a zero thrust to the involved area, but with an audible popping sound. The results showed that from placebo care through to CMT, overall, five out of the seven children showed improvement in structural, orthopaedic and palpatory findings, illustrating that CMT had a significant clinical effect. Also, four of the seven

children showed improvement in autonomic activity, which was recorded via the electrodermal testing, thus showing that CMT produced a clinical autonomic effect. The results suggest a clinically significant effect of CMT on hyperactivity and its autonomic substrata in these patients. These results are not conclusive however, but do suggest that CMT has the potential to become an important non-drug intervention for children with hyperactivity (Giesen, Center and Leach, 1989). Due to time constraints and variable data, the above study displayed weaknesses. Small sample sizes were also used in this study.

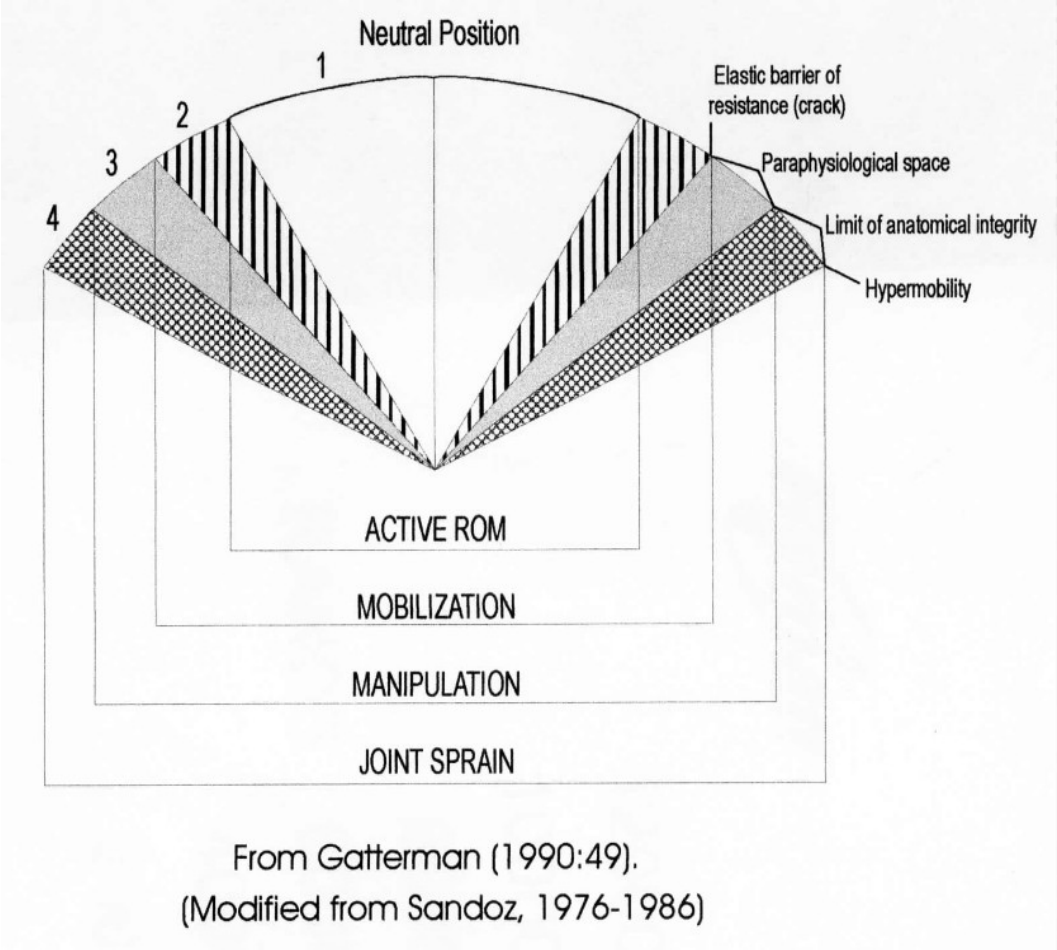
2.6.3.1 Physiology of Chiropractic Manipulative Therapy

CMT aims to restore mobility to individual joints by using high velocity thrusts of controlled amplitude to the specific joint (Gattterman, 1990:49).

Manipulation and mobilization can be and often are used synonymously, however, a clear distinction exists in the effect on the synovial joint by these two procedures (Maitland, 1986: 3).

The following figure illustrates the four stages of ranges of movement between manipulation and mobilization.

Figure 4.10



From Gatterman (1990:49).
(Modified from Sandoz, 1976-1986)

Figure 4.10 shows a central arc, representing the range of active movement of a joint in one plane (e.g.: flexion/extension or right/left rotation). When the joint is passively mobilized, produced by traction or joint springing, the range of motion is slightly increased in both directions. Once the end of the passive range of motion is reached and slack has been taken out, a resistance is felt at that point which is called “the elastic barrier of resistance”. In mobilizing a joint, movement of the joint is done in both directions only up to this elastic barrier of resistance. If mobilization of a joint is forced beyond the elastic barrier, a cracking noise is heard and a noticeable “give” is felt and the range of motion of that joint has been increased beyond the usual physiological limit.

This is called manipulation. The characteristic crack, when manipulation of a joint is achieved, is the result of a sudden release of dissolved gases in the joint cavity as the articular surfaces of the joint suddenly move apart. After the release of these gases, there is a period of time called the refractory period, where the gases are redissolved. However, during this period, which lasts approximately 20 minutes, another articular crack cannot be produced. At the end of the paraphysiological space, there is a second barrier of resistance known as “the limit of anatomical integrity”. If the joint were to be forced beyond this barrier, ligamentous and capsular damage would result.

According to Gatterman (1990: 50), there are 3 physical events that differentiate manipulation from mobilization, which are:

(1) The sudden separation of the articular surfaces as the joint passes through the elastic barrier of resistance;

(2) A cracking noise is heard, and

(3) On x-ray, a radiolucent space appears within the joint

2.6.3.2 The Verterbral Subluxation Complex

In the Chiropractic profession, the cornerstone of the science, art and philosophy of the profession is indeed the reduction of the subluxation (Anrig and Plaugher, 1998:466). The meaning of subluxation has evolved from a simple static concept, i.e. a bone-out-of-place, to a complex biomechanical entity of many components, and in simple terms, is a loss of proper movement

or position of a verterbral joint which in turn may affect proper nerve function (Redwood, 1997:29). The more modern terminology for this entity is the verterbral subluxation complex (VSC) (Anrig and Plaugher, 1998:466). Technically, the VSC is presented as a model of verterbral motion segment dysfunction interacting with pathologic changes in muscle, nerve, vascular, ligamentous and connective tissue (Redwood, 1997:29).

According to Schafer and Faye (1989:2), any physical, functional or psychic mechanism that produces a loss of segmental mobility within its normal physiologic range of motion, is a fixation. The Faye model of the VSC presents a subluxation as a complex clinical entity comprising of one or more of the following components: neuropathophysiology, kinesiopathology, myopathology, histopathology and a biochemical component (Schafer and Faye, 1989:xix). The central element is that the subluxation causes a pathophysiology, which then can lead to pathologic changes. However, correcting a subluxation can lead to restoring the normal physiologic process and therefore leading to the reversal of the pathologic changes (Redwood, 1997:33).

The following flow diagram was modified from Schafer & Faye (1989:xix).

THE SUBLUXATION COMPLEX

SUBLUXATION - - - - - - - - - - ->PATHOPHYSIOLOGY - - - - - - - - - - ->
PATHOLOGY

SUBLUXATION – A complex clinical entity comprising one or more of the following:

1. *NEUROPATHOPHYSIOLOGY*

→ Irritation → Fascilitation → Anterior Horn → Muscles Hypertonic
→ Lateral Horn →Sympathetic Vasosomotor
→ Posterior Horn → Sensory

→ Degeneration → Atrophy
→ Sympathetic Atonia
→ Anesthesia

→ Decreased Axoplasmic Flow

2. KINESIOPATHOLOGY

→ Hypomobility - Fixation Theory – H.Gillet
→ Hypermobility - Illi
→ Loss of Joint Play - J. Mennel

Compensation → Hypermobility + Hypomobility = Normal
→ Hypomobility and Hypermobility can be in the same motion unit

Change of axis of movement

3. *MYOPATHOLOGY*

→ Spasm → Compensation
→ Fascilitation
→ Hilton's Law
→ Visceromotor Reflex

→ Atonia

4. *HISTOPATHOLOGY*

→ Cellular flow of inflammatory process
→ Edema within interverterbral foramen, impeding flow of circulating fluids

5. BIOMECHANICAL CHANGES

→ L.A.S (Seyle) from local tissue damage of further G.A.S
→ Histamines
→ Prostaglandines
→ Kinines
Stress Syndrome
∴ Proinflammatory

2.6.3.3 Neuropathophysiology

The VSC is based on the model that a fixation or subluxation causes the nerve complex; consisting of a nerve root, the dorsal root ganglion, a spinal nerve and connective tissue coverings, to become irritated and compressed (Gatterman, 1990:40). The irritation of the nerve complex results in increased activity of the nerve, while compression leads to degeneration of the tissue (Gatterman, 1990: 40).

2.6.3.4 Kinesiopathology

Kinesiopathology includes hypomobility, absent or diminished joint play, compensatory hypermobility, fixation dysfunction, intersegmental posture/alignment and changes in the pattern of movement of the functional spinal unit (FSU) (Anrig and Plaugher, 1998:467; Redwood, 1997:35). The FSU consists of two adjacent vertebrae and all the ligaments and other soft tissue structures that connect them, resulting in an important segment of spinal motion in the spinal column (Anrig and Plaugher, 1998:467).

2.6.4 Chiropractic Paediatrics

The care of infants and children through chiropractic care has been happening since the beginnings of chiropractic, the earliest report being that of D D Palmer in 1910, one of the forefathers of the profession (Anrig and

Plaugher, 1998:2). As early as 1915, paediatrics was offered in the curriculum of the West Coast Chiropractic College in Oakland California, and in 1919, the Los Angeles College of Chiropractic offers no less then 50hrs of curriculum material in paediatrics (Anrig and Plaugher, 1998:2).

Larry Webster, D.C, (1937-1997) founded the International Chiropractic Paediatrics Association (ICPA) in 1975 to co-ordinate information and to stimulate research in paediatrics (Anrig and Plaugher, 1998: 3-4).

The primary feature that defines Chiropractic is its contribution to the health care system by the importance that is placed on spinal column health and the integrated nervous system (Anrig and Plaugher, 1998:8).

Anrig and Plaugher (1998:8) suggest that many chiropractors believe that spinal subluxations have a large impact on dis-ease, through a close relationship between the nervous system and the spine.

Everyday activities, sports and recreation can lead to damage of the spinal joints of a child, leading to signs of a subluxation such as limited motion in an area, pain, swelling, tenderness and neurological changes (Anrig and Plaugher, 1998:9).

2.6.5 Techniques used

2.6.5.1 The Diversified Technique

The rationale for the diversified technique is based on sound orthopaedic and neurobiomechanical principles (Gitelman and Fligg, 1992:484). Originally, the criteria used by this approach for the selection of an adjustment was based on a static model of joint alignment, using diagnostic tools such as x-ray, posture analysis and static palpation; however, with the addition of motion palpation as a diagnostic tool, manipulative procedures have taken on a more specific approach (Gitelman and Fligg, 1992:484). This allows the practitioner to assess the structures of the human body more effectively (Gitelman and Fligg, 1992:484).

The key to the diversified technique is the specific diagnosis of the active lesion and the structural environment of the lesion within the patient i.e. external stresses from the environment, lifestyle and occupation of the patient – all playing a vital role in the patient's neurobiomechanical mechanism (Gitelman and Fligg, 1992:484). At the consultation, once detailed documentation regarding age, sex, occupation, lifestyle and nature of the problem have been made, including information of general body examination and specific areas like cervical, thoracic, lumbar and pelvic areas, the appropriate adjustive technique is applied thus implementing the most ideal technique within the context of the clinical picture (Gitelman and Fligg, 1992: 483).

This technique attempts to correlate joint dysfunction with the appropriate adjustive spinal manipulative procedure, while taking into consideration the factors of muscle dysfunction, and involves techniques that not only influence the musculature of the area involved, but also facilitates the manipulation (Gitelman and Fligg, 1992: 484).

2.6.5.2 Motion Palpation

The spine is a segmented, living, dynamic organ that is constantly moving through every activity that is performed during the day, even during breathing and sleeping. Thus, in order to understand the principle of motion palpation, the picture one sees of the spine as a static, straight, vertical structure must be eliminated (Schafer and Faye, 1989:7).

As described by Shafer and Faye (1989:65), movement of a healthy joint can normally be achieved painlessly in the joint by active and passive motion; however, pain will arise if the anatomical barrier is reached. Shafer and Faye (1989:65) continue to add that compressed tissues that cause pain, will generally be worsened by compression of the joint, and relieved by traction of the joint; on the contrary, a painful tensile tissue will be aggravated by traction and relieved by compression.

Schafer and Faye (1989:66) describe how the basic motion palpation examination is conducted. First, a general spinal survey is conducted with the purpose of isolating any general areas that will require further specific motion palpation at a later stage, with specific range of motion techniques (Schafer and Faye, 1989:66). With the general spinal survey, the practitioner sits

slightly diagonally behind the seated patient, stabilizing the patient across his/her shoulders and nape of the neck with a non-examining hand, by placing the elbow on the shoulder. With the patient in a seated position, the practitioner places the back of his/her palpating hand (fingers facing downward) on the patient's sacrum, pushing the hand inward causing translation of the sacrum. The pressure is then released and the patient's spine automatically returns to the neutral position. This sequence is repeated a few times in order to note the pattern of movement of the sacrum. The same is done over both the sacroiliac joints. Next, the practitioner turns his fingers horizontally as he repeats this movement over the entire lumbar area, from the lower segments to L1. Then, the thoracic area is examined in the same manner. To scan the patient's cervical spine, the stabilizing hand in placed on the patient's forehead. At the C7 level, using the thumb and middle finger, the laminae on each side of the cervical vertebrae are pushed forward (as before), continuing all the way up the cervical spine. The entire scan should take about one minute and at no time should the practitioners' hand leave the patient's skin as this causes a punching movement, rather than a smooth push effect. Once the practitioner notes any areas of the spine where the movement feels less springy, more specific motion palpation will be done at that level. (Schafer and Faye, 1989:66-68).

Faye states, "in the neutral posture the discs have a zero coefficient of resistance. Any resistance perceived will be at one or more of the sites of possible fixation" (Schafer and Faye, 1989:68).

2.7 CONCLUSION

In summary, attention deficit hyperactivity disorder (ADHD) is recognized as the most common neurobehavioural disorder of childhood and affects children from early infancy through school and into adult life (Shaywitz & Shaywitz, 1991).

The prevalence of ADHD is estimated at 5-10% of school-aged children, accounting for half of the childhood referrals to diagnostic clinics (The Merck Manual, 1999: 2256). In South Africa, between 7 and 10% of children suffer with ADHD (Taljaard, 2000).

It is a condition characterized by impulsivity, inattention and hyperactivity due to a variety of aetiologies. Ritalin (Methylphenidate Hydrochloride), a psychostimulant, has been extensively used in the treatment of ADHD and other related disorders. Psychostimulants are the most commonly used drugs in ADHD. Although the effects of Ritalin have shown to improve attention, impulsivity and behavioural processes, the side effects are marked and include symptoms such as decreased appetite, weight loss, hypertension, tachycardia, headaches and insomnia (Brown, 1991; Rostain, 1991).

Studies have shown that Chiropractic Manipulative Therapy (CMT) has a significant effect on hyperactivity, by reducing the levels thereof and improving the attention span of children. These studies however were inconclusive and in that light, a controlled placebo-based study needs to be carried out to

conclude whether CMT has the potential to become an important non-drug intervention in the management of ADHD in Children.

Although no single treatment shows to be the best in treating this condition, a multidisciplinary approach could be effective.

CHAPTER THREE

3.1 Objective

This study was a randomised, placebo controlled clinical trial, which investigated the efficacy of chiropractic manipulative therapy in the management of Attention Deficit Hyperactivity Disorder (ADHD) in children, in terms of subjective and objective findings.

3.2 Research Methodology

3.2.1 Subjects

No gender bias was intended in the study: the use of the pronoun ‘he’ or ‘his’ in the dissertation was merely for ease of reference.

The proposed sample size was sixty (thirty patients per group). However, due to a poor response to the study through poor parent compliance and the low percentage of children being diagnosed with ADHD but not on any medication, there was difficulty in attaining sixty children for this study. The sample size was thus reduced to thirty, and later reduced to twenty patients.

The inclusion criteria were as follows:

- Age range of each child to be from six to twelve years (inclusive).
- A psychologist, paediatrician or someone equally qualified must have diagnosed the child with ADHD.
- A parent or legal guardian must have signed the informed consent form (Appendix F).

The exclusion criteria were as follows:

- Children who were on any drug treatment for ADHD (Ritalin or other).
- A child not within the specified age group or age range.
- Any child with contra-indications to CMT was excluded (Triano et al. 1992:352).

The sample group was obtained by personally approaching the principals of schools in the Durban area and placing advertisements in the various school-news leaflets (Appendix K). After a positive response from the headmaster / headmistress, letters were given to the parents of any ADHD children within the schools explaining the research study (Appendix G). However, due to the poor response of the parents to this study, only four children were recruited to the study from schools. The majority of the children participating in this study were recruited from the Malvern Children's Home, Queensborough.

3.2.2 Subject Allocation

The 20 subjects were randomly allocated to one of two groups. At the initial consultation, a dice was given to the child. Odd numbers represented Group One (treatment group) and even numbers represented Group Two (placebo group). When the child threw the dice, and for example an odd number appeared, that child was allocated to Group one. The next child was then automatically allocated to Group two. Therefore, every third child had a chance to throw the dice.

Those children who were assigned to Group One received Chiropractic Manipulation and those children assigned to Group Two received placebo ultrasound at 0,0w/cm².

Single blinding was utilised for this study, with only the researcher being aware of which intervention each patient was receiving.

3.2.3 Study Design

At the initial consultation, all patients underwent a detailed case history (Appendix A), a physical examination (Appendix B), and regional examinations of the cervical, thoracic and lumbar spines respectively (Appendix C, D and E). Patients with contra-indications to CMT (Triano et al. 1992:352) were excluded from the study. If the patient fulfilled the requirements of the study, each parent was asked to sign the Informed Consent Form (Appendix F) before the treatment commenced, as well as to

read the Letter of Information (Appendix G). Each child received six treatments over a three-week period.

The subjects in Group 1 (the experimental group) received spinal manipulation as their treatment. The indicated level of the spinal adjustment was located by motion palpation (Schafer and Faye, 1989: 65-66) either in the cervical, thoracic or lumbar spine and was limited to one adjustment per area. The involved area was adjusted according to the diversified technique (Szaraz, 1990). The subjects in Group 2 (the placebo group), received ultrasound therapy set at 0,0w/cm2 placed along the lower cervical, thoracic and lumbar paraspinal muscles for 10 minutes in total.

At each treatment, patients in Group 1 first received motion palpation to assess the level of the spinal fixation, and were then treated accordingly with a chiropractic adjustment at the required level of fixation. Patients in Group 2 were asked to take off their shirt and lie face down on the treatment bed. The de-tuned ultrasound was then applied to their paraspinal muscles in the cervical, thoracic and lumbar regions for 10mins. The evening after each treatment session, the parents/guardians were required to fill out the Parent Questionnaire (Appendix I), to assess the child's actions and behaviour after the treatment. These forms would be returned to the researcher at the following treatment session.

In the classroom, the teacher's were required to complete the Revised Conners' Questionnaire (Appendix H) and the Activity Level Scale (Appendix J), without the children being aware that this procedure was taking place.

These forms were completed once after the first treatment and once after the final treatment, and returned to the researcher on completion thereof.

3.2.4 Ethical considerations

The patients were not coerced into participating in the study and the parents of the patients were assured that all patient information would be treated confidentially. Personal information was kept in the patient's file and the patient remained anonymous with regard to any written material required for the final draught of the research document.

Informed consent was obtained from all the parents of the patients, as they were all minors, prior to commencement of the treatment and relevant information was given to all parents regarding the study, in a language that they understood (Appendix F).

The parents were informed that their child's participation in the study would involve no financial benefit and it was seen to that the general rights and welfare of the patients were protected.

The parents were informed that they would be free to withdraw their child at any stage.

3.3 The Data

This study made use of both primary and secondary data as mentioned below.

3.3.1 Primary Data

- Case history (Appendix A)
- Physical examination (Appendix B)
- Cervical regional examination (Appendix C)
- Thoracic regional examination (Appendix D)
- Lumbar regional examination (Appendix E)
- Revised Conners Questionnaire (Appendix H)
- Parent questionnaire (Appendix I)
- The Activity Level Scale (Appendix J)

3.3.2 Secondary Data

Secondary data was obtained from journal articles, books, the Internet and Medline to obtain information on the aetiology, pathology, diagnosis and treatment of ADHD. Where literature was not available at the Technikon Natal Library, then inter-library loans were used.

3.3.3 Location of the Data

The primary data was obtained from the Parent Questionnaires, the Revised Conners Questionnaire and the Activity Level Scale. The parents of the patients completed the Parent Questionnaire each evening following their child's treatment. The schoolteacher of each child completed the Revised

Conners' Questionnaire and the Activity Level Scale once after the first treatment and once after the final treatment.

All consultations were conducted at the Technikon Natal, Chiropractic Day Clinic.

3.4 Method of Measurement

3.4.1 Subjective measurement

Parent Questionnaire (Appendix I)

This was a 10-item questionnaire that was based on the Conners' Abbreviated Teacher's Rating Scale. Each stipulated activity was rated on a scale from 0 - 3, according to the degree of activity, where 0 was "*not at all"*, 1 "*just a little"*, 2 "*pretty much"* and 3 "*very much"*. The evening after the treatment, the parent completed the questionnaire by ticking one block per activity that the child represented, according to the degree of activity scale.

3.4.2 Objective measurement

Revised Conners Questionnaire (Appendix H)

This is the most widely used scale for evaluating children that are diagnosed with ADHD (Conners, 1969). Originally, the Conners Questionnaire consisted of thirty-nine items, but now, researchers are utilising the twenty-four-item questionnaire, namely the Revised Conners Questionnaire (Barkley, 1993), as

well as the ten-item questionnaire, known as the Abbreviated Teacher's Rating Scale.

For the purpose of this study, the twenty-four-item subset, recommended by Barkley (1993), was used.

The schoolteacher of each child completed this questionnaire once after the first treatment and once after the final treatment. The teachers observed the child during a normal day of school activities, without the child being aware of this procedure. Each stipulated activity was rated on a scale from one to five, according to the degree of activity, where one is "*almost never"* and five is "*almost always"*.

The Activity Level Scale (Appendix J)

This is a classroom observation technique (Gittelman, 1980).

Without the child's knowledge his activity level in the classroom was recorded during direct observation. The child was observed during structured class time, because it would be difficult to obtain reliable ratings of behaviour when there were no clear rules governing the children.

Each child was observed for a full class period (e.g. 30-min). The observer / teacher worked systematically through numbers 1 - 6 on the scale.

Each time the activity that was being observed was distinctively seen, a tick was placed in the relevant space. The ticks were added and a result obtained for each activity over the time period. Thus a maximum of 6 could be obtained for each activity in severely hyperactive children.

3.5 Statistical Analysis

3.5.1 Introduction

All subjective and objective results were entered into a spreadsheet, and then analysed using the SPSS Statistical Package (version 9.0) as supplied by SPSS Inc., Marketing Department, 444 North Michigan Avenue, Chicago, Illinois, 60611.

Non-parametric tests, namely the Mann-Whitney, Freidman and the Wilcoxon Signed Rank tests were used to analyse both categorical and continuous variables.

Group 1 (the treatment group) consisted of 11 patients and group 2 (the placebo group) consisted of 9 patients. The two groups were independent of each other.

The SPSS statistical package was used for data entry and analysis.

The alpha value of significance was set at = 0.05.

3.5.2 Non-Parametric Testing

A) MANN-WHITNEY U-TEST

The Mann-Whitney U-Test is used to determine inter-group comparison between groups 1 and group 2, in terms of data gathered using the results from the Parent Questionnaire, the Revised Conners' Questionnaire and the Activity Level Scale. The purpose of this was to analyse whether there was a significant difference between the two groups at the initial and final consultations.

Ho: There is no difference between the two groups.

Ha: There is a difference between the two groups.

Decision rule:

If $p < \alpha$, reject Ho.

If $p \geq \alpha$, accept Ho.

Where p is the reported p-value.

B) WILCOXON SIGNED RANKS TEST

The Wilcoxon Signed Ranks Test is used to determine intra-group comparison within group 1 and group 2, in terms of the data gathered using the results of the Parent Questionnaire, the Activity Level Scale and the Revised Questionnaire. The purpose of this was to analyse whether there was a significant improvement within each group between the initial and final consultations.

Ho: There is no improvement between the consultations.

Ha: There is an improvement between the consultations.

Decision rule:

If $p < \alpha$ reject Ho.

If $p \geq \alpha$, accept Ho.

(The reported p-value is the SPSS print out value of p).

C) FREIDMAN TEST

The Freidman Test is used to determine intra-group comparison within group 1 and group 2, in terms of the data gathered using the results of the Parent Questionnaire, the Activity Level Scale and the Revised Questionnaire. The purpose of this was to analyse whether there was a significant improvement within each group between the initial and final consultations.

Ho: The treatments yield identical results at the α = 0.05 level of significance.

Ha: One treatment yields larger values than that of the other treatment.

Decision rule:

If $p < \alpha$ reject Ho.

If $p > \alpha$, accept Ho.

3.6 Addressing the Subproblem

The results obtained from the statistical analysis of the subjective and objective data was then used to address the objectives of this study.

CHAPTER FOUR

4.1 Introduction

This chapter deals with the results accompanied by relevant interpretations obtained after statistically analysing the data from the measurement criteria utilised namely;

- The Parent Questionnaire
- The Revised Conners' Questionnaire
- The Activity Level Scale

The results obtained for the intra-group and inter-group data analysis are tabulated below. The tables include the level of significance (p-value), the mean (Me) and the conclusion.

4.2 The Hypothesis

The null hypothesis (Ho) is the same for both groups and is described below:

Ho: On analysis of the intra-group data there would be no statistical improvement in the subjective and objective findings, indicating that the treatment was statistically insignificant.

The alternative hypothesis (Ha) is the same for both groups and is described below:

Ha: On analysis of the intra-group data there would be a statistical improvement in the subjective and objective findings, indicating that the treatment was statistically significant.

Integrating the data from the two groups required a further null hypothesis and an alternative hypothesis as described below:

Ho: On analysis of the inter-group data there would be no statistical difference in the subjective and objective findings, indicating that the two treatments were equally effective.

Ha: On analysis of the inter-group data there would be a statistical difference in the subjective and objective findings, indicating that the two treatments were not equally effective.

4.3 The Analysed data

The data was analysed at $\alpha = 0.05$ specified level of significance and the decision rule was applied as follows:

- Reject the null hypothesis if the p-value is $\leq \alpha$
- Accept the null hypothesis if the p-value is $> \alpha$

For the Mann Whitney – U test, the decision rule was applied as follows:

- Reject the null hypothesis if the p-value is $\leq \alpha/2$
- Accept the null hypothesis if the p-value is $> \alpha/2$,

  where $\alpha/2 = 0.025$ (2 Tailed Test).

4.4 Demographic Data

4.4.1 The Age distribution of patients

Table 4.1 AGE DISTRIBUTION OF PATIENTS

AGE	CHIROPRACTIC GROUP		PLACEBO GROUP	
	TOTAL	%	TOTAL	%
6	0	0%	0	0%
7	1	9%	1	11%
8	3	27%	3	33%
9	0	0%	0	0%
10	4	36%	2	22%
11	1	9%	2	22%
12	2	18%	1	11%
AVERAGE	9.63		9.44	

The average age for group 1 was 9.63 years.

The average age for group 2 was 9.44 years.

The average age for both group 1 and group 2 was 10.35 years.

4.4.2 The Gender distribution of patients

Table 4.2 GENDER DISTRIBUTION OF PATIENTS

GENDER	CHIROPRACTIC GROUP		PLACEBO GROUP	
	TOTAL	%	TOTAL	%
MALE	9	81.81%	7	77.78%
FEMALE	2	18.18%	2	22.22%

The total number of males participating in this study was 16 (80%) and the total number of females was 4 (20%). Thus, the total number of males was four times the number of female patients.

4.4.3 The Racial distribution of patients

Table 4.3 RACIAL DISTRIBUTION OF PATIENTS

RACE	CHIROPRACTIC GROUP		PLACEBO GROUP	
	TOTAL	%	TOTAL	%
WHITE	10	90.90%	8	88.89%
INDIAN	0	0%	1	11.11%
COLOURED	1	90.10%	0	0%
BLACK	0	0%	0	0%

The total number of white patients amounted to 18 (90%).

The total number of indian patients amounted to 1 (5%).

The total number of coloured patients amounted to 1 (5%).

No black patients participated in this study.

4.5 Results

4.5.1 Non-parametric intra-group and inter-group analysis of the subjective data

TABLE 4.4 Intra-group comparison for the Parent Questionnaire with regard to treatments 1, 3 and 6 for Group 1 (for both tables)

	Parent Questionnaire	Mean	p-value
Group 1	1	14.45	0.058
	3	11.18	
	6	9.90	

The results of the Friedman Test indicates that at the $\alpha = 0.05$ level of significance, all of the 3 treatments were identical for Group 1 and therefore the null hypothesis is not rejected at a significance level of 0.05 (1 tailed), although it would have been rejected at a 0.06 % level of significance.

	Parent Questionnaire	p-value
Group 1	Treatment Interval 1-3	0.075
	Treatment Interval 3-6	0.277
	Treatment Interval 1-6	0.038

The results of the Wilcoxon Signed Ranks Test indicates that at the $\alpha = 0.05$ level of significance, the null hypothesis is not rejected between treatments 1 and 3 and also between treatments 3 and 6, however, it is rejected between treatments 1 and 6 indicating there has been a significant change in readings between the first and sixth treatment.

TABLE 4.5 **Intra-group comparison for the Parent Questionnaire with regard to treatments 1, 3 and 6 for Group 2 (for both tables)**

	Parent Questionnaire	Mean	p-value
Group 2	1	8.55	0.674
	3	9.33	
	6	8.22	

The results of the Friedman Test indicates that at the $\alpha = 0.05$ level of significance, all of the 3 treatments were not significantly different for Group 2 and therefore the null hypothesis is not rejected.

	Parent Questionnaire	p-value
Group 2	Treatment Interval 1-3	0.858
	Treatment Interval 3-6	0.570
	Treatment Interval 1-6	0.733

The results of the Wilcoxon Signed Ranks Test indicates that there is no significant difference between treatments 1 and 3 , treatments 3 and 6 and even treatments 1 and 6 . The null hypothesis in all three cases is therefore not rejected at a 5% level of significance.

TABLE 4.6 Inter-group comparison between Group 1 and Group 2 with regard to the Parent Questionnaire for the 6 treatments

Parent Questionnaire	Group	Mean	p-value
1	1	13.05	0.032 (*0.016)
	2	7.39	
2	1	12.41	0.109 (*0.0545)
	2	8.17	
3	1	10.95	0.703 (*0.3515)
	2	9.94	
4	1	11.09	0.619 (*0.3095)
	2	9.78	
5	1	11.41	0.446 (*0.223)
	2	9.39	
6	1	11.27	0.517 (*0.2585)
	2	9.56	

(*) p-value = reported p-value/2

The results of the Mann-Whitney Test indicate that at the $\alpha = 0.05$ level of significance, no significant difference was observed between Group 1 and Group 2 at treatments 2 through to 6 at a significance level of 0.025 for the 2 tailed test. The null hypothesis is therefore not rejected for these treatments. However, for treatment 1, the null hypothesis is rejected at a 0.025 2-tailed significance level, indicating that there is a significant difference between the 2 groups at the first treatment.

4.5.2 Non-parametric intra-group and inter-group analysis of the objective data

TABLE 4.7 Intra-group comparison for the Revised Conners' Questionnaire with regard to treatments 1 vs 6 for Group 1

	Revised Conners'	Mean	p-value
Group 1	1	43.72	0.036
	6	46.36	

The results of the Wilcoxon Signed Ranks Test indicate that there is a significant improvement between treatment 1 and treatment 6, thus the null hypothesis is rejected at a 5% level of significance.

According to the results, the scores for the Revised Conner's Questionnaire show that between treatment 1 and 6, the scores increased. These results are however in contrast with the results of the Parent Questionnaire for Group 1. This puts the internal validity of the test under question and one should query the assumption of the "truthfulness of the respondents" to this questionnaire.

TABLE 4.8 Intra-group comparison for the Revised Conners' Questionnaire with regard to treatments 1 vs 6 for Group 2

	Revised Conners'	Mean	p-value
Group 2	1	44.33	0.161
	6	41.88	

The results of the Wilcoxon Signed Ranks Test indicate that there is no significant improvement between treatment 1 and treatment 6 for Group 2, thus the null hypothesis is not rejected at a 5% level of significance.

TABLE 4.9 Inter-group comparison between Group 1 and Group 2 with regard to the Revised Conners' Questionnaire for treatments 1 and 6

Revised Conners'	Group	Mean	p-value
1	1	43.72	0.760
	2	44.33	
6	1	46.36	0.269
	2	41.88	

The results of the Mann-Whitney Test indicates that at the $\alpha = 0.05$ level of significance, no significant difference was observed between Group 1 and Group 2 at treatments 1 and 6. The null hypothesis is therefore not rejected at a 5% level of significance.

TABLE 4.10 Intra-group comparison for the Activity Level Scale with regard to treatments 1 vs 6 for Group 1

	Activity Level	Mean	p-value
Group 1	1	7.72	0.151
	6	10.27	

The results of the Wilcoxon Signed Ranks Test indicate that there is no significant change between treatment 1 and treatment 6 for Group 1, thus the null hypothesis is not rejected at a 5% level of significance.

TABLE 4.11 Intra-group comparison for the Activity Level Scale with regard to treatments 1 vs 6 for Group 2

	Activity Level	Mean	p-value
Group 2	1	11.11	0.120
	6	10.00	

The results of the Wilcoxon Signed Rank Test indicate that there is no significant improvement between treatment 1 and treatment 6 for Group 2, thus the null hypothesis is not rejected at a 5% level of significance.

TABLE 4.12 Inter-group comparison between Group 1 and Group 2 with regard to the Activity Level Scale for treatments 1 and 6

Activity Level	Group	Mean	p-value
1	1	7.72	0.303
	2	11.11	
6	1	10.27	1.000
	2	10.00	

The results of the Mann-Whitney Test indicates that at the $\alpha = 0.05$ level of significance, no significant difference was observed between Group 1 and Group 2 at treatments 1 and 6. The null hypothesis is therefore not rejected at a 5% level of significance for both treatments.

4.6 Mean Values represented graphically

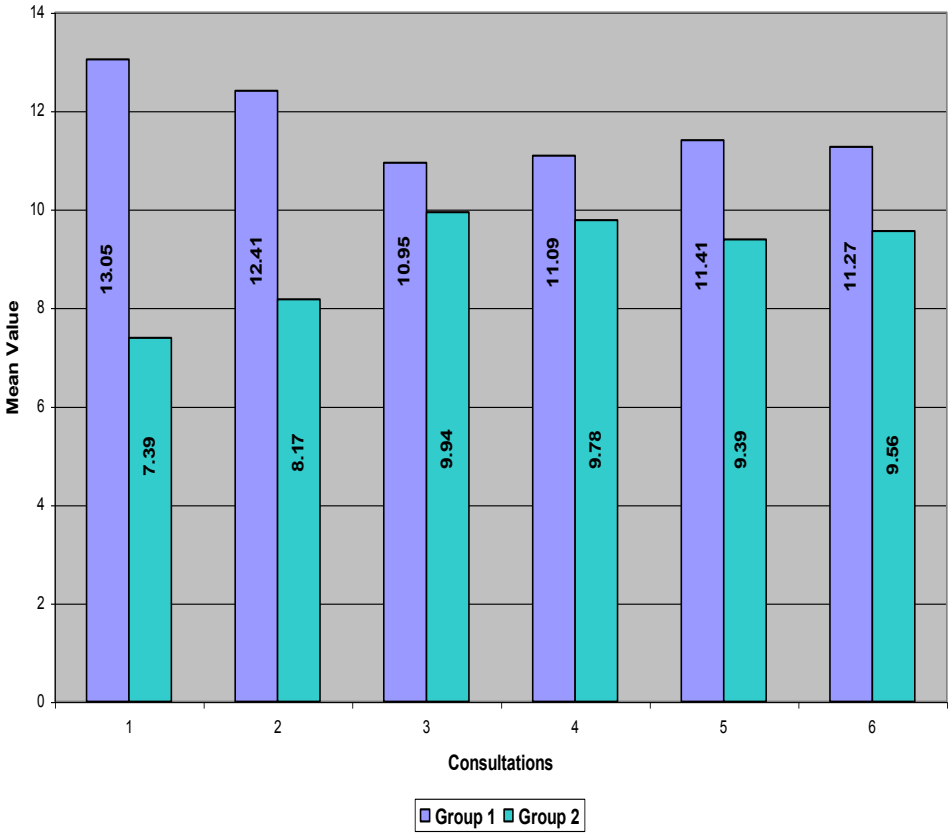


Figure 4.1 Parent Questionnaire – Intergroup comparison

This figure indicates the changes in the mean Parent Questionnaire values over the full evaluation period for Group 1 and Group 2. Readings were taken at each consultation (1-6).

Group 1 shows an initial decrease in mean values from the first treatment session, but then reaches a steady plateau. Group 2 shows a slow increase in mean values from the first treatment session.

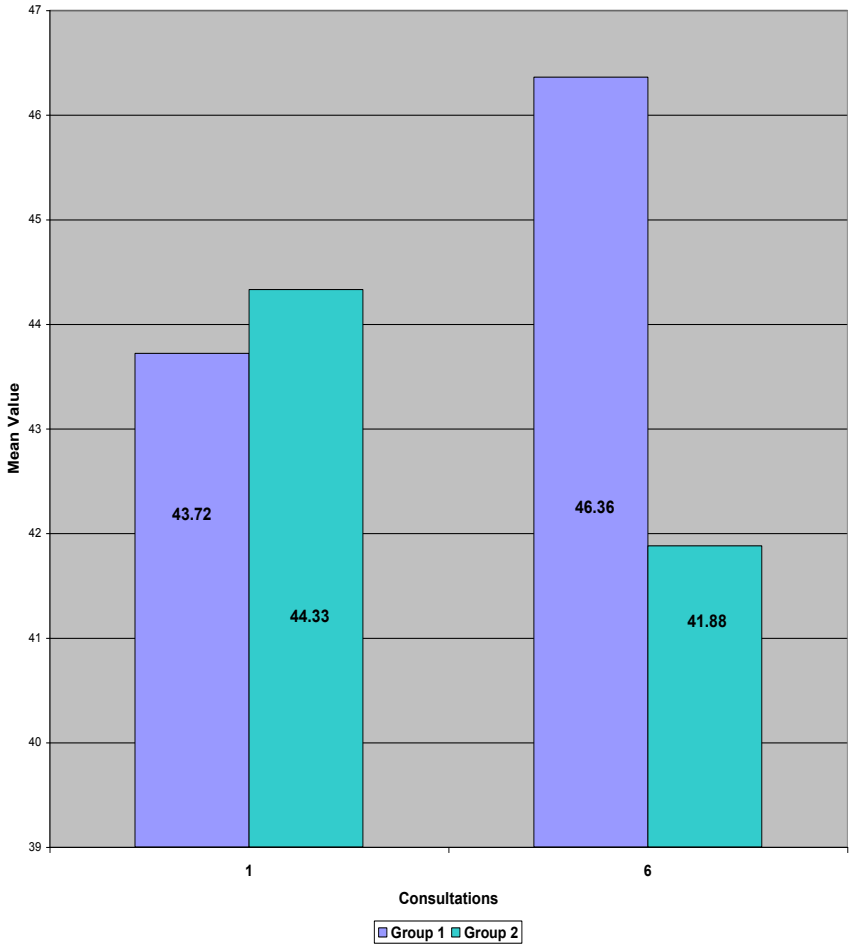


Figure 4.2 Revised Conners' Questionnaire – Intergroup comparison

This figure indicates the changes in the mean Revised Conners' Questionnaire values over the evaluation period for Group 1 and Group 2.

One can see that the mean for group 1 increased over the treatment period, showing that the hyperactivity levels of the children actually increased. This is in contrast to the Parent Questionnaire for Group 1 where the inter-group analysis shows a decrease in the mean values. Readings were taken at consultation 1 and 6.

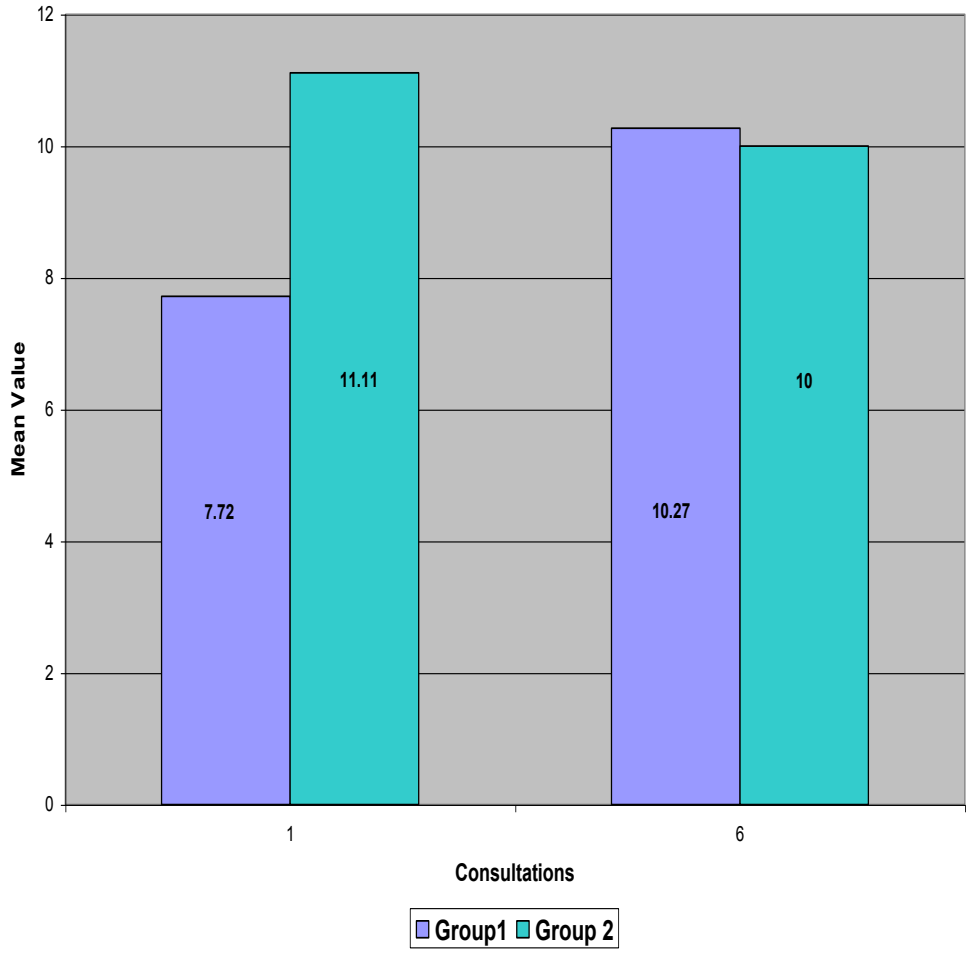


Figure 4.3 Activity Level Scale – Intergroup comparison

This figure indicates the changes in the Activity Level Scale values over the evaluation period for Group 1 and Group 2.

One can see that the mean for group 1 increased over the treatment period, showing that the hyperactivity levels of the children actually increased. This is in contrast to the Parent Questionnaire for Group 1 where the inter-group analysis shows a decrease in the mean values.

Readings were taken at consultation 1 and 6.

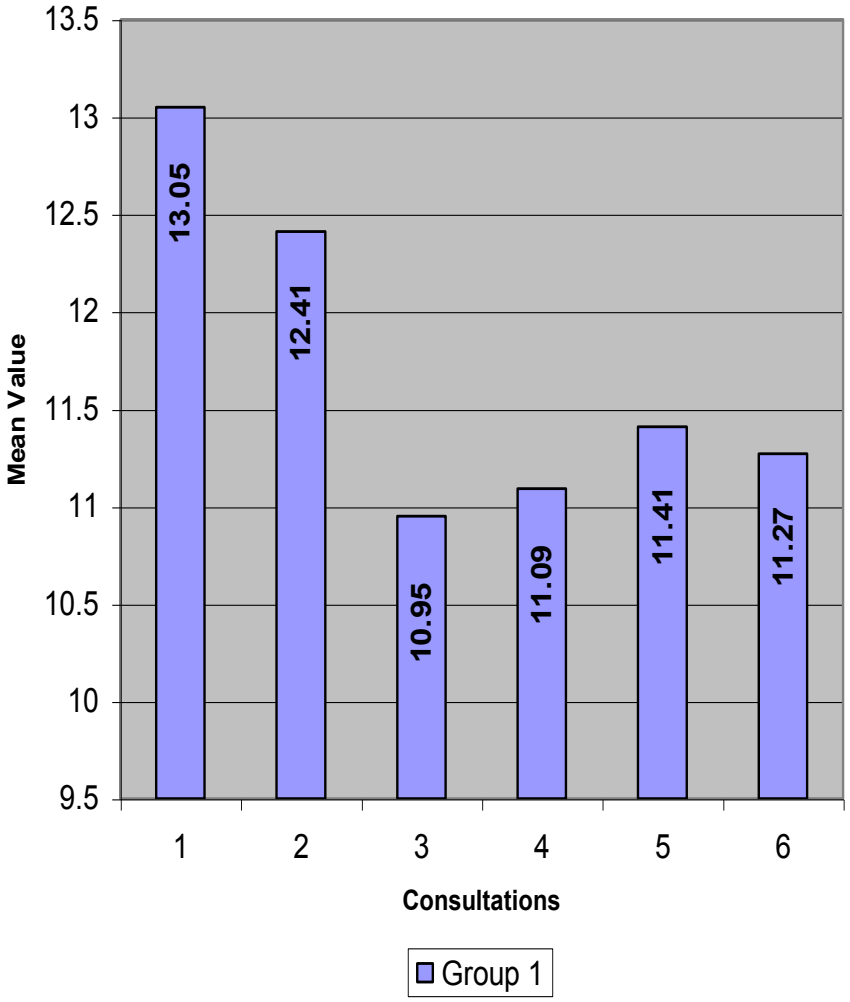


Figure 4.4 Parent Questionnaire – Group 1

This figure indicates the changes in the mean Parent Questionnaire values over the evaluation period for Group 1.

This shows that there was an overall decrease in the mean values over the all the treatment session, showing that the hyperactivity levels of the children decreased.

Readings were taken at each consultation (1-6).

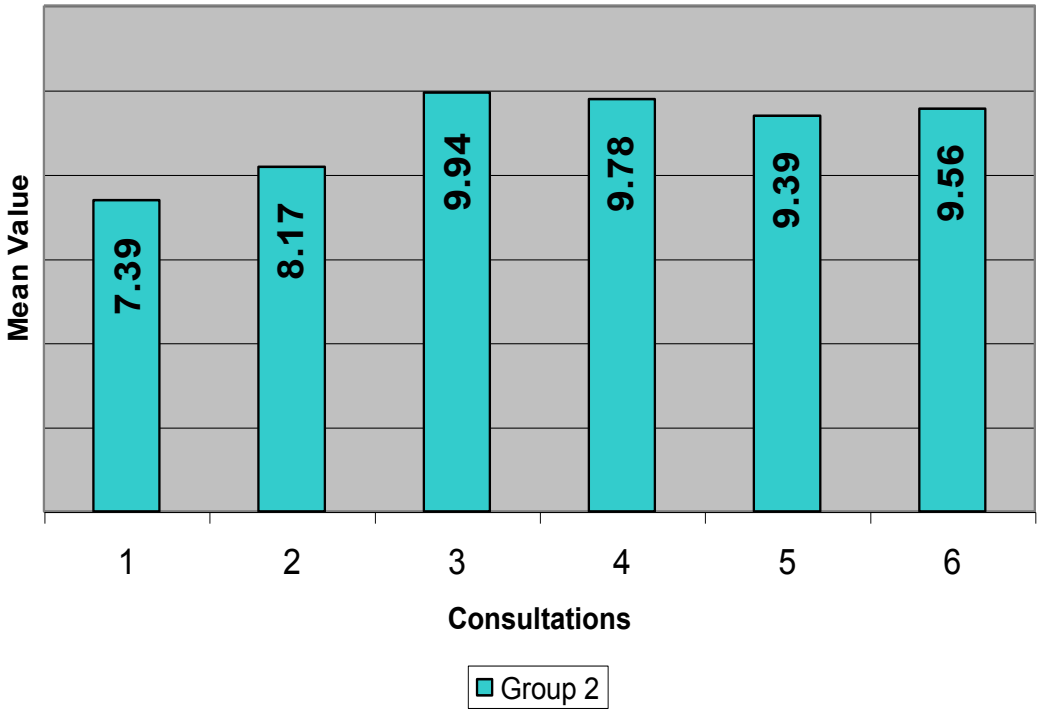


Figure 4.5 Parent Questionnaire – Group 2

This figure indicates the changes in the mean Parent Questionnaire values over the evaluation period for Group 2.

There was no significant change in the mean values over the treatment period.

Readings were taken at each consultation (1-6).

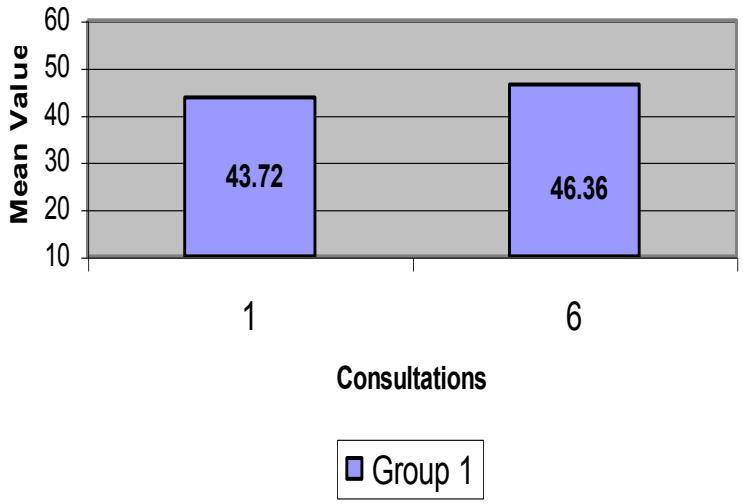


Figure 4.6 Revised Conner's Questionnaire – Group 1

This figure indicates the changes in the mean Revised Conner's Questionnaire values over the evaluation period for Group 1.

There was no significant change in the mean values over the treatment period, showing that CMT had no effect on hyperactivity levels.

Readings were taken at the first and last consultation.

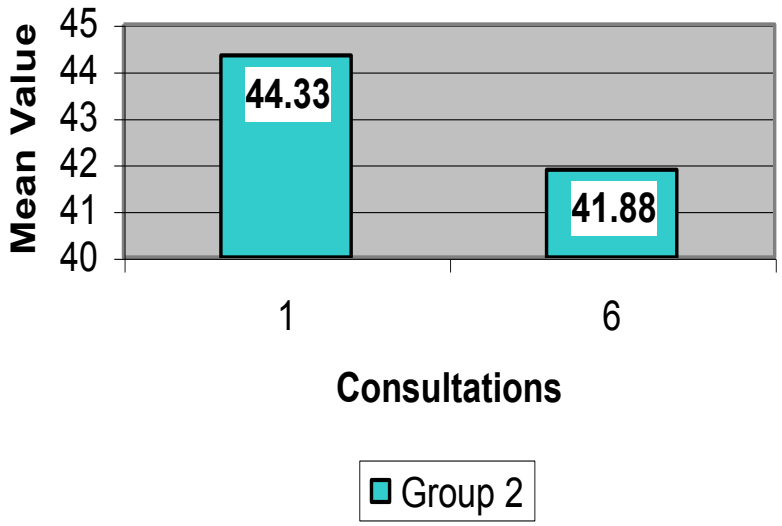


Figure 4.7 Revised Conner's Questionnaire – Group 2

This figure indicates the changes in the mean Revised Conner's Questionnaire values over the evaluation period for Group 2.

There is a slight decrease in the mean values over the treatment period for group 2, however, statistically, the results are insignificant.

Readings were taken at the first and last consultation.

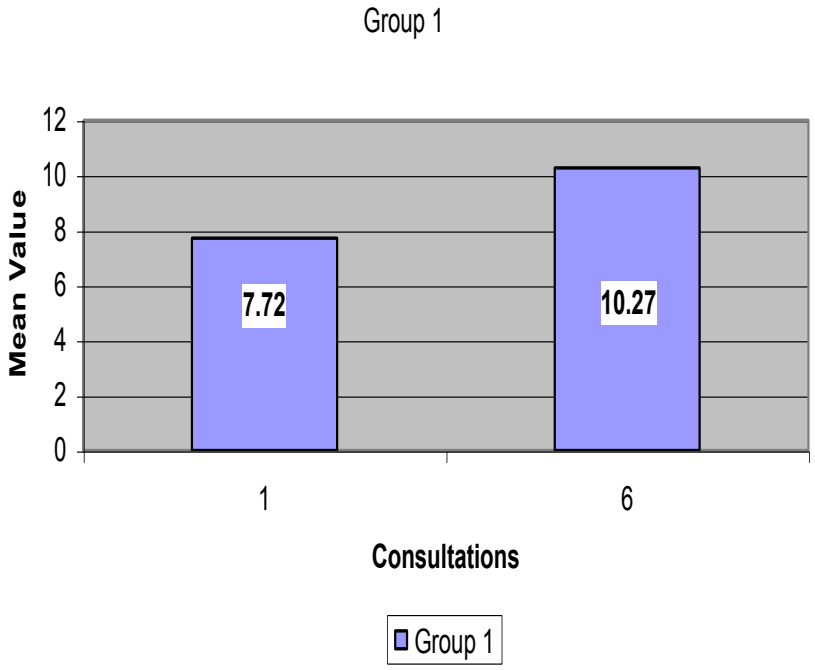


Figure 4.8 Activity Level Scale – Group 1

This figure indicates the changes in the mean Activity Level Scale values over the evaluation period for Group 1.

There is a slight increase in the mean values over the treatment period, showing that the hyperactivity levels of the children slightly increased over the treatment period.

Readings were taken at the first and last consultation.

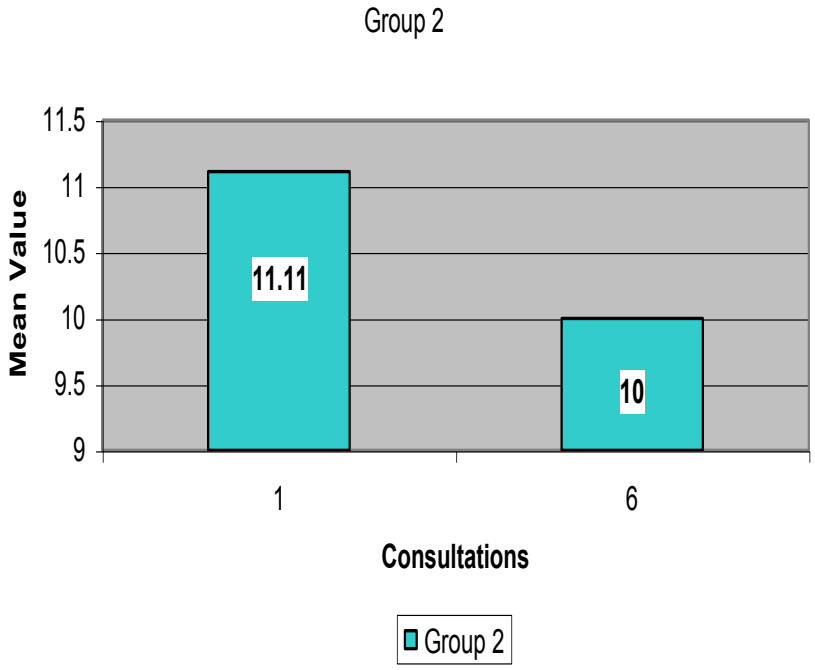


Figure 4.9 Activity Level Scale – Group 2

This figure indicates the changes in the mean Activity Level Scale values over the evaluation period for Group 2.

There was a very slight decrease in mean values, however the results are statistically insignificant.

Readings were taken at the first and last consultation.

CHAPTER FIVE

5.1 INTRODUCTION

This chapter deals with the discussion of the results obtained from the subjective and objective data. Subjective readings were taken after all treatment sessions. Subjective data was obtained using the Parent Questionnaire. Objective readings were taken after the first treatment and the last treatment sessions. Objective data was obtained using the Revised Conner's Questionnaire and the Activity Level Scale.

Non-parametric statistics were used when analyzing data. Non-parametric statistics made use of the Mann-Whitney U and the Wilcoxon Signed Ranks tests, as well as the Friedman test when analyzing the data. The Mann-Whitney U test was used for inter-group analysis of subjective and objective data, namely the Parent Questionnaire, Revised Conner's Questionnaire and the Activity Level Scale. The Wilcoxon Signed Ranks test and the Friedman test were used for intra-group analysis of subjective and objective data.

Statistical analysis of the data was performed by comparing the initial and the final consultation, in order to determine the effectiveness of each of the treatments in the management of Attention Deficit Hyperactivity Disorder in children.

5.2 INTRA-GROUP ANALYSIS OF DATA

5.2.1 Subjective Measures

5.2.1.1 Parent Questionnaire

The statistically analyzed data obtained from the Parent Questionnaire (Appendix I) representing intra-group comparison, is found in tables 4.4 & 4.5. These results indicated a statistically significant improvement within the chiropractic group between treatment 1 and 6. This indicates that from the first treatment to the last treatment, there was a significant change in the readings, thus showing that the hyperactivity levels of the children decreased overall. This suggests that Chiropractic treatment may have a slightly positive effect on ADHD children in terms of their hyperactivity / overactivity. However, between the other treatments, (1 to 3 and 3 to 6), there was no major improvement. In the placebo group there was no significant change between the treatments showing that placebo treatment had no effect on the ADHD children in terms of hyperactivity levels.

5.2.1.2 Summary

In conclusion, there is indication in terms of the subjective data that group 1 may have benefited from chiropractic treatment from the initial to the final consultations. The analysis indicated that between treatment 1 and 6 there was a change in the readings indicating that the overall activity levels of the children in group 1 decreased. Between treatments 1 - 3, and 3 – 6, there was no change in the readings, showing that the change in activity levels of the

children only changed over the full treatment period, ie: 6 treatments. There was no change in the placebo group indicating that placebo ultrasound had no effect on the activity levels of these children.

5.2.2 Objective Measures

5.2.2.1 The Revised Conner's Questionnaire

The statistically analyzed data obtained from the Revised Conner's Questionnaire (Appendix H) representing intra-group comparison is found in tables 4.7 & 4.8. According to these results, the mean values of the group receiving CMT increased between treatment 1 and 6, suggesting that the hyperactivity levels and overall symptoms of the ADHD children increased. This is in contrast to the Parent Questionnaire for this group where the trend is opposite as the mean values drop between treatment 1 and 6. The increase in values for the Revised Conner's Questionnaire in the chiropractic group puts the internal validity of the test under question and one needs to query manner in which the persons responsible for filling out the questionnaires completed them.

The results for Group 2 show an insignificant drop in values showing no significant improvement between treatment 1 and 6. This indicated that placebo ultrasound had no effect on the activity levels of these children

5.2.2.2 Activity Level Scale

The statistically analyzed data obtained from the Activity Level Scale (Appendix J) representing intra-group comparison, is found in tables 4.10 & 4.11. According to these results, the mean values for the group receiving chiropractic treatment increased between treatment 1 and 6, showing that the children's hyperactivity levels were increased over this period. This is again in contrast to the Parent Questionnaire for the chiropractic group where the trend is opposite as the mean values drop between treatment 1 and 6. The increase in values for the Activity Level Scale in Group 1 puts the internal validity of the test under question and one needs to query the assumption of the "truthfulness of the respondents" to the questionnaire.

The results for Group 2 show an insignificant drop in values showing no significant improvement between treatment 1 and 6.

5.2.2.3 Summary

In conclusion, it can be seen that in terms of the objective data, neither one of the two groups benefited more than the other in terms of their respective treatments between the initial and final consultations. Therefore chiropractic manipulation and placebo ultrasound had the same effect on the children overall. According to the objective data, none of the treatments were effective in decreasing the activity levels of these children.

5.3 INTER-GROUP ANALYSIS OF DATA

5.3.1 Subjective Measures

5.3.1.1 The Parent Questionnaire

The statistically analyzed data obtained from the Parent Questionnaires (Appendix I) representing inter-group comparison, is found in table 4.6. These results did not indicate a statistically significant difference when comparing group 1 and group 2 during the second, and up to and including the final consultation. However for treatment 1, the results indicate that the two treatments population means were significantly different with respect to hyperactivity levels in ADHD. It is also interesting that the mean values for group 1 for treatment 1 are significantly higher that that of group 2.

5.3.1.2 Summary

In conclusion, there is indication in terms of the subjective data that group 1 benefited from chiropractic treatment from the initial to the final consultations.

It was hypothesized that there would be a statistically significant improvement between the treatments in terms of subjective findings in each of the two groups. The null hypothesis is accepted, thereby indicating no statistically significant improvement within each group at a 5 % level of significance.

5.3.2 **Objective Measures**

5.3.2.1 The Revised Conner's Questionnaire

The statistically analyzed data obtained from the Revised Conner's Questionnaire (Appendix H) representing inter-group comparison, is found in table 4.9. These results did not indicate a statistically significant difference when comparing group 1 and group 2 between the initial and final consultations, suggesting that the two treatments population means were not significantly different.

5.3.2.2 The Activity Level Scale

The statistically analyzed data obtained from the Activity Level Scale (Appendix J) representing inter-group comparison, is found in table 4.12. These results did not indicate a statistically significant difference when comparing group 1 and group 2 between the initial and final consultations, suggesting that the two treatments population means were not significantly different.

5.3.2.3 Summary

In conclusion, it can be seen that in terms of the objective data, neither one of the two groups benefited more than the other in terms of their respective treatments between the initial and final consultations.

It was hypothesized that there would be a statistically significant improvement between the treatments in terms of objective findings in each of the two groups. The null hypothesis is accepted, thereby indicating a no statistically significant improvement within each group at a 5 % level of significance.

5.4 DISCUSSION OF DEMOGRAPHIC DATA

Table 4.1, depicting the age distribution of the patients participating in this study, shows that the average age for both the chiropractic group and the placebo group were very similar due to the inclusion criteria for ages of the patients to be between six and twelve years inclusively. The average age for group 1 was 9.63 and group 2 was 9.44. The average age for both groups was 10.35 years.

Gender distribution (Table 4.2) showed four times the number of males compared to females in the study, thereby indicating the male predominance for ADHD. This ratio is slightly lower than that of the figures in the Merck Manual (1999:2256), which reports the male: female ratio to be 10:1.
However, due to the small sample size in this study, conclusions relating to the relative prevalence in males and females cannot be substantiated.

From the data in Table 4.3, depicting the racial distribution of the patients, it can be seen the majority of patients were white (90%).

5.5 STUDY LIMITATIONS

5.5.1 Limitations of the subjective data

One of the limitations of this study was lack of stratification of the patients. Due to the fact that the majority of the patients in this study came from a children's home, there was difficulty in attaining a wider spectrum of racial stratification. Thus white patients dominated this study (90%).

Another limitation is the possibility that the parents of the patients may not have fully understood the parent questionnaire (Appendix I) even though every attempt was made by the researcher to explain any difficulties that the parent may have had. In addition to this, the parents may have provided results that would please the examiner. Both of these factors would result in the data being affected either positively or negatively.

Patient compliance with respect to not partaking in any other form of treatment is reliant upon the integrity of the patient, and in this study, the integrity of the parent involved. At the beginning of the study, the parent's were informed that no medication whatsoever was to be given to the child/children. However, if any other substance was given to the child (ie: in the form of vitamins or natural substitutes) to aid in decreasing their hyperactive symptoms, the researcher would not know and thus the analysis of the data would not be completely accurate.

5.5.2 Limitations of the objective data

The teachers of the children had to complete the Revised Conner's Questionnaire and the Activity Level Scale questionnaires. They might have not understood the questionnaires or they were limited for time, which would alter the accuracy and validity of the information and which would in turn affect the results either positively or negatively.

The questionnaires were fairly lengthy and this could have added to the difficulty of the teacher's completing the questionnaires accurately as they might have been pressed for time.

5.6 COMPARISON WITH OTHER STUDIES

A direct comparison to other studies could not be made as no other study could be found comparing manipulation to a straight placebo treatment in children with ADHD, and with children that were not on any form of drug therapy.

However, Walton performed a study whereby 12 ADHD children on Ritalin therapy, were compared to 12 ADHD children partaking in chiropractic therapy with regards to their hyperactivity levels as well as their attention span. Results showed that initially, the children on the Ritalin therapy showed better results in terms of their hyperactivity and attention spans, but they had to have high doses of Ritalin. The high doses resulted in side effects such as

insomnia, personality changes and appetite loss in half of the subjects. However, in the long term, chiropractic treatment showed to improve their hyperactivity levels, as well as improve their attention span by 20 – 40 % (Cited by Leach, 1994:175).

Giesen, Center and Leach (1989) performed a study whereby 7 ADHD children were assessed before and after CMT. They all underwent 4 different tests including: placebo activator, electrodermal testing (for autonomic activity), a wristwatch (for hyperkinetic behaviour) and CMT. The results indicated that 5 out of the 7 showed that CMT had a positive clinical effect and 4 out of the 7 showed an increase in the autonomic activity of the body.

Thus, there have been studies linking CMT to decreasing hyperactivity levels in children with ADHD. These results are inconclusive however, but do suggest that CMT has the potential to become an important non-drug intervention for children with hyperactivity (Giesen, Center and Leach, 1989).

Further research into this topic needs to be carried out with larger sample sizes and stricter control of variables so as to ascertain whether CMT is effective in the management if ADHD in children.

CHAPTER SIX

6.1 RECOMMENDATIONS

In future studies, the following should be looked into:-

- Stratification should be undertaken so as to provide homogeneity between the two groups in terms of age, gender and race. This would reflect on the level of maturity and neurological development as well as even justify changes in behaviour in children with ADHD.

- The parents or guardians should introduce a “diary-type” record of the child. This could note behavioural changes and could include more of the child’s day such as diet, extramural activities, tests and schoolwork etc. This will help the researcher to understand each child much better.

- Future studies should try and measure neurotransmitter levels, as this may give more insight into the treatment of ADHD as well as other diseases.

- In the future, there needs to be better control and monitoring over the teachers who fill in the questionnaires. Due to the fact that a teacher has numerous students in their classrooms at all times, one can understand the difficulty of that teacher to solely focus on one child for a short period of time, in order to complete the questionnaire for that

child. The researcher needs to possibly be there with the teacher at the time that he/she completed the forms, as to insure that the forms are filled out correctly.

- It is suggested that there is more time taken on briefing the teachers with regards to the completion of the forms. Briefing should also explain the importance of the correct information to be put onto the forms. The correct information contributes to the accurate analysis of such forms and thus ensures the validity of the research. It is possible that a teacher might rush through a questionnaire just to get it finished, thus including possible false information on the questionnaire.

- For the parent's, it is suggested that briefing with regards to the importance of filling in the forms correctly and honestly, is highlighted. One can understand that as a parent, you would want your child to improve with any treatment that is given to them. This might sway the responses of the parent's in filling out the questionnaires. This will allow false information to be analysed and will alter the true and accurate analysis of the data.

- The frequency of completion of the Revised Conner's Questionnaire and the Activity Level Scale need to be increased. This is to obtain more readings and more data to use for the statistical analysis.

- As seen from the above comments, there is far too much latitude with regards to the administration of the testing, and in the future, this needs to be refined as to allow more accurate data analysis.

6.2 CONCLUSIONS

The purpose of this study was to determine the efficacy of Chiropractic Manipulative Therapy in the management of Attention Deficit Hyperactivity Disorder (ADHD) in children.

The original sample size was set at 60 patients. That number was reduced to 30 patients due to the poor response of schools to the study. However, the final sample size was 20 patients due to the difficulty in attaining the 30 patients. It is very possible that a sample size of 20 patients was too small for the results of this study to be statistically conclusive.

The majority of the children used in the study were from a Children's home and thus were looked after by "foster" parents / house parents who not only looked after a single child, but had between 6 – 10 children in their care. Therefore, the data received from the parents/guardians are possibly not as accurate as they should be, as their time allocated solely to monitor the child in the study was limited.

Although inter-group data analysis showed that neither one of the two groups benefited more than the other in terms of their respective treatments between the initial and final consultations, analysis of the intra-group data showed that there was a significant change in group 1 (chiropractic group). This change occurred over the period from treatment 1 to treatment 6. This information showed that there might have been improvement from the initial to the final

consultation in the children who received chiropractic treatment. Intra-group analysis of group 2 (placebo ultrasound) showed no change in the series of treatments.

In conclusion, the overall results of this study were inconclusive as the tests used yielded contrasting results. Thus no sound conclusion can be drawn to whether CMT was effective in treating children with ADHD, however further research into this topic is definitely recommended.

REFERENCES

1. American Psychiatric Association. Diagnostics and Statistical Manual of Mental Disorders. 4th edition. Washington, D.C. 1994. ISBN 0-89042-061-0

2. Anrig, C.A and Plaugher, G. 1998. Paediatric Chiropractic. Williams and Wilkins. 789p. ISBN 0-683-00136-1

3. Bain, L.J. 1991. A Parent's Guide to Attention Deficit Disorders. Delta: Dell Publishing, New York. Pg 216. ISBN 0-385-30031-X

4. Barkley, R.A. 1981. Hyperactive Children: A handbook for Diagnosis and Treatment. New York: Guildford Press. 458p. ISBN 0-471-10478

5. Barkley, R.A. 1993. Workshop Manual: ADHD in Children. Unpublished manuscript. University of Massachusetts Medical Center, Worcester.

6. Barkley, R.A. 1995. Taking Charge of ADHD. New York. The Guildford Press. 294p.

7. Bergmann, T.F., Peterson, D.H. and Lawrence, D.J. 1993. Chiropractic Technique. New York, U.S.A.: Churchill Livingstone. 803p. ISBN 0-443-08752-0

8. Brown, C.S. 1991. Treatment of ADHD: A Critical Review. Doctrines in Clinical Psychiatry. 25: 1207-1213

9. Buhrmester, D., Whalen, C.K., Henker, B., Macdonald, V. and Hinshaw, S.P. 1992. Prosocial Behaviour in Hyperactive Boys: Effects of Stimulant Medication and Comparison with Normal Boys. Journal of Abnormal Child Psychology. 20: 103-121

10. Cadonet, R.J. and Stewart, M.A. 1991. An Adoption Study of Attention Deficit / Hyperactivity Disorder / Aggression and their Relationships to Adult Antisocial Personality. Comprehensive Psychiatry. 32: 73-82.

11. Campbell, S.B. and Werry, J.S. 1986. Attention Deficit Disorder (Hyperactivity). In Quay, H.C. and Werry, J.C. Psychopathological Disorders of Children. pp 111-155. New York: John Wiley and Sons. 690p. ISBN 0-471-88974-1

12. Carlson, C.L., Pelham, W.E., Swanson, J.M. and Wagner, J.L. 1991. A Divided Attention Analysis of the Effects of Methylphenidate on the Arithmetic Performance of Children with ADHD. Journal of Child Psychology and Psychiatry. 32: 463-471

13. Coleman, J.C., Butcher, J.N. and Carson, R.C. 1980. Abnormal Psychology and Modern Life. 6th ed. Glenview: Scott Foresman and Company. 702p. ISBN 0-673-15213-8

14. Conners, C.K. 1969. A Teacher Rating Scale for use in Drug Studies with Children. American Journal of Psychiatry. 126:804-888

15. Cooper,P. and Ideus,K. 1996. Attention Deficit / Hyperactivity Disorder: A practical guide for teachers. London. David Fulton. 97p. ISBN 1-85346-431-7

16. Cooter, R.B. 1988. Effects of Ritalin on Reading. Academic Therapy. 23: 461-468

17. Donnelly, M. and Rapport, J.L. 1985. ADD. In Weiner, J.M. Diagnosis and Psychopharmacology of Childhood and Adolescent Disorders. pp. 179-197. New York: Wiley. 448p. ISBN 0-471-04262-5

18. Dorland,I and Newman, W.A. 1988. Dorland's Illustrated Medical Dictionary. Philadelphia: W.B.Saunders Company. 1888p. ISBN 0-7216-2848-6

19. Evans, R.W., Gualitiera, C.T. and Hicks, R.E. 1986. A Neuropathic Substrate for Stimulant Drug Effects in Hyperactive Children. Clinical Neuropharmacology. 9: 264-281

20. Gatterman, M.I. 1990. Chiropractic Management of Spinal Related Disorders. Williams & Wilkins, Maryland. 437p. ISBN 0-683-03438-3

21. Giesen, J.M; Center, D.B and Leach, R.A. An evaluation of Chiropractic Manipulation as a treatment of hyperactivity in children. Journal of Manipulative Physiological Therapeutics. 12 (5): 353-363 (Oct 1989)

22. Gitelman, R. 1980. Assessment of Classroom Behavior of Hyperactive Children. Nutritional Reviews. 44:135-144

23. Gitelman, R and Fligg, B. Diversified Technique. In Haldeman, S. 1992. Principles and Practice of Chiropractic. 2nd edition. Appleton and Lange. 641p. ISBN 0-8385-6360-0

24. Green, C and Chee,K. 1997. Understanding ADHD: A Parent's Guide to Attention Deficit Hyperactivity Disorder in Children. Vermillion, London. ISBN 0-091-81700-5

25. Graham, P. 1986. Attention and Attention Deficit Disorder. In Graham, P. Child Psychiatry. A Developmental Approach. pp 175-185. Oxford: Oxford University Press. 465p. ISBN 0-192-61633-5

26. Kaplan, B.J., McNicol, J., Conte, R.A. and Moghadam, H.K. 1989. Overall Nutrient Intake of Pre-school Hyperactive and Normal Boys. Journal of Abnormal Child Psychology. 17: 127-132

27. Klein, R.G., Landa, B., Mattes, J.A. and Klein, D.F. 1988. Methylphenidate and Growth in Hyperactive Children. A Controlled Withdrawal Study. Archaeological General Psychiatry. 45: 1127-1130

28. Leach, R.A, 1994. The Chiropractic Theories. 3rd ed. Williams and Wilkins. 401p. ISBN 0-683-04904-6

29. Maitland, G.D. Vertebral Manipulation. 5th ed. Butterworth Heinemann. 390p. ISBN 0-7506-1333-5

30. Medifile. 1999. October. Volume 13. 10: 65-67

31. Merck Manual (1999). The Merck Manual of diagnosis and therapy. Merck Research Laboratories. Seventeenth edition (Centennial edition). ISBN 0-911910-10-7

32. O'Shea, T. 2000. Attention Deficit Disorder: A Designer Disease. Today's Chiropractic. Mar/Apr, 14-25.

33. Picton, H. 1997. Hyperactive children. Caring and coping. Johannesburg: Witwatersrand University Press. 150p. ISBN 1-86814-306-6

34. Redwood, D. 1997. Contemporary Chiropractic. Churchill Livingstone Inc. 354p. ISBN 0-443-07809-2

35. Reichenberg-Ullman, J. 1996. Ritalin Free Kids : Safe and Effective Homoeopathic Medicine for ADD and other Behavioural and Learning Problems. Prima Publishing. 300p. ISBN 0-7615-0719-1

36. Rostain, A.L. 1991. Attention Deficit Disorders in Children and Adults. Paediatric Clinics of North America. 38(3): 607-635.

37. Rowe, K.S. 1988. Synthetic Food Colourings and Hyperactivity: A Double Blind Crossover Study. Australian Paediatric Journal. 24: 143-147.

38. Schafer, R.C. and Faye, L.J. 1989. Motion Palpation and Chiropractic Technic – Principles of Dynamic Chiropractic. The Motion Palpation Institute. 426p. ISBN 0924889-00-4

39. Schain, R. 1978. Attention Behaviour and Drugs in Hyperactive Children. In Oettinger, L. The Psychologist, The School and the Child with MBD/LD. New York: Grure and Stratton Inc. 210p. ISBN 0-808-91063-9

40. Serfontein, G. 1990. The Hidden Handicap: The Connection Between Dyslexia and Hyperactivity in Children. Australia: Simon and Schuster. 184p. ISBN 0-7318-0157-1

41. Shaywitz, S.E., Shaywitz, B.A. (1991). Introduction to the special series on attention deficit disorder. Journal of Learning Disabilities 24, 68-71.

42. Szaraz, Z.T. 1990. Compendium of Chiropractic Technique. 2nd ed. Toronto. Villian, L.R. associates Ltd. Technical Productions. 160p.

43. Taljaard, E. 2000. Personal communication via fax. 19 June 2000. President of the Hyperactive and Attention Deficit Disorder Support Group of Southern Africa.

44. Triano, J.J. 1992. The use of instrumentation and laboratory examination procedures by the Chiropractor. In Halderman,S. Principles and Practice of Chiropractic. 2nd ed. pp. 352. Norwalk, California. Appleton and Lange. 641p. ISBN 0-838-56360-0

45. Warner-Rodgers, J. 1998. Attention Deficit-Hyperactivity Disorder. In Behavioural Approaches to Problems in Childhood. Howlin P (ed). Mackeith Press, London. ISBN 1-898-68312-3

46. Woods, S.K. and Ploof, W.H. 1997. Understanding ADHD: Attention Deficit Hyperactivity Disorder and the Feeling Brain. Sage Publications, California. ISBN 0-803-97423-X

APPENDIX A

CHILDHOOD HISTORY FORM
FOR ATTENTION DISORDER

Child's name_____
Birth Date_____ Age_____ Sex_____

Grade at school_____

Child is presently living with:
____Natural Mother ____ Natural Father ____Stepmother ____Stepfather
____Adoptive Mother ____ Adoptive Father ____Foster Mother ____Foster Father

---

PARENTS

Mother's Name_____ Father's Name_____
Occupation (M)_____ Occupation (F)_____
Age (M)_____ Age (F)_____
Have any of your blood relatives experienced problems similar to those your child is experiencing? If so, describe_____

Medical problems? (M)_____(F)_____

SIBLINGS

Name	Age	Medical, Social or School problems
1.		
2.		
3.		
4.		

PREGNANCY & BIRTH

Excessive vomiting _____ Hospitalisation required _____
Excessive staining/blood loss _____Threatened miscarriage _____
Infection(s)_____
Smoking during pregnancy_____ Number per day_____
Alcoholic consumption during pregnancy _____describe if beyond occasional drink_____
Medication during pregnancy_____
X-ray studies during pregnancy_____
Duration of pregnancy (in weeks) _____
Type of labour: Spontaneous _____ Induced _____ Duration (hrs)_____

Type of delivery: Normal _____ Breech _____ Caesarean _____
Complications: Cord around neck _____ Haemorrhage _____
Infant injured in delivery_____Other_____

Birth Weight _____

Post-delivery: Jaundiced _____ Cyanosis _____ Incubator Care _____
Infection _____ No of days in hospital_____

INFANCY

Were any of the following present – to a significant degree – during the first few years of life? If so, describe.

Did not enjoy cuddling _____ Difficult to comfort _____
Was not calmed by being held or stroked _____
Colic _____ Excessive restlessness _____
Excessive irritability _____ Diminished sleep _____
Frequent head banging _____ Difficulty nursing _____
Constantly into everything _____

MEDICAL HISTORY

Childhood diseases _____
Operations _____
Hospitalisations _____
Head injuries _____ Convulsions _____
Coma _____ Eye problems _____
Persistent high fevers _____ Allergies or asthma _____
Ear problems _____ Sleep problems _____
Appetite _____ Poisoning _____

Present height _____ Present weight _____
Current medication _____ Dosage per day _____

SCHOOL

Rate your child's school experiences related to academic learning:

	Good	Average	Poor
Nursery school			
Current grade			

Has your child ever had to repeat a grade? Yes_____ No_____

Present class placement? Regular class _____ Special class _____

Rate your child's school experiences related to behaviour:

	Good	Average	Poor
Nursery school			
Current grade			

Does your child's teacher describe any of the following as significant classroom problems?

Doesn't sit still in his/her seat _____
Frequently gets up and walks around the classroom _____
Shouts out _____
Won't wait his/her turn _____
Doesn't pay attention during storytelling _____

HOME BEHAVIOUR

All children exhibit, to some degree, the behaviours listed below. Check those that your child exhibits to an excessive or exaggerated degree when compared to other children his/her age.

Fidgets with hands, feet or squirms in the seat _____
Has difficulty remaining seated when required to do so _____
Shifts from one uncompleted activity to another _____
Has difficulty playing quietly _____
Excessive number of accidents _____
Frustrates easily _____
Temper tantrums _____

INTERESTS AND ACCOMPLISHMENTS

Child's main hobbies and interests? _____
Child's areas of greatest accomplishment? _____
What does your child enjoy doing most? _____
What does your child dislike doing most? _____

Revised version from:
Goldstein, S and Goldstein, M (1990). Managing Attention Disorders in Children. New York: John Wiley & Sons.

APPENDIX B

TECHNIKON NATAL

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:_____File#: _____Date:_____
Clinician:_____Signature:_____
Intern:_____Signature:_____

1. VITALS

Pulse rate:
Respiratory rate:
Blood pressure: R L
Temperature:
Height:
Weight:

2. GENERAL EXAMINATION

General Impression:
Skin:
Jaundice:
Pallor:
Clubbing:
Cyanosis (Central/Peripheral):
Oedema:
Lymph nodes
- Head and neck:
- Axillary:
- Epitrochlear:
- Inguinal:

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

1) Is this patient in **Cardiac Failure** ?
2) Does this patient have signs of **Infective Endocarditis** ?
3) Does this patient have **Rheumatic Heart Disease ?**

Inspection
- Scars
- Chest deformity:
- Precordial bulge:
- Neck -JVP:

Palpation:
- Apex Beat (character + location):
- Right or left ventricular heave:
- Epigastric Pulsations:
- Palpable P2:
- Palpable A2:

- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
- Ascites:
- Masses:

Auscultation - Bowel sounds:
- Arteries (aortic, renal, iliac, femoral, hepatic)

Rectal Examination
- Perianal skin:
- Sphincter tone & S4 Dermatome:
- Obvious masses:
- Prostate:
- Appendix:

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

Gait and Posture
- Abnormalities in gait:
- Walking on heels (L4-L5):
- Walking on toes (S1-S2):
- Rombergs test (Pronator Drift):

Higher Mental Function
- Information and Vocabulary:
- Calculating ability:
- Abstract Thinking:

G.C.S.:
- Eyes:
- Motor:
- Verbal:

Evidence of head trauma:

Evidence of Meningism:
- Neck mobility and Brudzinski's sign:
- Kernigs sign:

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

II External examination of eye:
- Visual Acuity:
- Visual fields by confrontation:

- Forearm = Supination & Pronation:
- Fingers = Extension (Interphalangeals & M.C.P's):
- Thumb = Opposition:
- Hip = Flexion & Extension:
  = Adduction & Abduction:
- Knee = Flexion & Extension:
- Foot = Dorsiflexion & Plantar flexion:
  = Inversion & Eversion:
  = Toe (Plantarflexion & Dorsiflexion):

b. Tone
- Shoulder:
- Elbow:
- Wrist:
- Lower limb - Int. & Ext. rotation:
- Knee clonus:
- ankle clonus:

c. Reflexes
- Biceps:
- Triceps:
- Supinator:
- Knee:
- Ankle:
- Abdominal:
- Plantar:

Sensory System:

a. Dermatomes
- Light touch:
- Crude touch:
- Pain:
- Temperature:
- Two point discrimination:

b. Joint position sense
- Finger:
- Toe:

c. Vibration:
- Big toe:
- Tibial tuberosity:
- ASIS:
- Interphalangeal Joint:
- Sternum:

Cerebellar function:

Obvious signs of cerebellar dysfunction:
= Intention Tremor:
= Nystagmus:
= Truncal Ataxia:

APPENDIX C

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
REGIONAL EXAMINATION - *CERVICAL SPINE*

Patient: _____ File: _____

Date: _____ Intern/Resident: _____

Clinician: _____ Sign: _____

OBSERVATION:

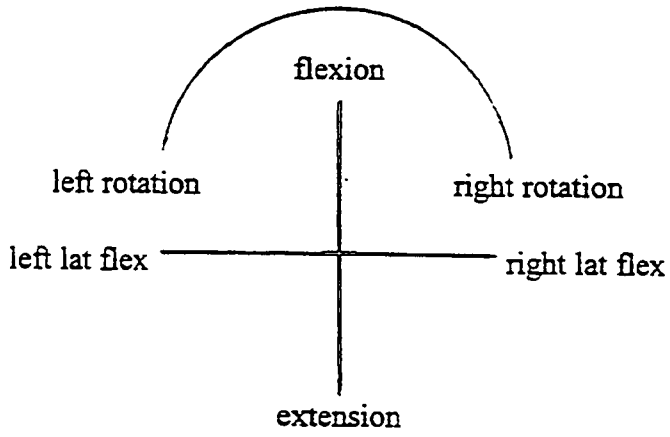
Posture
Swellings
Scars
Discolouration
Hair Line
Bony & Soft Tissue Contours

Shoulder position:
Left:
Right:
Muscle spasm
Facial expression

RANGE OF MOTION:

Flexion (45'):
L/R Rotation (70'):

Extension (70'):
L/R Lat Flex (45'):



PALPATION:

Lymph Nodes
Thyroid Gland

Trachea

ORTHOPAEDIC EXAMINATION:

Tenderness
Trigger Points: SCM, Scalenii, Post Cervicals, Trapezius, Lev Scap

Doorbell sign
Kemp's test
Cervical distraction
Halstead's test
Hyperabduction test
Shoulder abduction test

Cervical compression
Lateral compression
Adson's test
Costoclavicular test
Eden's test
Shoulder depression test

APPENDIX D

REGIONAL EXAMINATION - THORACIC SPINE

Patient: _____ File #: _____ Date: _____

Intern: _____ Signature: _____

Clinician: _____ Signature: _____

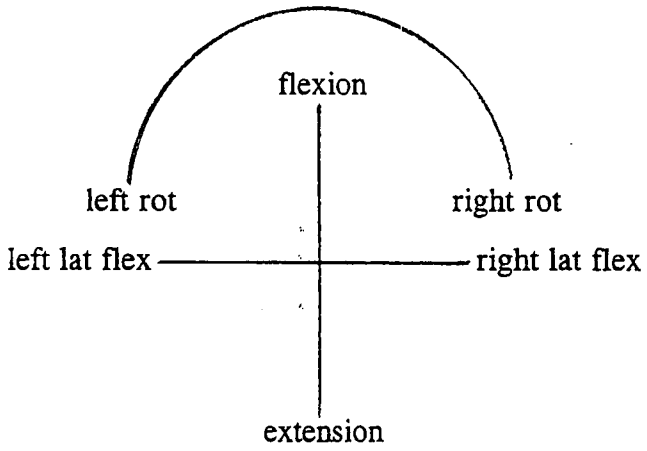
STANDING

Posture (incl. L/S & C/S):
Muscle Tone:
Skyline view - Scoliosis
Spinous Percussion
Breathing (quality, rate, rhythm, effort):
Deep inspiration

Scars:
Chest Deformity
(pigeon, funnel,
barrel):

RANGE OF MOTION

Forward flexion	20 - 45 degrees (15cm from floor)
Extension	25 - 45 degrees
L/R Rotation	35 - 50 degrees
L/R Lateral Flexion	20 - 40 degrees



RESISTED ISOMETRIC MOVEMENTS: (in neutral)

Forward flexion
Extension
L/R Rotation
L/R Lateral Flexion

SEATED:

Palpate Auxillary Lymph Nodes
Palpate Ant/Post Chest Wall
Costovertabral Expansion (3 - 7cm diff. at 4th intercostal space)
Slump Test (dural stretch test)

APPENDIX E

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
REGIONAL EXAMINATION - *LUMBAR SPINE AND PELVIS.*

PATIENT: _____

FILE #: _____ DATE: _____

INTERN/RESIDENT: _____

SUPERVISING CLINICIAN: _____

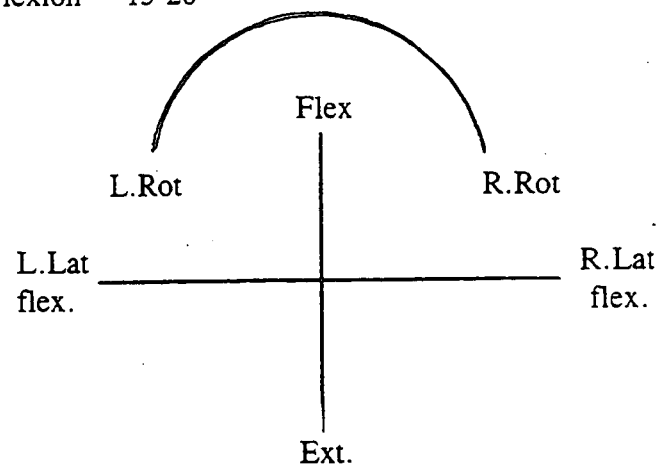
STANDING:

Posture
Minor's Sign
Skin
Scars
Discoloration
Muscle Tone
Bony & Soft Tissue Contours

Spinous Percussion
Schober's Test (6cm)
Treadmill
Body Type
Attitude

RANGE OF MOTION

Forward Flexion = 40-60°(15cm from floor)
Extension = 20-35°
L/R Rotation = 3-18°
L/R Lateral Flexion = 15-20°



SUPINE:

Skin
Hair
Nails
Palpate Abdomen/groin
Pulses (abdomen)

Observe abdomen
Fasciculations
Abdominal Reflexes

NEUROLOGICAL EXAMINATION

DERMATOMES			MYOTOMES			REFLEXES		
	L	R		L	R		L	R
T12			Hip Flex			Pat.		
L1			Hip int rot			Achil		
L2			Hip ext rot			H/S		
L3			Hip abd					
L4			Hip add					
L5			Knee flex					
S1			Knee ext					
S2			Dorsiflex					
S3			Plantarflex					
			Eversion					
			Ext.hal.long					

Tripod
Kemp's Test

MOTION PALPATION and JOINT PLAY:

LEFT: Upper Thoracics:
Lumbar Spine:
Sacroiliac Joint:

RIGHT: Upper Thoracics:
Lumbar Spine:
Sacroiliac Joint:

Basic Exam: Hip
Case History:

ROM: Active:
Passive:
RIM:
Orthopaedic/Neuro/
Vascular:

Observ/Palpation:

Basic Exam: Thoracic Spine
Case History:

ROM: Motion Palp:
Active:
Passive:
Orthpaedic/Neuro/
Vascular:

Observ/Palpation:

APPENDIX F

INFORMED CONSENT FORM

(To be completed by parent / guardian)

Date :_____

Title of research project :The efficacy of Chiropractic Manipulative Therapy in the management of Attention Deficit Hyperactivity Disorder in children

Name of supervisor :Dr. A. van der Meulen

Name of research student :Lara Berger

Please circle the appropriate answer		Yes	No
1.	Have you read the research information sheet?	Yes	No
2.	Have you had an opportunity to ask questions regarding this study?	Yes	No
3.	Have you received satisfactory answers to your questions?	Yes	No
4.	Have you had an opportunity to discuss this study?	Yes	No
5.	Have you received enough information about this study?	Yes	No
6.	Who have you spoken to?_____		
7.	Do you understand the implications of your involvement in this study?	Yes	No
8.	Do you understand that you are free to withdraw your child from this study?		
	a) at any time?	Yes	No
	b) without having to give any reason for withdrawing?	Yes	No
	c) without affecting your child's future health care?	Yes	No
9.	Do you agree to voluntarily allow your child to participate in this study?	Yes	No

If you have answered **NO** to any of the above, please obtain the information before signing

Please Print in block letters:

Patient / Subject Name: _____ Signature:_____

Parent / Guardian Name: _____ Signature:_____

Witness Name: _____ Signature:_____

Research Student Name: _____ Signature:_____

APPENDIX G

TECHNIKON NATAL CHIROPRACTIC CLINIC

Chiropractic Research on Attention Deficit Hyperactivity Disorder

Dear Parent,

Thank you for considering enrolling your child in this research programme. Outlined below is a brief explanation of what the research programme entails as well as what would be expected of you and your child.

This research programme aims to compare the effect of chiropractic treatment versus ultrasound therapy in the management of attention deficit hyperactivity disorder (ADHD) in children. If you choose for your child to participate in the study, he or she will undergo a full case history and an assessment. This all takes place at the first consultation. This will enable us to determine if there are any contraindications to your child being in this research programme. A full time clinician is permanently on duty and will be there to assist me at any time.

Once it has been determined that your child is a candidate for this research programme, he/she will be randomly assigned to one of two groups. One group will receive chiropractic adjustments and the other group will receive ultrasound as the treatment. Each child has a 50/50 chance of receiving either treatment, or a placebo treatment. All treatment sessions are free and neither procedure entails any risk to your child.

The programme will consist of six treatments over a period of three weeks. Your child is expected to be present at each of these treatments for completion of the programme and to facilitate the collection of data. You, the parent are expected only to be present at the first consultation, but are welcome to attend any other treatment session that your child has. After each treatment, you, the parent will be given a questionnaire pertaining to your child's behaviour and activity level post treatment. This questionnaire must be filled out the evening following each treatment in order for the data to be captured correctly.

Your child should **not** be on any medication whatsoever pertaining to ADHD.

Please feel free to ask me about any other concerns that you may have.

Lara Berger
(Chiropractic Intern)

APPENDIX H

REVISED CONNERS QUESTIONNAIRE

CHILD'S NAME:_____ AGE:_____

DATE OF READINGS:_____

COMPLETED BY:_____

		1	2	3	4	5
1.	Works independently					
2.	Persists with task for reasonable amount of time					
3.	Completes task with little additional assistance					
4.	Follows simple directions accurately					
5.	Follows a sequence of instructions					
6.	Functions well in the classroom					
7.	Extremely overactive ("on-the-go")					
8.	Over-reacts					
9.	Fidgety (hands always busy)					
10.	Impulsive (acts or talks without thinking)					
11.	Restless (squirms in seat)					
12.	Behaves positively with peers and classmates					
13.	Verbal communication clear and "connected"					
14.	Nonverbal communication accurate					
15.	Understands group norms and social rules					
16.	Cites general rule when criticising ("We aren't supposed to do that")					
17.	Skillful at making new friends					
18.	Approaches situations confidently					
19.	Tries to get others in trouble					
20.	Starts fights over nothing					
21.	Makes malicious fun of people					
22.	Defies authority					
23.	Picks on others					
24.	Mean to other children					

For each item, tick number 1 through 5 that most closely corresponds with your evaluation of the child's behaviour

Almost never 1 2 3 4 5 Almost always

Taken from: Barkley, R.A. 1993. Workshop Manual: ADHD in Children. Unpublished manuscript. University of Massachusetts Medical Center, Worcester.

APPENDIX I

PARENT QUESTIONNAIRE

CHILD'S NAME: _____

AGE: _____

DATE: _____

COMPLETED BY: _____(MOTHER / FATHER)

	DEGREE OF ACTIVITY			
(Please Tick)	0 Not at all	1 Just a little	2 Pretty much	3 Very much
1. Restless				
2. Excitable				
3. Disturbs other siblings				
4. Fidgeting				
5. Distractable				
6. Cries				
7. Mood changes quickly				
8. Temper outbursts				
9. Short Attention Span				
10. Gets frustrated quickly				
TOTAL				

APPENDIX J

THE ACTIVITY LEVEL SCALE

CHILD'S NAME:_____

DATE OF READINGS:_____

COMPLETED BY:_____

Please tick the appropriate block:

1. TALK RELATED -Excess verbalization that is related to the ongoing task.						
2. TALK UNRELATED -Verbalizations that are completely unrelated to the ongoing task.						
3. LOWER EXTREMITY MOVEMENT -Swinging, tapping and shaking of the legs and feet.						
4. UPPER EXTREMITY MOVEMENT -Shaking hands, playing with hands. -Twirling thumbs, tapping or drumming of fingers.						
5. BODY MOVEMENTS -Jerky, rocky movements of the whole body.						
6. ODD NOISES -Humming, clicking teeth, whistling during task performance.						
TOTAL						

Taken from: Gittelman,R. 1980. Assessment of Classroom Behaviour of Hyperactive Children. Nutritional Reviews.

RESEARCH INTO ADHD

Has your child been diagnosed with ADHD?
(attention deficit hyperactivity disorder)

Research into this topic is currently being run at the Chiropractic Day Clinic

For more information contact
Lara Berger (final year student)
at
031-2042205 or 082-7055949

APPENDIX K