

**THE RELATIVE EFFECTIVENESS OF SPINAL
MANIPULATION VERSUS SPINAL
MANIPULATION IN CONJUNCTION WITH LOW
BACK STRAPPING IN THE TREATMENT OF
MECHANICAL LOW BACK PAIN, IN THE
DYSFUNCTIONAL PHASE**

by

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A dissertation presented to the faculty of Health at Technikon Natal in partial compliance with the requirements for the Mater's Degree in Technology: Chiropractic.

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Dedication

This dissertation is dedicated to my parents Mick and Lynne Broughton who have provided me with continued love and support. They encouraged me to choose my goals and gave me the confidence to achieve them.

Gave me wings and let me fly.

“Without you this would not have been possible.”

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Abstract

The absence of tested theory has resulted in a continued variation in protocols for the treatment of mechanical low back pain. This study was designed in order to determine the relative effectiveness of spinal manipulation versus spinal manipulation in conjunction with a low back strapping in the treatment of mechanical low back pain in the phase of dysfunction.

It was hypothesised that both treatment regimes would be effective but that the group receiving both the manipulation and the low back strapping, would be significantly more effective in terms of objective and subjective findings, over a two-week treatment period.

This randomised clinical trial consisted of a sample population of sixty volunteer subjects, diagnosed as having either posterior facet syndrome of the lumbar spine, sacroiliac syndrome or a combination of the two conditions. The sixty subjects were then randomly assigned to one of two treatment groups of thirty each, one group receiving the appropriate spinal manipulation and the other receiving spinal manipulation with an additional low back strapping for the first three to five days of treatment. Each patient was seen six times over a two-week period.

The subjective measurements were assessed by means of the patients' response to the Numerical Pain Rating Scale-101 and the Patient Specific

Functional Scale. This information was collected before the onset of the initial treatment, at the third consultation and again at the sixth and final consultation. Objective data was gathered from the goniometer and the pressure algometer measurements. These readings were also taken at the initial consultation, the third consultation and at the final consultation.

The intra-group comparison of the objective data revealed a greater improvement in the range of motion of the group receiving strapping, as compared to the non-strapping group over the period between the first and the third treatments. This period was critical to the research, as it is the period over which the strapping was applied to those in the strapping group, there after the strapping was removed. The p-values for the range of motion findings showed the strapping group as having a greater number of statistically significant findings, with a higher degree of significance over the period of the first to the third treatments and over the first to the sixth treatment. The non-strapping group however only saw statistically significant improvements in flexion and extension over the period between the first and the third treatments, and in all direction of motion when comparing the first and sixth, and the third and sixth treatments. The intra-group comparison suggests that the strapping group may have been more effective than the non-strapping group in increasing the lumbar range of motion, and increasing the pain threshold in the early stages of the treatment protocol.

Subjectively the data indicated that both groups were equally successful in making statistically significant reductions in the pain and disability of the patients, as they perceived it.

The inter-group comparison for all objective and subjective measurements revealed no statistically significant results, and due to the low power of the study the likelihood of a type II error was high, thus making the incorrect acceptance of the null hypothesis possible.

It was evident from the data that patients in both groups responded equally well to their respective treatments. Both spinal manipulation alone and spinal manipulation in conjunction with low back strapping will, over a two-week period, increase the lumbar range of motion and decrease pain and disability in the patient diagnosed as having mechanical low back pain. The origin of the mechanical low back pain being from either, lumbar facet syndrome, sacroiliac syndrome or both, and in the phase of dysfunction.

Future studies should pay attention to the specificity of the study by focusing on either acute, subacute or chronic low back pain, and by limiting the study to one of the following, posterior facet syndrome, sacroiliac syndrome or quadratus lumborum spasm.

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Definition of terms

Dysfunction: the term dysfunction implies that one of the three components of the joint is not functioning normally. It refers to any joint where there is decreased or aberrant mobility for which manipulation is indicated. (Kirkaldy-Willis and Burton 1992: 105.)

Spinal manipulative therapy: for the purpose of this study refers to a specific form of direct articular manipulation utilising a short lever and characterised by a dynamic, high velocity, low amplitude thrust. Kirkaldy-Willis (1992: 28) defines manipulation as a passive manual maneuver during which a synovial joint is carried suddenly beyond the normal physiological range of movement without exceeding the boundaries of anatomical integrity. The usual characteristic is a thrust- a brief, sudden and carefully administered "impulsion" that is given at the end of normal passive range of motion. It usually is accompanied by a cracking noise. Gatterman (1990: 42) defines it as a passive maneuver in which specifically directed manual forces are applied to vertebral or extra-vertebral articulations of the body, with the object of restoring mobility to the restricted area.

Mechanical low back pain: is defined as pain resulting from the inherent susceptibility of the spine to static loads due to muscle and gravity forces and to kinetic deviation from normal function (Gatterman 1990: 129). According to Kirkaldy-Willis (1988: 133-135), mechanical low back pain refers to low back pain within the dysfunction stage, and specifically to the posterior facet syndrome and sacroiliac syndrome.

Joint fixation: a non-pathological reversible mechanical problem whereby an articulation has become temporarily immobilised or restricted within its normal physiological range of motion (Gatterman 1990: 408).

Chapter one

1.0 Introduction

The optimal management of low back pain is still under debate (Koes et al. 1995). There exist a large variety of therapeutic interventions, but none of them seem to be clearly superior to others (Koes et al. 1995).

At some time in their lives, approximately 75% of adults have low back pain (Margo 1994). With an over all annual incidence of 5%, a prevalence of 15 to 20 percent in American adults and a recurrence rate of about 75 percent, low back pain is one of the most common symptoms that results in physician visits (Margo 1994). Although the incidence of low back pain has not increased for a number of years, disability attributed to low back pain has been increasing dramatically in Western society (Margo 1994).

Each year two million people are disabled by low back pain making the compensation claims, costs of replacing injured workers and medical care for these patients enormous (Miers 1992). Deyo (1986) states that in many large industrial settings, low back pain is second only to upper respiratory infections as a cause of absence from work. It is estimated that 1400 days of work per 1000 workers are lost annually in the United States because of back pain, and perhaps more in Great Britain (Deyo 1986).

Although 80% of individuals with back pain return to work within 6 weeks, one out of five will become severely disabled. Modern treatment of low back pain has become multidisciplinary and is likely to include psychology, physical therapy, medicine, occupational therapy and vocational rehabilitation (Robinson et al. 1992). Although the condition is usually a benign process and is self-limiting in the majority of cases, the sheer number of those affected is of major concern. Low back pain clearly represents the single greatest and most inefficient expenditure of health care resources in our society today (Kirkaldy-Willis 1992: 2).

It is well known that the lifetime prevalence of low back pain is from 60%-90%. It is also well established that 80% of these sufferers will "get better on their own". From this data a philosophy of "Why not let the majority get better on their own and treat the rest?" has been born. The fallacy of such thinking is reflected in the fact that each episode of back pain in the United States causes an average of about 12 days of bed disability annually and the direct and indirect costs of such an episode are considerable. It is clear that prevailing societal philosophy is what really predetermines the world-wide cost of low back care, and that this is inordinately high everywhere at the present time. (Kirkaldy-Willis 1992:2.)

It therefore stands to reason that we should investigate any therapeutic intervention, which claims to have a significant influence in the conservative management of this type of condition.

Although there are established methods of describing the patho-anatomy and patho-physiology of mechanical low back pain (Kirkaldy-Willis 1988: 134) a standardised and proven treatment protocol for low back pain has not yet been agreed upon. Ottenbach and Difabio (1985) noted that the effect of spinal manipulative therapeutics is greater when manual therapy is performed in conjunction with other forms of therapy rather than when performed by itself.

Chiropractic spinal manipulation combined with other treatment modalities, frequently used in practice, such as injections, strapping, massage and exercise, needs to be compared to chiropractic spinal manipulation on its own in order to determine which is more effective in the management of mechanical low back pain. The results of this study may thus help to determine the most clinically and cost effective treatment of mechanical low back pain. Furthermore it may enable clinicians to choose the more effective treatment, based on clinical evidence and not merely opinion.

1.1 Aim

The aim of this investigation was to evaluate the relative effectiveness of spinal manipulation versus spinal manipulation in conjunction with low back strapping, applied over the first three to five days of treatment, in the treatment of mechanical low back pain, in the dysfunctional phase.

1.2 Objectives

Objective one was to determine the effectiveness of spinal manipulation and also spinal manipulation in conjunction with low back strapping, applied over the first three to five days of treatment, in the treatment of low back pain in the dysfunctional phase, using objective measures.

Objective two was to determine the effectiveness of spinal manipulation and also spinal manipulation in conjunction with low back strapping, applied over the first three to five days of treatment, in the treatment of low back pain in the dysfunctional phase, using subjective measures.

Objective three was to evaluate the data from objective one and two in order to determine whether one of these therapy methods was more beneficial in treating mechanical low back pain in the dysfunctional phase.

1.3 The hypotheses

Hypothesis one: Spinal manipulative therapy would be effective in the management of mechanical low back pain in the dysfunctional phase, in terms of objective and subjective clinical findings.

Hypothesis two: Spinal manipulative therapy in conjunction with low back strapping, applied over the first three to five days of treatment, would be effective in the treatment of low back pain in the dysfunctional phase, in terms of objective and subjective clinical findings.

Hypothesis three: Spinal manipulative therapy in conjunction with low back strapping would be more effective than spinal manipulative therapy alone in the treatment of mechanical low back pain in the dysfunctional phase, in terms of objective and subjective clinical findings.

1.4 Needs for a solution to the problem

An important and essential first step in the process of identifying cost-effective solutions is to establish scientific evidence of the effectiveness of alternative therapies for low back pain. (Manga 1993.)

At present there are no known studies that compare the use of low back strapping in conjunction with manipulative therapy to manipulative therapy alone. It has however been noted that a combination of physical therapy and manipulation is often more effective than manipulation alone. For this reason, and the endless struggle for a quicker recovery time, less time lost from work and a more cost effective method of treating low back pain, an answer to the problem is desirable.

This pilot study aims to add to the growing pool of knowledge on low back pain, by following strict research outlines, such as those suggested by Koes et al. (1996). This randomised clinical trial could serve as a basis for further studies on the topic of mechanical low back pain.

Chapter two

2.0 Review of the Related Literature

2.1 Introduction

Low back pain continues to be one of the most prevalent problems in health care today (DeRosa and Porterfield 1992). It is one of the most frequent reasons that patients visit primary health care physicians and is the second most common reason for time taken off work (Carey et al. 1995). The management of spinal pathology, including low back pain, is of considerable therapeutic interest to rehabilitation specialists.

Despite the frequent occurrence of low back pain and the substantial loss of work associated with backache, according to Ottenbacher and Difabio (1985), there is surprisingly little consensus regarding the management of these disorders. Low back pain is a disease that needs a great deal of study and understanding, for it remains an enigma of medical science, for the patient, the insurance carrier, attorneys, employers and family members (Caillet 1981:v).

Mikheev (1993), as cited by Manga et al. (1993: 84), reports that the World Health Organization has recently described low back pain in the industrial world as an epidemic that can only be controlled through multidisciplinary management, including the unique skills of the chiropractic profession. Low back pain

remains a problem at epidemic proportion and, despite the multiplicity of treatments available for low back pain, a clear choice of treatment has not yet emerged, (Pope et al. 1994).

It has been suggested by Haldeman (1992) that, greater emphasis be placed on the clinical effectiveness of chiropractic treatment. The primary objective of this study is to determine whether the combined effects of spinal manipulative therapy and strapping of the low back are significantly more effective than spinal manipulation alone in the management mechanical low back pain in the dysfunctional phase.

The following overview of the related literature focuses on the etiology and epidemiological aspects of mechanical low back pain, as well as the theoretic basis for the actions and effects of spinal manipulation and strapping as they pertain to mechanical low back pain.

2.2 Low back pain

2.2.1 Incidence and prevalence

According to Pustaver (1994) low back pain will affect 70-80% of adults at some time during their lives, with 20-30% of the population suffering low back pain at any given time. Low back pain is second only to upper respiratory infections for lost working

hours. Back symptoms are the number one reason for patients to seek orthopedic and neurosurgical consultations, and nearly half of the patients who seek chiropractic care do so for low back pain.

Manga et al. (1993) concluded that low back pain is ubiquitous, and there are numerous epidemiological and related statistical studies documenting its very high incidence and prevalence. They state that disability caused by low back pain has increased over the past two decades. Health economists have shown that low back pain is amongst the most costly of health problems and it accounts for the single largest percentage of workers' compensation benefit payments for illness and injury. Expenditures of medical services account for nearly 40% of total worlds' compensation claims costs (Nyiendo 1991). Eighty Five percent of the costs of mechanical low back pain are spent on the 10% of patients whose condition has progressed to the point of chronicity and long-term disability (Donelson 1991).

According to Kanner (1994) back pain is one of the most prevalent pain syndromes and the largest cause of lost work-days. A Finnish study (Heliovaara et al. 1989) suggests that the lifetime prevalence of low back pain in the general population was 75% and that 50% had at least one episode within the prior year; 60% reported some disability from back pain. Donelson (1991)

also states that 40% to 85% of patients will have recurrences within a year after their initial episode.

A community-based study involving the use of chiropractic services found that low back pain is the most common complaint for patients seeking chiropractic care (Shekelle and Brook 1991). A review of chiropractic claims undertaken by Nyiendo and Lamm (1991) demonstrated that chiropractic claimants were found to be more likely to have a history of chronic, recurrent low back pain and more likely to have suffered exacerbation, when compared to medical practitioners' claimants. This study reinforces the indication that chiropractors are treating patients presenting with one of the most common, chronic and costly epidemics in health care today.

2.3 Spinal joint degeneration and its classification

This study utilised the classification of low back pain as set out by Kirkaldy-Willis (1992:105-119), which outlines three phases of degeneration that lead to disability namely: dysfunction, instability and stabilisation. Kirkaldy-Willis states (1992:105) that the majority of patients seen in a low back pain clinic are in the phase of spinal dysfunction and as such, this is the area that this study focused on. Baring in mind that in the phase of dysfunction Kirkaldy-Willis (1992: 121) includes the following conditions:

Posterior facet syndrome,

Sacroiliac syndrome,
Maigne's syndrome and
various myofascial dysfunction syndromes.

And according to Kirkaldy-Willis (1988: 133-135), mechanical low back pain refers to low back pain within the dysfunction stage, and especially to posterior facet syndrome and sacroiliac syndrome.

2.3.1 Phase of dysfunction

The pathology seen in this phase is due to rotational strains and compressive forces in flexion. The earliest changes of synovitis and minor strains in the facet joints (hypomobility) together with minor rotational strains of the annulus leading to the formation of circumferential tears in the annulus of the disc are characteristic of a state of dysfunction (Kirkaldy-Willis 1992: 61). The episode of trauma results in posterior joint and annular strain. Because of small capsular and annular tears, a small degree of joint subluxation may take place. The posterior joint synovium is injured, leading to synovitis (Kirkaldy-Willis 1992: 105). As this dysfunction becomes more severe, leading to the formation of radial tears in the annulus, a localised bulging or protrusion of the annulus that is called a disc herniation may occur, often caused by relatively minor further trauma. Disc herniations occur

most commonly at the end of phase 1 or at the beginning of phase 2, but may occur in phase 3 as well (Kirkaldy-Willis 1992: 61-62).

In phase 1 the muscles become ischemic due to spasm, this then causes pain. It is believed that the ischemia causes the muscle to release acidic substances, such as lactic acid, or other pain-promoting products, such as histamine, kinins, or cellular proteolytic enzymes, that are not removed rapidly enough by the slowly moving blood. A high concentration of these abnormal products then stimulates the pain endings in the muscle, and pain impulses are conducted through the sympathetic afferent nerve fibers into the central nervous system (Guyton 1992: 181). Accumulation of metabolites in the muscle further aggravates the pain and sustains the hypertonic state of contraction. The posterior joint continues to be splinted and the minor subluxation is maintained (Kirkaldy-Willis 1992: 105).

At the end of phase 1, dysfunction, the changes in the three-joint complex may progress in one of two ways.

a) They may result in those seen in phase 2, the unstable phase.

These changes will be discussed shortly.

b) They may proceed directly to those of phase 3, stabilization. In this case the characteristic changes of phase 2 are not seen.

2.3.2 Phase of instability

With each successive episode of trauma, healing of capsular tears of the posterior joint and annular tears of the disc is less complete, as the collagen of scar tissue is not as strong as normal collagen. The three parts of the joint complex are thus placed under increasing risk (Kirkaldy-Willis 1992: 110). Throughout phase 2 the tendency for problems to recur becomes more marked, because of the instability. The mechanisms involved are twofold: a further episode of trauma and continuing stress. Either or both of these result in increased instability.

Progressive changes seen in the facet joints are degeneration of cartilage, stretching or attenuation of the capsule, and laxity of the capsule. Changes in the disc are a coalescence of circumferential annular tears, loss of nuclear substance with internal disruption, and bulging of the annulus around the circumference of the disc. The result is a detectable increased abnormal movement in the three-joint complex. (Kirkaldy-Willis 1992: 110.)

2.3.3 Phase of stabilization

Phase 3 patients present in two ways.

- a) In the older patient, there is a long history of low back pain. Back pain is commonly associated with a degenerative scoliosis and abnormal muscle action. Leg pain is often a predominant feature.
- b) More rarely, in younger patients, the back pain decreases and the leg pain is the more pronounced feature.

There are three mechanisms at work in this phase. Stiffness of the posterior joints is increased because of destruction of articular cartilage, fibrosis within the joint, enlargement and locking of the facet, and periarticular fibrosis. Similar changes occur in the disc, with loss of the nuclear material, approximation of vertebral bodies, destruction of the cartilage plates, and fibrosis within the disc and osteophyte formation around the periphery of the disc. Occasionally a bony ankylosis will join two vertebrae together. These changes often cause entrapment of spinal nerves. (Kirkaldy-Willis 1992: 116.)

2.3.4 Presentation, Signs and Symptoms

Phase 1 presents as either a rotational or compressive strain, sometimes due to a major but more often to a minor episode of trauma. The symptoms are those of acute, subacute and chronic

low back pain. Pain is often localized to one area and to one side. Pain may be referred to the groin, to the region of the greater trochanter, and to the posterior thigh as far as the knee; or rarely, below the knee. The pain is relieved by rest and made worse by movement. One or more particular movements may cause a "catch" type pain and aggravate the pain.

The multiple signs include tenderness to pressure, usually on one side and at one level over the sacrospinalis and multifidus muscles. The muscle at this site is in a state of sustained contraction (hypertonic). Lateral bending is abnormal; i.e., the patient bends more to one side than the other (hypomobility). Muscle activity is usually abnormal. All movements are restricted, especially extension. Some degree of functional scoliosis, seen clearly on forward flexion, may be present. Palpation at the level of the lesion may demonstrate that one spinous process is out of line with the next. (Kirkaldy-Willis 1992: 106.)

According to Kirkaldy-Willis (1992: 121) the clinical lesions associated with this phase include, posterior facet syndrome, sacroiliac syndrome, Maigne's syndrome and myofascial dysfunction syndrome of the gluteus maximus, medius and minimus as well as quadratus lumborum, piriformis, tensor fascia latae and the hamstring group.

Phase 2's presentation may either be similar to that of the dysfunctional phase or chronic and insidious without any recorded history of minor trauma. The symptoms may be no more than those seen in severe dysfunction. The patient may complain that the back feels weak, that it feels as though it is going to give way, or that certain movements, coming upright again after bending forwards, produces a "catch" in the back.

The signs of phase 2 are twofold. Inspecting or palpating the spinous processes when the patient moves may detect increased abnormal movement between one vertebra and the next. A "catch", a sway or shift at one level may be observed as the patient returns to the standing position after bending forward. The patient may not be able to do this without support gained by placing the hands on the knees or thighs.

In the phase of instability the lesions Kirkaldy-Willis (1992: 121) includes are, disc herniation, facet and disc degeneration, lateral stenosis and central stenosis.

The presentation of patients in *phase 3* can be two ways. In the older patient, there is a long history of low back pain. Back pain is commonly associated with a degenerative scoliosis and abnormal muscle action. Leg pain is often the predominant feature. Frequently the low back pain that was severe over past years becomes less incapacitating. This is fact may be the most

common occurrence rather than the exception. Painful episodes may occur from time to time. These are often muscular in origin and can be relieved by lidocaine injections or by wearing an Elasticon garment. Commonly seen signs are tenderness to pressure over several areas; marked stiffness of the spine, with reduction of movement in all directions; and scoliosis, often with a rotational component. Neurological signs indicating nerve entrapment are sometime elicited.

The clinical lesions of this phase include lateral stenosis, central stenosis, multilevel stenosis and disc herniations (Kirkaldy-Willis 1992: 121).

When discussing the clinical lesions associated with each of the three phases it is important to bare the following in mind: a specific lesion can be identified in more than one phase, more than one lesion may be present at any given time and one specific lesion may set the stage for the development of another. (Kirkaldy-Willis 1992: 121.)

2.3.5 Diagnostic criteria

As this study is directed solely at the phase of dysfunction, and more specifically at posterior facet syndrome and sacroiliac syndrome, the diagnostic criteria governing these two conditions becomes very pertinent.

Posterior facet syndrome presents with localised pain over the involved area and is usually unilateral. Referred pain to the buttock, posterior thigh, and occasionally below the knee is frequently seen. The pain is dull, deep, poorly defined and the severity may vary from mild to severe. Movement tends to aggravate the pain, while rest relieves it. Associated clinical signs include local tenderness on palpation of the affected area, hypertonic paraspinal musculature, and reduced lumbar spinal range of motion, especially in extension as this aggravates the condition as a result of facet compression. Kemp's test and lumbar facet joint challenge are usually positive. (Kirkaldy-Willis 1988: 133-135.)

Sacroiliac syndrome exhibits itself as pain in varying degrees over the back of the sacroiliac joint, referring pain to the groin, over the greater trochanter, down the back of the thigh to the knee and rarely down the lateral or posterior leg to the ankle, foot and toes. Associated clinical signs include tenderness on application of pressure over the posterior superior iliac spine and in the region of the sacroiliac joint and the buttock. Motion palpation findings of the joint, as it moves in the sagittal plane, may indicate reduced motion. Orthopaedic tests that are normally positive include, the Patrick Faber, Gaenslen's, Erichsen's and lateral recumbent sacroiliac compression tests. (Kirkaldy-Willis 1988: 135-137.)

The natural history of both posterior facet syndrome and sacroiliac syndrome indicates that patients should recover spontaneously within two months from initial onset (Kirkaldy-Willis 1988: 8). Therefore any patients with pain for more than a period of four weeks was excluded from the study to ensure a minimal effect related to natural history. Furthermore, according to Kirkaldy-Willis' Classification, a four-week period or less is also considered a window of duration for the classification of the diagnosed conditions into the dysfunction stage.

2.4 Spinal joint dysfunction

2.4.1 Anatomy and pathophysiology

It is only through a better understanding of pain and its pathophysiology that responsible decisions can be made regarding its treatment. To understand back pain, there must be a framework from which to work. The aim should be an understanding of the various neuroanatomical mechanisms, the nature of back pain, and the rationale for its treatment. Only when one understands these mechanisms, can one begin to institute rational treatments with predictable outcomes. The very nature of back pain and its impact upon industrialized countries has imposed a sense of urgency for a better understanding of various pain pathways and neural mechanisms. (Frymoyer 1991: 594.)

Haldeman (1992) in his discussion of spinal pain syndromes states that a review of the literature in search of a single aetiology of spinal pain can be very frustrating. He states that, there are clinicians and scientists of considerable repute who have implicated each of the various spinal and paraspinal tissues in the aetiology of spinal pain. For most of the tissues there are at least two or three pathological processes that are considered possible causes of the noxious stimulus.

One needs a better understanding of the pain sensitive structures in order to understand the pathophysiology involved in lower back pain. In a study undertaken by Pustaver (1994), in which he conducted a Medline literature search on studies detailing the neurological and biomechanical aspects of manipulation, he reviews the pain sensitive structures in spinal tissues. He states that the outer fibers of the intervertebral disc contain free nerve endings. The disc is innervated posteriorly by branches of the sinuvertebral nerve. Laterally it is innervated by branches of the ventral rami and gray rami communicantes. The posterior structures, including the lumbar zygapophyseal joints, are innervated by medial branches of the posterior primary ramus. Medial branches also innervate the deep spinal muscles. The lateral branch of the posterior primary ramus innervates the superficial spinal musculature. The posterior longitudinal ligament and the structures within the spinal canal are innervated by the

sinuvertebral nerve, and the anterior longitudinal ligament is innervated by branches of the lumbar dorsal rami.

Wyke (1985:74) states that Type IV mechanoreceptors, unmyelinated pain fibers, are located throughout the joint capsule. These fibers provide the articular nociceptive system. These fibers are normally quiescent, and only become active when abnormally high tension occurs in the articular tissues or when exposed to high concentrations of chemical irritants (i.e. from the inflammatory process).

The synovial joints are heavily laden with Type I and Type II joint mechanoreceptors. These are the receptors that play a large role in the effect of manipulative therapy. Type I receptors are located in the outer layers of the fibrous joint capsules. They have a low threshold, are slowly adapting, and function as static and dynamic articular mechanoreceptors. Type I mechanoreceptors will signal direction, amplitude and velocity of joint movement. (Wyke 1985:74.)

Type II mechanoreceptors are located in the inner layer of the joint capsule, have a low threshold and are rapidly adapting. These are dynamic mechanoreceptors that signal the onset of joint movement. (Pustaver 1994.)

Facet syndrome, the facet dysfunction and the resultant clinical manifestations have been shown to be a common cause of low back pain. Bernard and Kirkaldy-Willis (1987), in a retrospective study of 1293 low back pain patients, found the most common cause of referred pain syndromes were posterior joint syndromes and sacroiliac syndromes. The cause of restricted intervertebral mobility or joint fixation has generated much speculation (Rahlmann 1987). Rahlmann included in his literature review some possible theories that merit further investigation, which include meniscoid entrapment, displaced intervertebral disc fragments (disc disruption), segmental or intersegmental muscle spasm and periarticular connective tissue adhesions.

Some of the daily activities that can cause mechanical low back pain, from disuse eg. sitting in an office all day associated with lack of movement; injury eg. lifting a heavy object; or from poor posture. All three of these examples may result in joint dysfunction (Kirkaldy-Willis and Cassidy 1988: 134.)

A study by Radin (1987) found the facet syndrome to be the common cause of failed lumbar disc surgery. His study concluded that this condition could be resolved in 70% of the cases if proper non-surgical treatment was rendered. Such treatment would be aimed at correcting the facet joint dysfunction, correction of joint mechanics, the "alteration of the normal dynamics, anatomical or

physiological relationships of contiguous articular structures”, has been termed the vertebral subluxation.

The vertebral subluxation complex is comprised of five components (Pustaver 1994):

1. *Neurophysiology*: with its aspects of nerve pressure and facilitation. Facilitation can lead to myohypertonicity, sympathetic vasomotor and sensory disturbances. Pressure can lead to atrophy, sympathetic atonia and anesthesia.
2. *Kinesiopathology*: Hypomobility, hypermobility, loss of joint play. With this component is the alteration of the axis of rotation of the joint complex.
3. *Myopathology*: Spasm and atonia.
4. *Histopathology*: Includes the inflammatory response, oedema.
5. *Biochemical*: Including histamine, prostaglandins, kinins, the chemical mediators of the inflammatory response as well as nociceptor stimulators.

According to Pustaver (1994), when a spinal articulation is fixated, at least one other articulation will be forced into greater range of motion. This hypermobile articulation will be forced into eccentric motion patterns about the fixed articulation. Pustaver (1994) also describes a fixation that implies the articulation can become fixed in any of its normal or abnormal positions.

Lumbar spine joint irritation and inflammation, such as those cause by a "fixation" or "hypermobility", can lead to referral patterns into the buttock and lower extremities, a symptom picture that has previously thought to be due to direct nerve root compression by herniated discal material. (Pustaver 1994.)

2.5 Treatment of low back pain

Traditional allopathic treatment for low back pain, including lumbar intervertebral disc herniation, has included bed rest, medication, physical therapy and surgery (Pustaver 1994). Pustaver (1994) also states that numerous studies have elaborated on the negative effects and the failures of these methods of treatment. Cherkin and Deyo (1993) studied the medical records and hospital discharge data of 2 418 low back pain patients, 18 years of age and older, who were hospitalised with a primary diagnosis indicating low back problems. When considering the frequency of non-surgical treatment, the most common physical therapies were bed rest (72%), application of heat, ice or ultrasound (26%) and lumbar traction (22%). Drug Therapy was very common, with 83% of patients receiving narcotic analgesics, 71% sedatives, 32% non-steroidal anti-inflammatory drugs, 25% corticosteroids and 7% sedatives (including muscle relaxants).

2.5.1 Bedrest

A randomised clinical trial undertaken by Deyo et al. (1986) revealed that prolonged bed rest speeds up the resolution of the painful symptomology or the period of dysfunction in most low back pain patients. However one reason that prolonged bedrest is often contraindicated is due to the fact that it can lead to decreased fibrinolytic activity (Klimiuk et al. 1987). Klimiuk (1987) states that after tissue is injured, the reparative process begins as fibrin is deposited. Therefore the fibrinolytic defect, which may occur with prolonged bedrest and use of medication, has the potential to create a chronic low back condition. A study by Videman (1987) showed not only does immobilisation delay the healing process, it also leads to osteoarthritis or osteoporosis.

Ordet and Grand (1992: 65) found that after 6 hours of immobilisation, there is a decreased impulse pattern in the motorneurons innervating the muscle resulting in muscle and bone atrophy. Musculoskeletal difficulties may benefit from motion and early mobilisation, further supporting the concept of limited bed rest (Ordet and Grand 1992: 65).

2.5.2 Surgery

Even though there are questions regarding the effectiveness of surgical intervention in the treatment of low back pain, the use of

surgery continues to rise. From 1979-1987, there was a 200% increase in the number of spinal fusions performed, a 23% increase in laminectomies, and a 75% increase in discectomies. (Deyo et al. 1991.)

When one considers the failure rate of low back surgery is 55%, coupled with the fact that 10 year follow-up studies (Weber 1983) have shown the same neurological recovery as was reported in those treated surgically and nonsurgically, the use of operative procedures in the treatment of mechanical low back pain conditions should be the last resort. According to Weber (1983) the exception to this rule would be in the case of cauda equina syndrome (i.e. saddle anaesthesia, bowel dysfunction, bladder dysfunction, and lower extremity weakness).

2.5.3 Medication

Since most low back pain is mechanical in nature, drugs are effective in pain reduction but rarely improve the underlying problem (Hansen et al. 1993). Another problem with drugs is that most analgesics, antidepressants and anti-inflammatories, can only be used for a limited period of time without side effects eg. addiction, dependency, and gastro-intestinal bleeding (Margo 1994).

2.5.4 Physical therapy

Margo (1994) found that although physical therapy has been a reliable treatment of patients with low back pain, research has not supported many of the treatments used such as traction, immobilisation and heat therapy. Deyo et al. (1991) supports this statement. No evidence supports the theory that relaxation modalities such as ultrasound and deep heat provide any long-term benefits, although they may offer temporary relief of pain. Similarly, little evidence shows that traction has any benefits (Haldeman 1992: 505). In a recent study Deyo et al. (1991), found that the use of transcutaneous electrical muscle stimulation (TENS) showed benefits no better than that of the placebo group.

2.5.5 Injection

Injection therapy (steroids and local anaesthetics) eg. facet joint injections, as a treatment for either acute or chronic low back pain has failed to be scientifically supported (Margo 1994). However, Kirkaldy-Willis and Burton (1992: 248) noted that sacroiliac and facet injections nearly always relieved the patient of pain for several hours. They stated that in approximately 50% of cases, the patients are free of pain for weeks or months. In some cases relief is permanent.

Kirkaldy-Willis and Burton (1992: 251) found with regards to myofascial pain and dysfunction syndrome, that when stretch and spray fails to relieve the pain and spasm, injection with 0.25% bupivacaine seems to relieve symptoms. The site of the injection is directly into the trigger point, and this seems to offer instantaneous relief of pain.

2.5.6 Spinal manipulative therapy

Spinal manipulative therapy has been referred to as chiropractic adjustment, spinal manipulation, manual therapy or manual medicine (Haldeman 1993). One of the problems in conducting research on manipulation is the obscurity surrounding the definition of the word 'manipulation' (O'Donoghue 1994: 670). The definition of manipulation utilised in this study is the following: a passive manoeuvre in which specifically directed manual forces are applied to vertebral and extravertebral articulations of the body, with the object of restoring mobility to restricted areas. Short lever manipulation is a high velocity thrust directed specifically at an isolated joint (Gatterman 1990: 410).

There is mounting research evidence that manipulation is the most effective form of therapy in the treatment of mechanical low back disorders (Pustaver 1994). Manga et al. (1993) make reference to the New Zealand Commission Report of 1979, the

findings of which were very supportive of chiropractic, declaring it safe and effective for musculoskeletal spinal disorders, including low back pain, and several other disorders.

Only a few randomised trials have evaluated the effectiveness of chiropractic spinal adjustive therapy. In their short term placebo-controlled trial of chiropractic adjustments for the relief of nonacute low back pain, Waagen (1986) concluded that after 2 weeks of manipulation, the experimental patients had significantly more relief from pain and increase in spinal mobility compared with the control patients. Pain was measured on a visual analog scale, and a global index was used for the objective measurements of change in spinal mobility. Unfortunately, one third of the original sample population dropped out. The authors consider the results preliminary because of the small sample size.

The conclusions drawn by reviewers of spinal manipulative therapy have, however not been unanimous. Nevertheless, there appears to be consensus that manipulation is a therapeutic approach that in many cases offers more immediate relief to patients' with spinal disorders than any other form of conservative therapy, particularly so in the case of low back pain. (Haldeman 1992.)

2.5.7 Low back strapping

There are no known studies that have been published to evaluate the effectiveness of strapping to the low back and all evidence thus far has been anecdotal. This leaves a void in the research, which needs to be addressed, as strapping is used in the field as an adjunct to other treatment protocols.

When speaking in terms of strapping of other joints it has been said that there is no doubt that, used intelligently, strapping has great benefits prophylactically and therapeutically (Garrick et al. 1973). It has also been said that the "X" pattern taping technique, when utilised in areas where chronic stress is placed on the tissue, can in certain situations, be beneficial in supporting muscle tissue in the forearm, thorax, lumbar-sacral region, upper leg, lower leg and foot (Wright and Whitehill 1991:14).

In a study undertaken by Heit et al. (1996) investigating the proprioceptive effects of ankle bracing and taping in 26 subjects, referred to two mechanisms whereby bracing and taping assist ankle injuries. Firstly the taping adds mechanical support to ligamentous structures and limits the extreme ranges of joint motion (Burks et al. 1991), and secondly the bracing or taping may prevent injuries by enhancing proprioception and stimulating muscular control (Karlsson and Andreasson 1992). Many authors may support the theory that bracing and taping plays an important

role in ankle injuries by proprioceptively stimulating muscular contractions, but the scientific basis for this theory has yet to be well established through research (Heit et al. 1996).

The principle of taping and bracing should apply to all joints of the body. The enhanced ankle joint position sense observed in the study by Heit et al. (1996) reflects results in studies of knee proprioception. Lephart et al. (1992) reported enhanced knee joint kinesthesia following the application of a neoprene knee sleeve, while Barrett et al. (1991) found improvements in the joint position sense in osteoarthritic and total knee arthroplasty patients who wore an elastic bandage.

2.6 Spinal manipulative therapy compared with other therapies

According to Bronfort (1992: 437), many of the conditions traditionally treated with spinal manipulative therapy, for example, low back pain, are multifactorial disorders and it would seem relevant to investigate the effectiveness of spinal manipulative therapy in combination with other conservative therapeutic approaches that have been shown to have beneficial effects (eg: certain back schools, exercise, and functional restoration programs). Gatterman (1990: 397) states that in most cases when manipulation is the treatment of choice, adjunctive procedures are of benefit.

In order to compare the effectiveness of chiropractic and medical management of low back pain of musculoskeletal aetiology, Hurtwitz (1994) followed 103 chiropractic patients and 187 medical patients for 3 months after their initial presentation for low back pain treatment. When compared to the medical patients, the chiropractic patients were 60% more likely to have their pain resolved after 3 months and were also almost twice as likely to perceive their treatment to be successful.

Carey et al. (1995) conducted a prospective study of 1555 patients with acute low back pain presenting to various practitioners (chiropractic, primary care providers, orthopaedic surgeons and health maintenance organisations). Of those subjects who consulted chiropractors, 42.5% regarded the overall results of the treatment to be "excellent", while only 26.5% of the patients who visited the other practitioners reported that the overall results were "excellent". In this study, patients who were treated by chiropractors took an average of 0.7 prescription medications during their episode of low back pain, compared with 1.9 prescription medications taken by patients who consulted primary care providers, orthopaedic surgeons or health maintenance organisations.

Triano et al. (1995) conducted a randomised trial on a sample of 145 patients with untreated low back pain lasting 7 weeks or longer, or having more than 6 episodes of low back pain in 12 months. The aim of the study was to compare the effectiveness of chiropractic spinal manipulative therapy, a manipulation mimic, which involved a low-force imitation of a manipulation, and a back education program. The manipulation group experienced a greater improvement in pain and activity tolerance. Self-reported functional levels were also higher in the manipulation group than in the manipulation mimic and back education group. The author concluded that spinal manipulation appears to be of clinical benefits in the treatment of low back pain, even in low back pain exceeding 7 weeks duration.

The British study by Meade et al. (1990) was aimed at comparing the effectiveness of chiropractic and hospital outpatient management for low back pain over an extended follow-up period. In this randomised clinical trial the hospital treatment consisted almost exclusively of spinal manipulation and mobilisation, carried out by physical therapists. A total of 741 patients, aged 18 to 64, presenting with low back pain, were randomly allocated to be treated either by a chiropractor or in a hospital outpatient setting. At the end of a 3 year follow-up period, the patients were asked whether they thought that their, allocated trial treatment had helped their back pain. The reported improvements in pain and disability levels in those subjects treated by chiropractors

were about 29% higher than in the hospital out patients, suggesting that low back pain patients treated by chiropractors derive greater benefit and long term satisfaction than those treated by hospitals.

Since 1940, more than 20 studies of workers compensation patients receiving chiropractic care have been reported. Most of these studies, (Bergeman and Cichoke 1980; Johnson et al. 1989), as well as prospective studies from general practice (Bronfort 1986), have suggested that chiropractic management of low back pain, consisting mainly of chiropractic manipulation, is superior to the medical approach, in terms of limiting patient work time loss and lowering treatment costs. All of these studies are non-randomised and most of them retrospective in design, resulting in uncertain patient group comparability, precluding any definite conclusions (Haldeman 1992: 421).

2.7 Effects of spinal manipulative therapy

The effects of manipulation are multifactorial. The greatest effects of manipulative therapy are due to mechanoreceptor involvement. According to Wyke (1985: 75), it is the Type I and Type II mechanoreceptors that are most involved in manipulative procedures. Wyke (1985:75) states the articular mechanoreceptors have reflexogenic, perceptual and pain controlling aspects. Reflexogenically, manipulation via articular

mechanoreceptor stimulation, will have an effect on muscle tone. This effect is not just a local but a global effect throughout the entire neuraxis due to collateral branches that are given off that have an effect on distant muscles. Input from these joint mechanoreceptors reaches the paracentral and parietal regions of the cortex; this has input to perceptual experiences of postural sensation and kinaesthesia. (Wyke 1985: 75.)

Manipulation also plays an important role in the suppression of pain. Mechanoreceptors give off collateral branches to the dorsal horn. Here they synapse on apical internuncial neurons whose axons go to the basal spinal nucleus where they will synapse on the presynaptic terminals of the nociceptive afferents. This is an inhibitory synapse; therefore, there is a resultant decrease in the transmission of pain impulses. (Wyke 1985: 75.)

Thiel (in Kirkaldy-Willis and Burton 1992: 288) noted that in both acute and chronic spinal pain, joint movement, previously restricted, is increased by spinal manipulation. Increased movement causes an increase in proprioceptive input, which in turn has a reflex inhibition on the transmission of pain through the mechanoreceptor substantia gelatinosa transmission. (Kirkaldy-Willis, Cassidy and Thiel in, Kirkaldy-Willis and Burton 1992: 288.)

During spinal manipulation the joint is carried deep into the parapsychological range for a very short period of time, the process of which can often be identified by a cracking sound within the joint (Sandoz 1976). The result is an increase in passive motion of the joint in all directions. The possible effects of manipulation according to Calliet (1981: 129-130) are as follows:

1. A facet joint immobilised by an acute synovial reaction and adherence of the joint surfaces of the facets takes place. The passive movement of the manipulation separates these surfaces,
2. Manipulation allows an entrapped meniscus to exit the facet joint in which it became entrapped,
3. The capsule of the facet joint becomes lodged between two adjacent articular surfaces and the manipulative process allows this capsule to be freed,
4. The mechanoreceptors of the joint are desensitised by the abrupt movement of the joint (manipulation), and reflex protective spasm is eliminated and allows the joint to move again,
5. The spindle systems of the adjacent muscles are reflexly stimulated by the dynamic thrust of the manipulation and reciprocally relax the extrafusal fibres, and
6. The mal-aligned spinal segments are realigned to conform to the centre of gravity.

However, Bergmann et al. (1993: 139) reports that the specific mechanical and physiological changes that take place to relieve the signs and symptoms of joint dysfunction have not been accurately determined.

Indications for manipulation: (Kirkaldy-Willis and Burton 1992: 291),

- Posterior facet and sacroiliac joint dysfunctions;
- Paraspinal muscle conditions;
- Disc herniation;
- Joint dysfunction in lateral and central canal stenosis;
- Joint dysfunction in Spondylolisthesis;
- Sacroiliac syndrome on post-operative low back pain.

Contra-indications of manipulation:

(Kirkaldy-Willis and Burton 1992: 291),

- Relative
- Osteopenia;
 - Spondyloarthropathies;
 - Patients on anti-coagulant medication;
 - Bleeding disorders;
 - Psychological overlay.

- Absolute
- Destructive lesion of the spine, ribs and pelvis;
 - Healing fracture or dislocation;
 - Gross instability;
 - Cauda Equina Syndrome
 - Large abdominal aneurysm;
 - Visceral referred pain.

2.8 Effects of strapping

According to Kirkaldy-Willis (1988: 250-252), the treatment for recurring and chronic facet syndrome in the phase of dysfunction requires a conservative approach i.e. low back school, manipulation and perhaps a course of physiotherapy and occupational therapy, together with light elastic garment. The elastic body support is designed to promote an early return to normal activity with freedom from pain (Kirkaldy-Willis 1992: 337). A light elastic garment is said to provide support to the back, permitting full movement of the spine, and thus does not contribute to muscle atrophy (Kirkaldy-Willis 1992: 247), however he does not state whether this is used for an acute, subacute or chronic condition.

It has been suggested that if bracing and taping do have an effect on ankle sprains, it must be through improved joint position sense of the foot (Heit et al. 1996). Zachazewski (1992) said that the

brace is a short term, stop-gap assisting entity, a crutch for a period of time soon after an injury. The object is to provide a device to aid the healing process and rehabilitation program, allowing the athlete to regain good strength, balance, proprioception and reaction time. He states that these critical factors are the hallmark of good rehabilitation program.

Martin and Wichmann (1996) state that primary functions of braces include protection, support, compression, restriction of movement and immobilisation. He added that they might improve proprioception and reduce swelling.

The enhanced position sense observed in the study undertaken by Heits et al. (1996), to determine the proprioceptive effects of ankle bracing and taping, reflects the effect of the interventions on the afferent neuromuscular pathway. Testing the afferent pathway assesses the subjects' ability to perceive joint motion and reproduce joint positions. Stimulating the afferent pathway may increase the speed and quality of muscle reactions. The findings of Glick et al. (1976) support this assumption. In examining the effects of ankle taping on the afferent neuromuscular pathway, Glick et al. (1976) found that the taped unstable ankle demonstrated an earlier onset of peroneal muscle firing and a prolonged peroneal muscle function time during a normal gait cycle compared with the untaped ankle joint. Karlsson and Andreasson (1992) also examined the efferent neuromuscular

pathway as they compared the effect of applying tape to both the unstable ankle and the stable ankle. Their results demonstrated an increased reaction time in the unstable ankle as compared to the stable ankle, yet there was an improvement in both.

These factors all point towards the likelihood that there may be some benefits to be derived from the use of low back strapping as an adjunct to the treatment of mechanical low back pain. It is, however, only through a study such as this that the true relative effectiveness can be evaluated. The studies on the ankle and knee, mentioned here, have neglected to specify whether the joint was in the acute, subacute or chronic phase, this needs to be considered and incorporated into future studies.

Contra-indications to strapping: (Reid 1992: 237),

- known allergies to tape or other materials used for taping,
- eczema, or infection in area of the proposed taping
- inadequate protection of blisters or open wounds in the area
- vascular disease with peripheral circulatory compromise
- inadequate sensation eg diabetic, alcoholic.

2.9 Summary

Low back pain continues to be one of the more prevalent problems in health care today. Not only is low back pain, one of the most common musculoskeletal problems in industrial societies, but it is the most costly (DeRosa and Portfield 1992). Each year two million people are disabled by low back pain making the compensation claims, cost of replacing injured workers and medical care for these patients enormous (Miers 1992). It is now generally accepted that between 60 to 80% of the general population will suffer from low back pain some day Kirkaldy-Willis (1992:2), and that between 20 to 30% are suffering from low back pain at any given time (Kirkaldy-Willis 1988:4).

The continuing stereotype is that patients with chronic low back pain require long courses of treatment, which are seldom completely effective for the remediation of the patients' symptomology. This general lack of success commonly creates frustration for both patient and the therapist as the search for an effective means of managing this condition continues. (Kent 1994.)

A community-based study involving the use of chiropractic services found that low back pain is the most common complaint

of patients seeking chiropractic care (Shekelle and Brook 1991). Mechanical low back pain is a common clinical entity, which needs professional treatment (Margo 1994).

Although there is evidence of spinal manipulation being used in conjunction with other therapies, a literature search performed by the author gave no evidence that an investigation showing the efficacy of manipulation and strapping together has been done.

It is facts such as these, which motivate studies of this nature, in order that a more cost-effective management of this epidemic problem may be achieved.

Chapter three

3.0 Methodology

The objective of this study was to compare spinal manipulative therapy and spinal manipulative therapy in conjunction with low back strapping, in terms of objective and subjective clinical findings, in order to determine the more effective approach in the management of mechanical low back pain in the dysfunctional phase.

3.1 Recruitment

Radio and newspaper advertising was utilised to attract prospective subjects suffering from low back pain. Upon reply, each subject was telephonically interviewed so as to explain the conditions of the study and to perform an initial screening to eliminate those patients obviously falling outside the range of the study. The advertisement called for patients having low back pain for a period of 4 weeks or less (Kirkaldy-Willis 1988: 8), and in the dysfunctional phase according to Kirkaldy-Willis' classification (Kirkaldy-Willis 1988: 134).

Exclusion criteria:

- If they were younger than 18 or older than 65 years of age.
- Any pregnant female applicant.
- If their condition exhibited neurological deficits or a vascular deficiency involving the lower limb and was so diagnosed before

applying to enter the study.

After agreeing to participate an initial consultation was scheduled for the prospective participant.

An initial consultation was conducted in which the candidate underwent an extensive case history (Appendix A), physical examination (Appendix B) and a low back regional examination (Appendix C), in order to determine the cause for their low back pain.

3.2 Screening of patients

During this process the participant was screened for any condition affecting the low back, posterior facet syndrome of the lumbar spine, sacro-iliac syndrome, or a combination of both (Kirkaldy-Willis 1988: 133-134). If clinically indicated, those patients in whom the diagnosis was not clearly defined underwent the relevant radiographic evaluation for possible pathology contra-indicating manipulation. Following the examination a diagnosis was determined and the patients with the appropriate diagnosis were included into the study.

Any of the patients suffering from an associated myofascial pain dysfunction syndrome as defined by Travel and Simon (1983 1:

1) were included in the study, however the myofascial component was left untreated. Patients using any medication were excluded from the study.

The specific orthopaedic procedures used to diagnose the posterior facet syndrome were: Kemp's test (Gatterman 1990:141) and lumbar facet challenge (Magee 1992: 343).

Kemp's test (axial compression) is conducted while the patient is seated or standing with the examiner stands behind the patient, grasps him or her around the chest with one arm and supports the lumbosacral region with the opposite hand. The examiner then bends the patient obliquely backward (rotates and extends) as far as possible and applies an axial compression to the side of rotation. Should this manoeuvre reproduce or aggravate local pain over the affected spinal segment(s) it may be indicative of a posterior lumbar facet syndrome (Schafer and Faye 1989: 208-209).

Lumbar facet challenge (joint 'springing') is carried out with the patient lying in prone position. The examiner places a thumb on the spinous process tip and pushes laterally, varying the force. The joint may be bounced with a little more vigor if there is no pain response. This produces end-feel, which is never reached abruptly in the normal joint. A joint with restricted mobility has

lost the springiness at the end position. It is this springiness that one palpates for when performing the facet joint challenge (Gatterman 1990; 49, 84).

The orthopaedic tests used to specifically diagnose the sacroiliac syndrome were: Patrick Faber's test, Gaenslen's test (Magee 1992: 319) and Erichson's test (Magee 1992: 320).

Patrick Faber's test requires that the patient lies supine, and that the examiner place the patients' test leg so that the foot of the test leg is on the knee of the opposite leg. In other words the affected side's hip joint is flexed, abducted and externally rotated. The examiner slowly abducted the test leg towards the table. The eliciting or aggravation of pain over the sacroiliac joint may be indicative of a sacroiliac syndrome. This test may, besides a sacroiliac problem, indicate a hip problem or iliospoas spasm (Magee 1992: 343).

Gaenslen's test requires that the patient lies supine with the patient positioned so that the test hip extends beyond the edge of the table. The patient draws both legs up onto the chest and then slowly lowers the test leg down into extension. Pain in the ipsilateral sacroiliac joint is indicative of a positive test (Magee 1992: 319).

Erichsons' test requires that the patient lies prone, the examiner places his/ her cephalad hand on the patients' posterior superior iliac crest and the caudal hand supports the knee and raises the ipsilateral leg into extension. The sacro-iliac joint is forcibly compressed. Pain experienced over the sacroiliac joint constitutes a positive test (Magee 1992: 320).

Once the patients were examined and found eligible they were asked to complete and informed consent form (Appendix D), indicating their willingness to take part in the study.

3.3 Randomisation

The total sample size of 60 patients was then divided into two groups of 30 patients each by using the random consecutive sample method. This method involved sixty pieces of paper being made, numbers 1-30 were designated to the manipulation group, whilst 31-60 were designated to the group receiving manipulation in conjunction with low back strapping. All the pieces of paper were placed in a box and one was drawn out at a time. Each number drawn was allocated a corresponding patient number (i.e. the first piece of paper was assigned to patient number one). The number drawn by the patient was then discarded. The process was repeated until the final patient initiated into the study was automatically allocated the last remaining number.

There was no blinding of either the patients or the examiner in this study. According to Winer (1985: 98) requirements for the double blind, or even the single blind trial are difficult to fulfill because patients are aware of whether they have had manual therapy or not, and it is difficult to guarantee that patients will not reveal their treatment to the doctor.

3.4 Intervention protocol

Patients were treated for a maximum of six treatments over a two-week period, this treatment protocol was used, as a favourable response to manipulation normally occurs over a seven to ten day period (Gatterman 1990: 163). Should the patients' condition have resolved before the six treatments were completed, they were then monitored for the remainder of the consultations. If the same condition recurred within the monitored period, the treatment was continued until the sixth consultation. The frequency and duration of treatment as stipulated by Haldeman (1992: 124) are parameters within which the author will work, logic dictates that once a patient is symptom free the treatment should stop.

Motion palpation, as instructed at Technikon Natal (with reference to Schafer and Faye 1989: 211-216, 256-259) was used to

identify segments with restricted or abnormal motion patterns in the lumbar spine and sacroiliac joints. A study undertaken by Evans (1994: 545), showed that motion palpation is found to be a sufficiently precise technique for the assessment of intervertebral movement. This was used to ascertain which technique was to be utilised to manipulate patients. This method is currently considered to be the most reliable test to identify a restricted spinal segment (Walker and Buchbinder 1997).

Patients in both the treatment groups were treated using the diversified method of manipulation. The techniques used were those described by Szaraz (1990: 137, 145, 156, 143, 139, 141). These included the lumbar roll (pisiform-mamillary), spinous hook/push, seated lumbar and extended or flexed sacroiliac joint. Any one of these techniques was used to manipulate the fixated lumbar spinal segment. The success of the manipulation was not based on an audible sound but rather the motion palpation findings following the adjustment. Should the segment fixation persist, an alternative technique was used in order to manipulate the segment.

Those patients receiving the low back strapping were strapped at their first consultation, the strapping remained on for a minimum of three days or a maximum of five days, as suggested by Reid (1992: 237). The patient was positioned with the legs and waist in

a slightly flexed position and the area from the twelfth thoracic vertebrae to the last lumbar vertebrae was cleaned and excessive hair removed if necessary. Rigid tape was applied first for, its supportive qualities, this was done in parallel strips, working inferior to superior, until the affected area was covered, overlapping each strip by half its width. This was then followed by applying the "X" pattern technique across the affected area, with the focus of the X on the fixated area. This "X" pattern was repeated three or four times, overlapping the tape by one-half its width. Elastic tape was then applied over the top in parallel horizontal strips once again from bottom to top and overlapping by one-half its width. The "X" pattern is beneficial in supporting muscle tissue in the lumbar-sacral region (Wright and Whitehill 1991: 4). Tape remover and alcohol was used to assist in the removal of the tape so as to prevent possible skin irritation.

Patients were encouraged to avoid any activity that differed from their daily routine. Any adverse effect to either of the treatment methods was recorded in the patients' file.

3.5 Data collection

The study made use of both experimental and descriptive survey techniques for data collection. The experimental design of the

study involved the measurement of the range of motion of the lumbar spine (as determined by the goniometer) and pain sensitivity (determined with the use of an algometer).

Lumbar spine ranges of motion were measured in flexion, extension, left lateral flexion, right lateral flexion, left rotation and right rotation, with the use of the BROM II (back range of motion) goniometer. The goniometer was supplied by Performance Attainment Associates-3600 LA Bore Rd, Suite 6, Saint Paul, MN 551104144. Although all ranges of motion were measured in this study, Breum et al. (1995) could only demonstrate accuracy in extension and lateral flexion measurements with this instrument. The goniometer consists of two sets of instruments: Part A is used for the measurement of flexion and extension, and Part B utilised for left and right lateral flexion (with a coronal-facing compass) and left and right rotation (with a horizontal-facing compass). The method of measurement utilised is as follows:

For flexion and extension: marks were made over the spine at S1 process below (point 1) and T12 spinous process above (point 2). The fulcrum of part A of the goniometer was then placed over point 1, and the valcro straps secured around the patients waist, whilst the goniometer's marker was then placed at point 2. This reading was then taken as an initial reading. The patient was then asked to bend forward as far as possible, while the goniometer

was held firmly so as to prevent any movement off the aforementioned points. At the limit of flexion, a second reading was taken. The first reading was then subtracted from this second reading in order to obtain the number of degrees of forward flexion. The patient was then asked to stand up straight once more and another initial reading was taken in order to determine the degrees of extension. The patient was then instructed to bend backwards as far as possible, again whilst the goniometer was held firmly in place so as to prevent any movement off point 1, at the limit, the second reading for extension was taken. This reading was then subtracted from the first reading for the number of degrees obtained in extension.

Part B of the goniometer was used to determine left and right lateral flexion. The valcro strap of part B was secured around the patients' waist between the areas of T12 and S1. A magnet was then attached to the strap. The part B instrument was then placed over the affected segment so that the coronal-facing compass faced the researcher in the coronal plane. In the event of more than one tender area, readings were taken over the tenderest point.

With the compass needle facing down the initial reading was taken. Whilst the examiner fixed the goniometer to the patients' body, the patient laterally flexed as far as possible and a second

reading was taken to the left and right and subtracted from the baseline measurement. Each measurement was confirmed and no more than three degrees variance was accepted, if a large disparity was found the measurements were repeated. If the variance fell within three degrees the highest reading was taken.

For left and right rotation part B of the instrument was again used, but this time the horizontal-facing compass was utilised. The patient was in a seated position, with the arms crossed over the chest. The instrument position was the same as before. However, the compass was zeroed according to the magnet position. The patient was then instructed to rotate maximally to the left and the right and a reading was taken for each. As with lateral flexion three degrees of variance was allowed for measurement confirmation.

Once the initial range of motion was recorded, a pressure threshold reading was taken (algometer) from each patient. Pain sensitivity was measured using the pressure algometer supplied by Wagner Instruments (P.O.Box 1217, Greenwich, CT 06836, USA). The patient was asked to indicate the area of most pain/ discomfort, usually at one or both sides of the involved segment. The patient was instructed to indicate immediately when the pressure exerted by the algometer became painful by saying "yes".

If the area was on one side of the involved segment the head of the algometer was placed on that side and depressed. Upon the patients response, the pressure was removed and a reading taken (maximum out of 10kg per square centimeter). When the pain was bilateral, both sides of the involved segment, both readings were taken and an average was calculated and rounded of to the nearest decimal place. Fischer (1986) conducted a study on 50 patients in an attempt to quantify tender spots through the use of the algometer. His conclusion was that the unit yielded highly reproducible results and showed excellent validity of measurement obtained. He also stated that the algometers ability to measure pressure sensitivity and to identify abnormally tender areas provides a means of quantifying treatment, including manipulation, so as to identify improvement. The algometer was fitted with a one square centimeter rubber disc, as this is more suitable for the measurement of tenderness in muscle, ligaments, joint capsules and tendons (Fischer 1986).

In the descriptive survey design the Numerical Pain Rating Scale-101(appendix H) and the Patient Specific Functional Disability Questionnaire (appendix G) was made use of.

The NSR-101, numerical pain intensity scale, used to measure the subjective response of the patient to the treatment in terms of

their perception of pain intensity. The questionnaire instructed the patient to rate their pain at its worst and at its least on a numerical scale of zero to one hundred, with zero indicating "no pain at all" and one hundred indicating " pain as bad as it could be". Adding the values representing the worst and least pain and then dividing this value by two calculated the average pain intensity (Jensen et al. 1986). The average pain intensity experienced by each patient over the treatment and follow-up periods was then utilised for statistical analysis. In a study conducted by Jensen et al. (1986) comparing six methods of judging pain intensity, the Numerical Pain Rating Scale came out superior to the others. It was considered more practical, simple to administer and score, administered in either written or verbal form and does not appear to age related.

The Patient Specific Functional Disability Questionnaire was used to measure disability related to low back pain in terms of the patients' perception of disability. The patient was asked to write down at least three activities in their daily life in which their back pain gave them difficulties. The degree to which the back pain was disabling was then scaled on a scale of one to ten. One representing an inability to perform the activity at all and ten being assigned to activities performed as well as if there were no back pain (Stratford et al. 1995). Adding up the values assigned and dividing the answer then by the number of activities the

patient stipulated, then averaged the scores. The average disability experienced by the patient over the treatment period was then utilised for statistical analysis.

Following the range of motion, algometer and questionnaires the patients were given their respective treatments. The patients were advised not to engage in activities varying from their normal daily routine.

Each patient received a series of six treatments over a two-week period as suggested by Haldeman (1993: 124). Data from the range of motion, algometer measurements and the NSR-101 and Patients Specific Functional Questionnaire was collected from the patient before treatments 1,3 and 6. The readings taken at the third consultation were used to give indication of the effects of the strapping on the recovery rate as compared to the group not receiving strapping. All strapping was removed prior to taking the readings.

If any of the patients were asymptomatic before the last visit, treatment was discontinued, but the patient was monitored for the full two weeks. According to Haldeman (1993: 124) logic dictates that once a patient was symptom free it would be pointless to continue with treatment.

All the data collected from the questionnaires, the algometer and the BROM were entered as a percentage onto a spreadsheet. This was entered into the statisticians' computer and the statistical package SPSS Base Users' Guide (1999) was used for the data entry and analysis.

Non-parametric tests were used to analyse categorical variables (variables measured in nominal or ordinal scale), namely the Patient Specific functional Scale, irrespective of the sample size. Parametric tests were used to analyse continuous variables, namely the algometer, goniometer and Numerical Pain Rating Scale-101 irrespective of the sample size per group. It was therefore assumed that the data populations were symmetric (i.e. normal distribution).

The data was analysed using the STATGRAPHICS PLUS VERSION 6 computer program (Manugistics Inc.).

The Wilcoxon's sign ranked test was used, for the categorical variables, to determine whether any significant change occurred between the initial and final treatments, the initial and third follow-up appointment, and between the final treatment and the third follow-up appointment, within each study group. In each respective hypothesis conducted, the null hypothesis (Ho) stated that no significant difference existed between for example the

initial and the third follow-up consultation. The alternative hypothesis states that there is a significant improvement. The null hypothesis (H_0) was rejected if the P value was less than alpha: and it was concluded that there was a significant difference within the group at the $\alpha = 0.05$ level of significance.

H_0 was accepted if the P value was greater than or equal to alpha: with the conclusion that there was no significant difference within the group at the $\alpha = 0.05$ level of significance. The P value was calculated by dividing the value of the two-tailed probability of equaling or exceeding the value of Z, by 2, and where $\alpha = 0.05$ i.e.: 95% level of significance.

For the continuous variables the two-sample unpaired t-test was used to compare results from related samples. In each test, the null hypothesis states that there is no significant improvement between the two related samples being compared, namely treatment one with treatment three, treatment one with treatment six, or treatment three with treatment six, at the α level of significance. The alternative hypothesis states that there is a significant improvement.

The Mann-Whitney U Test was used, for the categorical variables, to determine whether any significant difference existed between the two groups at the time of the initial, third follow-up and final

treatments. Each respective hypothesis test conducted was treated similarly to that described for the Wilcoxon's sign ranked test.

The two-sample unpaired t-test was used to compare the two independent samples, namely the strapping and the non strapping groups, with respect to each continuous variable. In each of the tests the null hypothesis states that there is no significant difference between group 1 and group 2 with respect to the variables in charge, at the $\alpha=0.05$ level of significance. The alternative hypothesis states that there is a significant difference.

Descriptive statistics incorporating the mean, standard deviation and standard error were used to analyse the p-value acquired in order to further interpret the results from data collected, once in spread sheet format.

The measurement of the central tendency found, within the raw data, was interpreted by calculating the mean value. This was done in order to provide a practical quantitative summary of each group's characteristics.

The mean value was calculated by adding the sum of a set of measurements and then dividing them by the number of scores used (n) (Portney and Watkins 1993: 322).

From the mean value the standard deviation (s.d.) was calculated in order to measure the variation of the data from the mean values acquired.

Standard error (s.e.) of measurement was used to indicate the response stability within the measured data. If we were to administer a test to one individual an infinite amount of times, we can assume that the response would vary from trial to trial. These differences would be a function of random measurement error. If the graph could be drawn to plot these responses, the distribution would resemble a normal curve, with the mean equal to the true score and errors falling above and below the mean.

This distribution of measurement errors is a theoretical distribution that represents the population of all possible measurement errors that could occur for that variable. With a more reliable measurement, errors would be smaller and the distribution will be less variable. Therefore, the standard deviation of measurement errors reflects the reliability of the response. Thus standard deviation is the standard error of measurement (SEM) (Portney (1993: 523-524).

Finally, Power Analysis was utilised to indicate the possibility of a Type II error. This is especially important in studies with a small

sample size as there is a greater chance of incorrectly accepting the null hypothesis. A high power would lessen the likelihood of a Type II error of occurring. According to Portney and Watkins (1993: 351-352) the purpose of power analysis is to determine the probability that a Type II error (falsely accepting the null hypothesis) was committed when a non-significant finding resulted from a study. The probability of making a Type II error is denoted by beta (β). The closer the value of $1-\beta$ is to 1, the better the power of the test. A power of 0.80 represents a reasonable protection against a Type II error.

The results obtained from these tests were then used to discuss and draw conclusions as to the relative effectiveness of spinal manipulation versus spinal manipulation in conjunction with a low back strapping in the treatment of mechanical low back pain.

Chapter four

4.0 The Results

4.1 Introduction

This chapter concerns itself with the results obtained after statistical analysis of the data from the measurement criteria as discussed in chapter 3.

Namely:- Algometer

- Back range of motion device (Brom)
- Numerical Pain Rating Scale-101
- Patient Specific Functional Scale

This data is presented in table form with relevant comments and interpretations made in order to either accept or reject the null hypothesis.

4.2 The Hypothesis

The null hypothesis is the same for both groups and is defined as follows:

Ho: There would be no statistical difference in the subjective and objective findings on analysis of the intra-group data indicating that this treatment was statistically insignificant.

The alternative hypothesis is again the same for both treatment groups and is defined as follows:

Ha: There would be a statistical difference in the subjective and objective findings on analysis of the intra-group data, showing that this treatment protocol was statistically significant.

In order to integrate the data from the two groups, a second null hypothesis and alternative hypothesis are required. This is defined as:

Ho: There would be no statistical difference in the subjective and objective findings on the analysis of the inter-group data, showing that the two treatment groups were equally effective.

Ha: There would a statistical difference in the subjective and objective findings on analysis of the inter-group data, showing that the two treatment groups were not equally effective.

Ho : $\mu 1 = \mu 2$

Ha : $\mu 1$ and $\mu 2$ were significantly different from one another.

Key abbreviations used in tables:

- s.d.: standard deviation
- s.e.: standard error
- **bold numbers**: statistically significant
- (R) : right
- (L) : left
- C1 : consultation 1
- C3 : consultation 3
- C6 : consultation 6
- N/S : non-strapping
- S : strapping
- PSFS: Patient Specific Functional Scale

4.3 Demographic data

This study consisted of a sample size of sixty patients, 30 of whom received spinal manipulative therapy only while the remaining thirty received spinal manipulative therapy in conjunction with a low back strapping.

Table 4.1 Age distribution of patients

Age	Non Strapping Group	Strapping Group	Total % of Patients
15-24	6	4	16.6%
25-34	6	7	21.6%
35-44	4	6	16.6%
45-54	8	5	21.6%
55-65	6	8	23.3%

Table 4.2 Gender distribution

Gender	Non Strapping Group	Strapping Group	Total & %
Male	17	13	30 (50%)
Female	13	17	30 (50%)

Table 4.3 Race distribution

Race	Non strapping group	Strapping group	Percentage %
Whites	21	21	70%
Indian	7	8	25%
Blacks	2	1	5%

4.4 The analysed data

a) p-Value:

The data was analysed at the $\alpha = 0.05$ level

The decision rule applied and states:

Reject the null hypothesis (H_0) if, $p \leq \alpha$

Accept the null hypothesis (H_0) if, $p > \alpha$

Now, $\alpha = 0.05$

Therefore the p-value would have to be below or equal to 0.05 to reject the null hypothesis and conclude that there is a statistically significant improvement at the $\alpha = 5\%$ level.

b) Power:

The probability of Type II error is β .

The power of a statistical test is $(1-\beta)$.

This is the probability of detecting a difference between the groups.

Therefore, power value should be as close to 1 as possible.

Thus, if a test has a low power of 0.20, it would mean that the probability of detecting a result could be purely chance, 20 times out of one hundred.

4.4.1 The Parametric two-sample unpaired t-test (continuous variables)

Table 4.4 Statistical results comparing the non-strapping and the strapping groups in terms of objective measurements at the first consultation.

	NON-STRAPPING GROUP				STRAPPING GROUP		
	CONSULTATION 1				CONSULTATION 1		
Goniometer	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
Flexion	24.23	7.87	1.44	0.07	22.933	6.24	1.14
Extension	9.5	4.5	0.84	0.00	5.2	2.35	0.43
(R) rotation	14.5	5.58	1.02	0.75	14.4	6.44	1.175
(L) rotation	14.87	6.095	1.11	0.97	14.23	6.57	1.2
(R) lateral flexion	22.23	5.87	1.07	0.81	18.57	5.96	1.09
(L) lateral flexion	21.267	5.595	1.02	0.37	17.87	6.41	1.17
Algometer	3.41	1.51	0.275	0.89	3.256	1.52	0.276

Power	
Flexion	0.0510
Extension	0.1709
(R) rotation	0.0500
(L) rotation	0.0504
(R) lateral flexion	0.0676
(L) lateral flexion	0.0639
Algometer	0.0570

With the exception of the goniometer measurements taken in extension, there was no significant difference between the objective data of the non-strapping group and the strapping group. Thus the null hypothesis is accepted and it is concluded that the two groups were similar in terms of range of motion and pain sensitivity.

The goniometer measurement of extension shows a statistically significant difference between the two groups at the first consultation, thus the null hypothesis is rejected at the 0.05 level of significance.

Table 4.5 Statistical results comparing the non-strapping and the strapping groups in terms of the objective measurements at the third consultation.

	NON-STRAPPING GROUP				STRAPPING GROUP		
	CONSULTATION 3				CONSULTATION 3		
Goniometer	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
Flexion	26.67	7.10	1.30	0.18	26.83	5.71	1.04
Extension	11.23	4.77	0.87	0.00	7.53	2.90	0.53
(R) rotation	16.87	6.68	1.22	0.66	15.20	5.93	1.08
(L) rotation	16.53	7.16	1.31	0.40	14.70	6.53	1.19
(R) lateral flexion	23.37	5.91	1.08	0.42	20.30	5.65	1.03
(L) lateral flexion	22.47	5.25	0.96	0.71	20.40	6.31	1.15
Algometer	3.68	1.44	0.26	0.38	4.00	2.16	0.39

Power	
Flexion	0.0500
Extension	0.1268
(R) rotation	0.0527
(L) rotation	0.0524
(R) lateral flexion	0.0634
(L) lateral flexion	0.0544
Algometer	0.0630

According to the above table there was a significant difference between the two treatment groups on the third consultation for extension. The null hypothesis is therefore rejected for the afore mentioned range of motion. For the remainder of the goniometer results and the algometer measurements the null hypothesis is accepted at the 0.05 level of significance for the above results.

Table 4.6 Statistical results comparing the non-strapping and the strapping group in terms of the objective measurements at the sixth (final) consultation.

	NON-STRAPPING GROUP				STRAPPING GROUP		
	FINAL CONSULTATION				FINAL CONSULTATION		
Goniometer	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
Flexion	28.80	5.85	1.07	0.34	27.75	6.73	1.23
Extension	12.37	4.66	0.85	0.08	8.62	3.98	0.73
(R) rotation	18.93	7.53	1.36	0.35	16.76	6.18	1.13
(L) rotation	18.87	7.77	1.42	0.06	15.07	5.79	1.06
(R) lateral flexion	25.73	6.38	1.16	0.45	20.83	6.275	1.145
(L) lateral flexion	24.80	5.70	1.04	0.89	20.21	6.70	1.22
Algometer	4.79	2.49	0.45	0.84	4.65	2.37	0.43

Power	
Flexion	0.0511
Extension	0.1143
(R) rotation	0.0532
(L) rotation	0.0597
(R) lateral flexion	0.0742
(L) lateral flexion	0.0721
Algometer	0.0500

From the above table it can be noted that there was no significant difference seen between the two groups on the sixth and final consultation. The null hypothesis is thus accepted at the 0.05 level of significance for above results.

Table 4.7 Statistical results comparing the non-strapping and the strapping groups in terms of the subjective measurements of the NSR-101 at the first, third and sixth consultations.

	STRAPPING GROUP				NON STRAPPING GROUP		
	CONSULTATION 1				CONSULTATION 1		
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	57.83	11.55	2.11	0.00	47.10	16.58	3.03
	POWER: 0.0539						
	CONSULTATION 3				CONSULTATION 3		
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	43.33	19.24	3.51	0.00	34.35	19.39	3.54
	POWER: 0.0509						
	CONSULTATION 6				CONSULTATION 6		
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	26.62	21.69	3.96	0.00	19.88	16.34	2.98
	POWER: 0.0505						

From the above set of results one can see that there is a statistically significant difference between the two groups at the first, third and sixth consultations. The null hypothesis is thus rejected for the NSR-101 questionnaire.

4.4.2 Non-parametric Mann-Whitney unpaired U test (categorical variables)

Table 4.8 Statistical results comparing the non-strapping and the strapping groups in terms of the subjective measurements of the Patient Specific Functional Scale from the first, third and sixth consultations.

	COMPARISON BETWEEN NON STRAPPING AND NON-STRAPPING GROUPS, THE p- VALUE IS
CONSULTATION 1	0.652
CONSULTATION 3	0.813
CONSULTATION 6	0.420

The above table indicates no significant difference between the two groups, thus the null hypothesis is accepted.

4.4.3 The Parametric two-sample unpaired t-test (continuous variables)

Table 4.9 Statistical results comparing the first and third consultations of the non-strapping group in terms of objective measurements.

	NON STRAPPING GROUP						
	CONSULTATION 1				CONSULTATION 3		
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
Goniometer							
Flexion	24.23	7.88	1.44	0.002	26.67	7.10	1.30
Extension	9.50	4.60	0.84	0.001	11.23	4.77	0.87
(R) rotation	14.50	5.59	1.02	0.068	16.87	6.68	1.22
(L) rotation	14.87	6.09	1.11	0.131	16.53	7.16	1.31
(R) lateral flexion	22.23	5.87	1.07	0.156	23.37	5.91	1.08
(L) lateral flexion	21.27	5.59	1.02	0.077	22.46	5.24	0.96
Algometer	3.41	1.51	0.275	0.336	3.67	1.44	0.26

Power	
Flexion	0.0529
Extension	0.0599
(R) rotation	0.0560
(L) rotation	0.0522
(R) lateral flexion	0.0517
(L) lateral flexion	0.0526
Algometer	0.0747

According to the above table there was significant improvement within the non-strapping group from the first to the third treatments for flexion and extension. The null hypothesis is therefore rejected for the afore mentioned ranges of motion.

Table 4.10 Statistical results comparing the first and sixth consultations of the non-strapping group in terms of objective measurements.

NON STRAPPING GROUP							
	CONSULTATION 1				CONSULTATION 6		
Goniometer	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
Flexion	24.23	7.88	1.44	0.000	28.80	5.85	1.07
Extension	9.50	4.60	0.84	0.000	12.37	4.66	0.85
(R) rotation	14.50	5.59	1.02	0.006	18.93	7.53	1.37
(L) rotation	14.87	6.09	1.11	0.002	18.87	7.77	1.42
(R) lateral flexion	22.23	5.87	1.07	0.001	25.73	6.38	1.16
(L) lateral flexion	21.27	5.59	1.02	0.003	24.80	5.69	1.04
Algometer	3.41	1.51	0.275	0.001	4.79	2.49	0.45

Power	
Flexion	0.0633
Extension	0.0789
(R) rotation	0.0650
(L) rotation	0.0602
(R) lateral flexion	0.0638
(L) lateral flexion	0.0697
Algometer	0.2004

From the above table a significant improvement was noted within the non-strapping group for all ranges of motion, as well as the algometer measurements. Thus, for the period between the first and the final treatments (sixth), the null hypothesis was rejected for all of the above values.

Table 4.11 Statistical results comparing the third and sixth consultation of the non-strapping group in terms of objective measurements.

NON STRAPPING GROUP							
CONSULTATION 3					CONSULTATION 6		
Goniometer	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
Flexion	26.67	7.10	1.30	0.001	28.80	5.85	1.07
Extension	11.23	4.76	0.87	0.023	12.37	4.66	0.85
(R) rotation	16.87	6.68	1.22	0.018	18.93	7.53	1.37
(L) rotation	16.53	7.16	1.31	0.001	18.87	7.77	1.42
(R) lateral flexion	23.37	5.91	1.08	0.002	25.73	6.38	1.16
(L) lateral flexion	22.47	5.24	0.96	0.010	24.80	5.69	1.04
Algometer	3.68	1.44	0.26	0.011	4.79	2.49	0.45

Power	
Flexion	0.0539
Extension	0.0541
(R) rotation	0.0526
(L) rotation	0.0528
(R) lateral flexion	0.0562
(L) lateral flexion	0.0596
Algometer	0.1476

The above table shows a significant improvement within all ranges of motion. The algometer measurement was also significant within the non-strapping group between the third and sixth treatments. The null hypothesis is therefore rejected for the above measurements.

Table 4.12 Statistical results comparing the subjective measurements of the NSR-101 within the non-strapping group.

NON STRAPPING GROUP							
CONSULTATION 1				CONSULTATION 3			
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	47.10	16.58	3.03	0.00	34.35	19.39	3.54
POWER: 0.0524							
CONSULTATION 1				CONSULTATION 6			
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	47.10	16.58	3.03	0.00	19.88	16.34	2.98
POWER: 0.0661							
CONSULTATION 3				CONSULTATION 6			
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	34.35	19.39	3.45	0.00	19.88	16.34	2.98
POWER: 0.0531							

The above table indicated that there was a significant improvement for the NSR-101 between the first and third, the first and sixth and the third and sixth treatments. The null hypothesis is thus rejected for the above measurements.

4.4.4 Non-parametric Wilcoxon's sign ranked tests (catagorical variables)

Table 4.13 Statistical results comparing the subjective measurements of the Patients Specific Functional Scale within the non-strapping group.

	NON STRAPPING GROUP THE p-VALUES FOR THE PSFS
CONSULTATION 1 and 3	0.000
CONSULTATION 1 and 6	0.000
CONSULTATION 3 and 6	0.000

With regard to the Patient Specific Functional Scale the above table shows a significant improvement between all treatments, the null hypothesis is thus rejected for the above measurements.

4.4.5 The Parametric two-sample unpaired t-test (continuous variables)

Table 4.14 Statistical results comparing the first and the third consultations of the strapping group in terms of objective measurements.

	STRAPPING GROUP						
	CONSULTATION 1				CONSULTATION 3		
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
Goniometer							
Flexion	22.93	6.24	1.14	0.001	26.83	5.71	1.04
Extension	5.27	2.35	0.43	0.000	7.53	2.91	0.53
(R) rotation	14.40	6.43	1.17	0.411	15.20	5.93	1.08
(L) rotation	14.23	6.57	1.20	0.369	14.70	6.53	1.19
(R) lateral flexion	18.57	5.93	1.09	0.020	20.30	5.66	1.03
(L) lateral flexion	17.87	6.41	1.17	0.003	20.40	6.31	1.15
Algometer	3.26	1.52	0.28	0.025	4.00	2.16	0.39

Power	
Flexion	0.0689
Extension	0.2224
(R) rotation	0.0507
(L) rotation	0.0502
(R) lateral flexion	0.0542
(L) lateral flexion	0.0562
Algometer	0.1184

The table above indicates a significant improvement in all ranges of motion excluding left and right rotation, as well as a significant improvement in the algometer between the first and the third treatments. The null hypothesis is therefore rejected for all the measurements with the exception of left and right rotation.

Table 4.15 Statistical results comparing the first and sixth consultations of the strapping group in terms of objective measurements.

	STRAPPING GROUP						
	CONSULTATION 1				CONSULTATION 6		
	Goniometer	Mean	s.d.	s.e.	p-value	Mean	s.d.
Flexion	22.93	6.24	1.14	0.000	27.75	6.73	1.23
Extension	5.27	2.35	0.43	0.000	8.62	3.98	0.73
(R) rotation	14.40	6.43	1.17	0.031	16.76	6.18	1.13
(L) rotation	14.23	6.57	1.20	0.402	15.07	5.79	1.06
(R) lateral flexion	18.57	5.93	1.09	0.002	20.83	6.27	1.14
(L) lateral flexion	17.87	6.41	1.17	0.002	20.21	6.70	1.22
Algometer	3.26	1.52	0.28	0.002	4.65	2.37	0.43

Power	
Flexion	0.0710
Extension	0.1860
(R) rotation	0.0556
(L) rotation	0.0507
(R) lateral flexion	0.0558
(L) lateral flexion	0.0547
Algometer	0.2309

With the exception of left rotation all of the above measurements show a significant improvement between the first and sixth treatments within the strapping group. The null hypothesis is rejected for all of the above measurements except left rotation

Table 4.16 Statistical results comparing the third and sixth consultations of the strapping group in terms of objective measurements.

	STRAPPING GROUP						
	CONSULTATION 3				CONSULTATION 6		
	Goniometer	Mean	s.d.	s.e.	p-value	Mean	s.d.
Flexion	26.83	5.71	1.04	0.288	27.75	6.73	1.23
Extension	7.53	2.91	0.53	0.043	8.62	3.98	0.73
(R) rotation	15.20	5.93	1.08	0.037	16.76	6.18	1.13
(L) rotation	14.70	6.53	1.19	0.653	15.07	5.79	1.06
(R) lateral flexion	20.30	5.66	1.03	0.464	20.83	6.27	1.14
(L) lateral flexion	20.40	6.31	1.15	0.778	20.21	6.70	1.22
Algometer	4.00	2.16	0.39	0.017	4.65	2.37	0.43

Power	
Flexion	0.0509
Extension	0.0617
(R) rotation	0.0529
(L) rotation	0.0501
(R) lateral flexion	0.0503
(L) lateral flexion	0.0500
Algometer	0.0754

The extension, right rotation and the algometer results all show a significant improvement, while the remainder of the results show none. Thus for only the afore mentioned results is the null hypothesis rejected when comparing the third and the sixth treatments within the strapping group.

Table 4.17 Statistical results comparing the subjective measurements of the NSR-101 within the strapping group.

STRAPPING GROUP							
CONSULTATION 1				CONSULTATION 3			
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	57.83	11.55	2.11	0.00	43.33	19.24	3.51
POWER: 0.0543							
CONSULTATION 1				CONSULTATION 6			
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	57.83	11.55	2.11	0.00	26.62	21.69	3.96
POWER: 0.0630							
CONSULTATION 3				CONSULTATION 6			
	Mean	s.d.	s.e.	p-value	Mean	s.d.	s.e.
NRS-101	43.33	19.24	3.51	0.00	26.62	21.69	3.96
POWER: 0.0524							

The above table indicates that there was a significant difference for the NSR-101 between the first and third, first and sixth and the third and sixth treatments. The null hypothesis is thus rejected for the above measurements

4.4.6 Non-parametric Wilcoxon's sign ranked test (catagorical variables)

Table 4.18 Statistical results comparing the subjective measurements of the Patient Specific Functional Scale within the strapping group.

	STRAPPING GROUP THE p-VALUES FOR THE PSFS
CONSULTATION 1and 3	0.000
CONSULTATION 1and 6	0.000
CONSULTATION 3 and 6	0.000

With regards to the Patients Specific Functional Scale the above table shows a significant improvement between all treatments, the null hypothesis is thus rejected for the above results.

Table 4.19 Statistical summary of the results highlighting the p-values of the two-sample unpaired t-test for lumbar ranges of motion and algometer measurements.

	C1-C3		C1-C6		C3-C6	
	N/S	S	N/S	S	N/S	S
FLEX.	0.002	0.001	0.000	0.000	0.001	0.288
EXT.	0.001	0.000	0.000	0.000	0.023	0.043
R- ROT	0.068	0.411	0.006	0.031	0.018	0.037
L- ROT	0.131	0.369	0.002	0.402	0.001	0.653
R- LF	0.156	0.020	0.001	0.002	0.002	0.464
L- LF	0.077	0.003	0.003	0.002	0.010	0.778
ALG	0.336	0.025	0.001	0.002	0.011	0.017
NRS-101	0.000	0.000	0.000	0.000	0.000	0.000

Table 4.20 Statistical summary of the results highlighting the p-values of the Wilcoxon's sign ranked test for the Patient Specific Functional Scale (PSFS).

	C1-C3		C1-C6		C3-C6	
	N/S	S	N/S	S	N/S	S
PSFS	0.000	0.000	0.000	0.000	0.000	0.000

Figures 4.1-4.8 are a visual representation of the median value changes as found within the first, third and final consultations.

These values are taken from the summary statistics and are not intended as a comparison between the two study groups as this could not be done from median values. However, they serve to augment the discussion of the results in Chapter 5 and serve to indicate possible trends within the two groups.

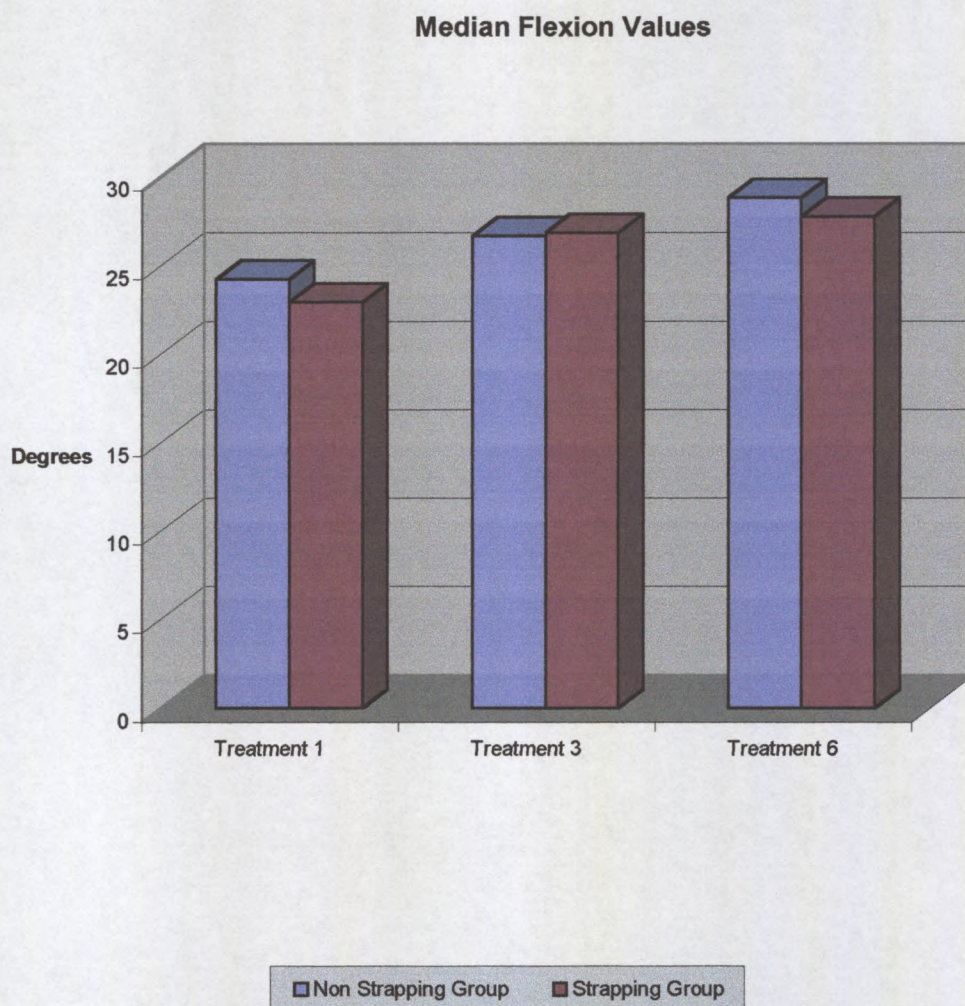
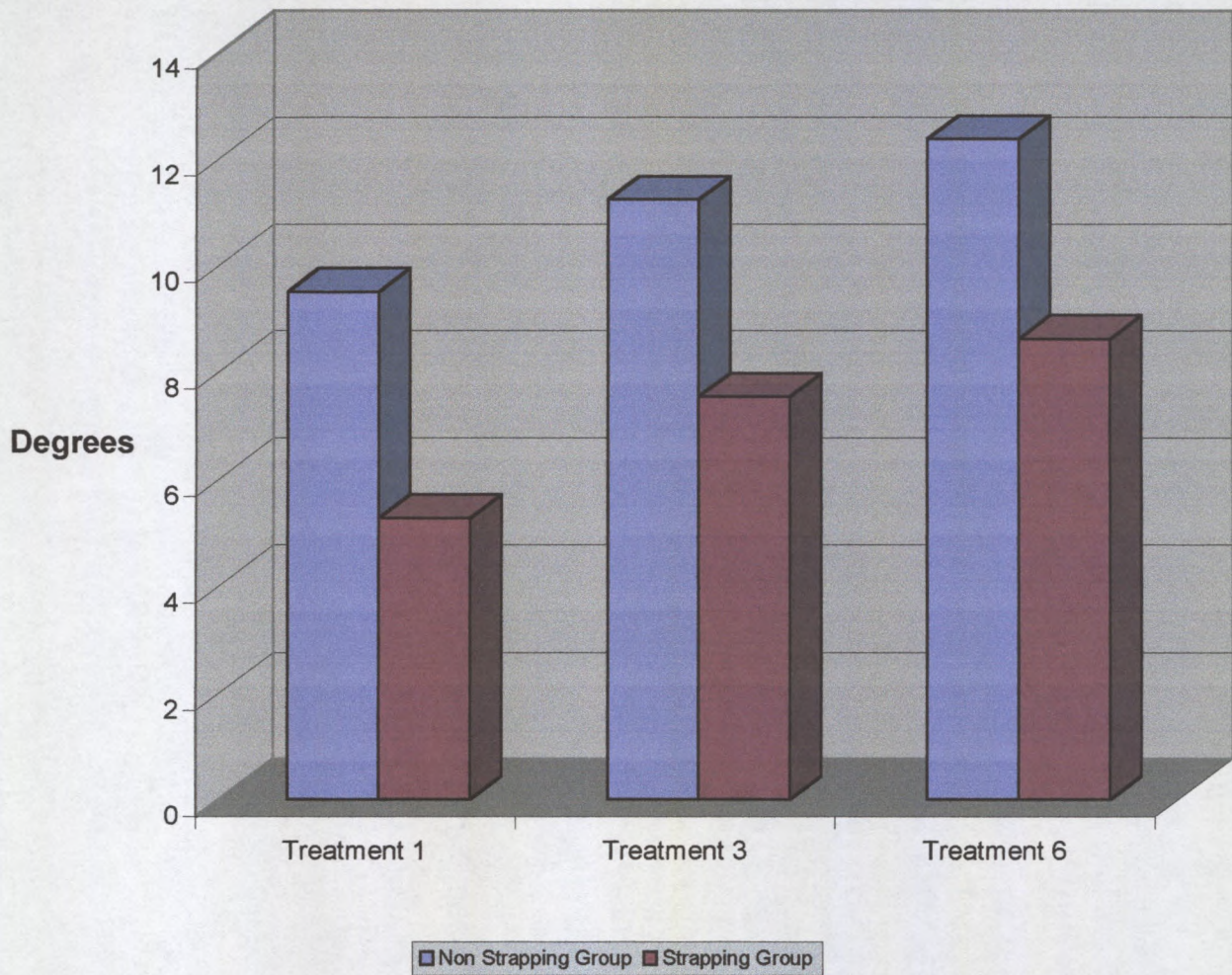


Figure 4.1

This figure indicates the changes in the median flexion values.

Figure 4.2

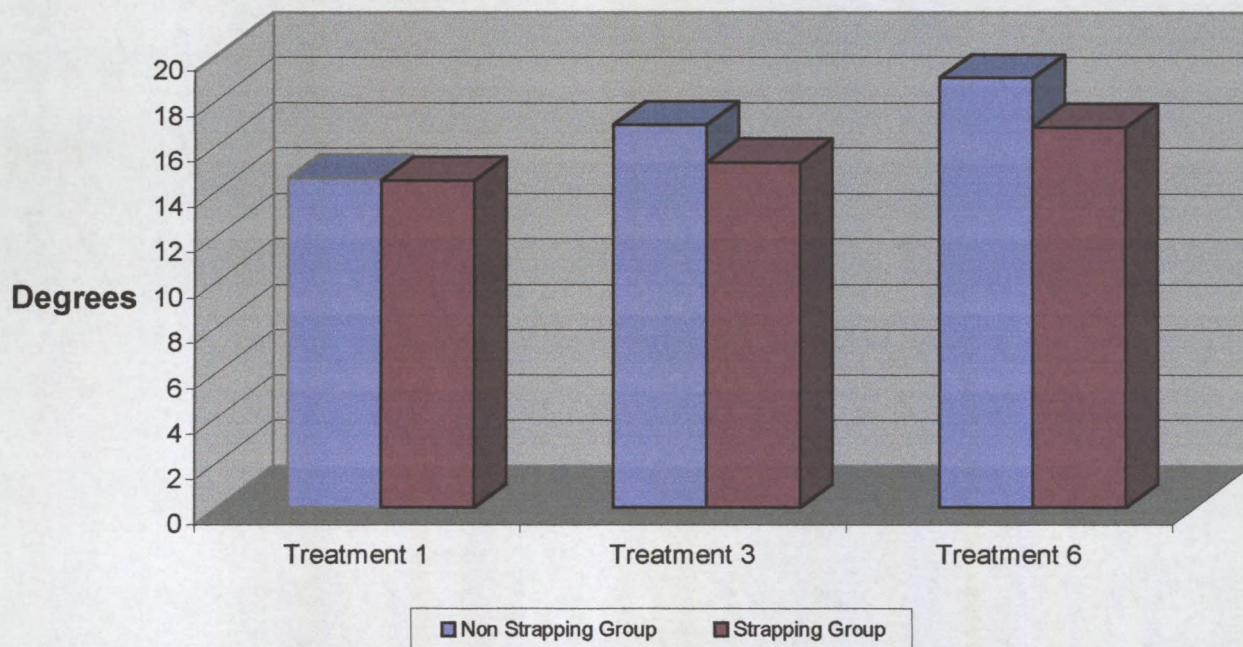
Median Extension Values



This figure indicates the changes in the median extension values over the period of evaluation.

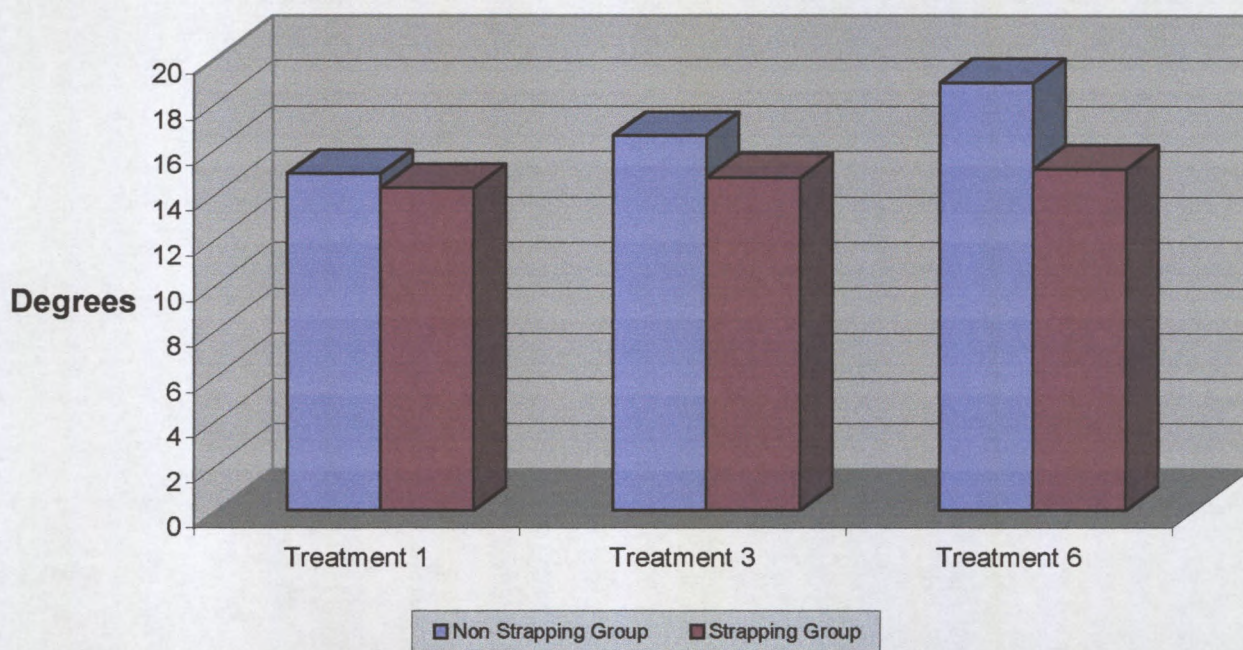
Figure 4.3 and 4.4

Median Right Rotation Values



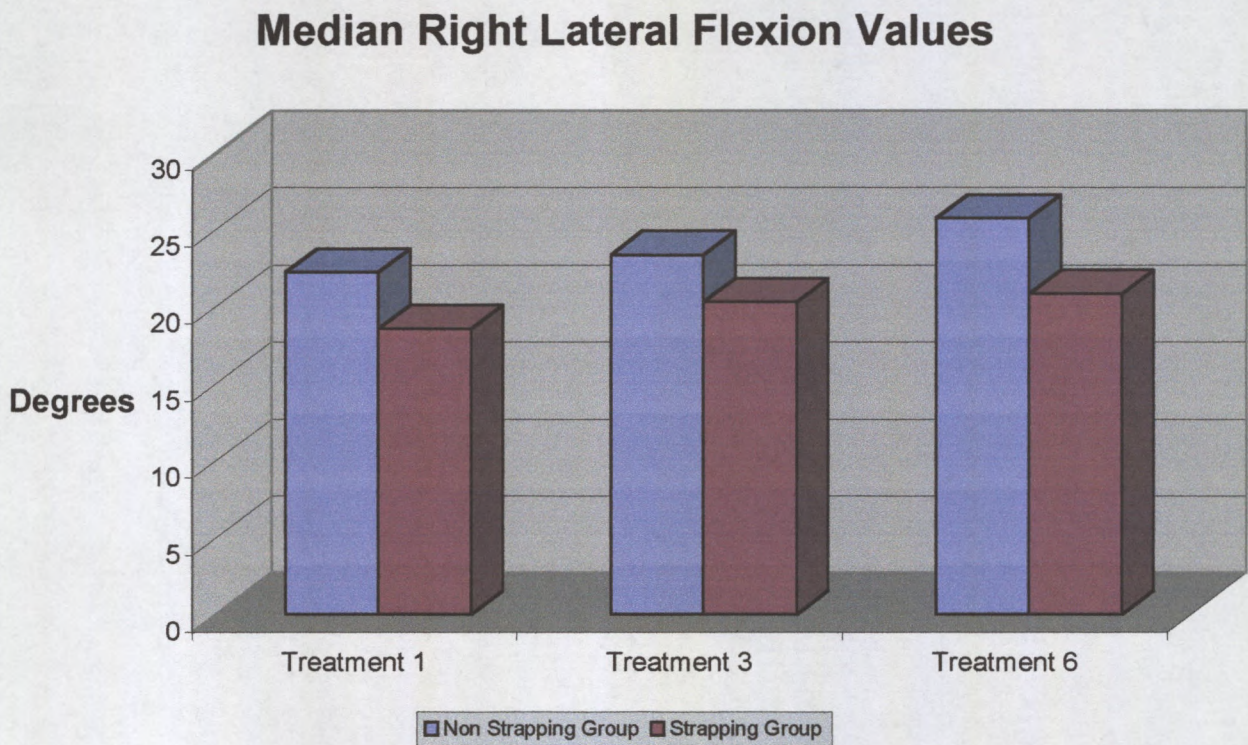
This figure indicates the changes in the median right rotation values.

Median Left Rotation Values



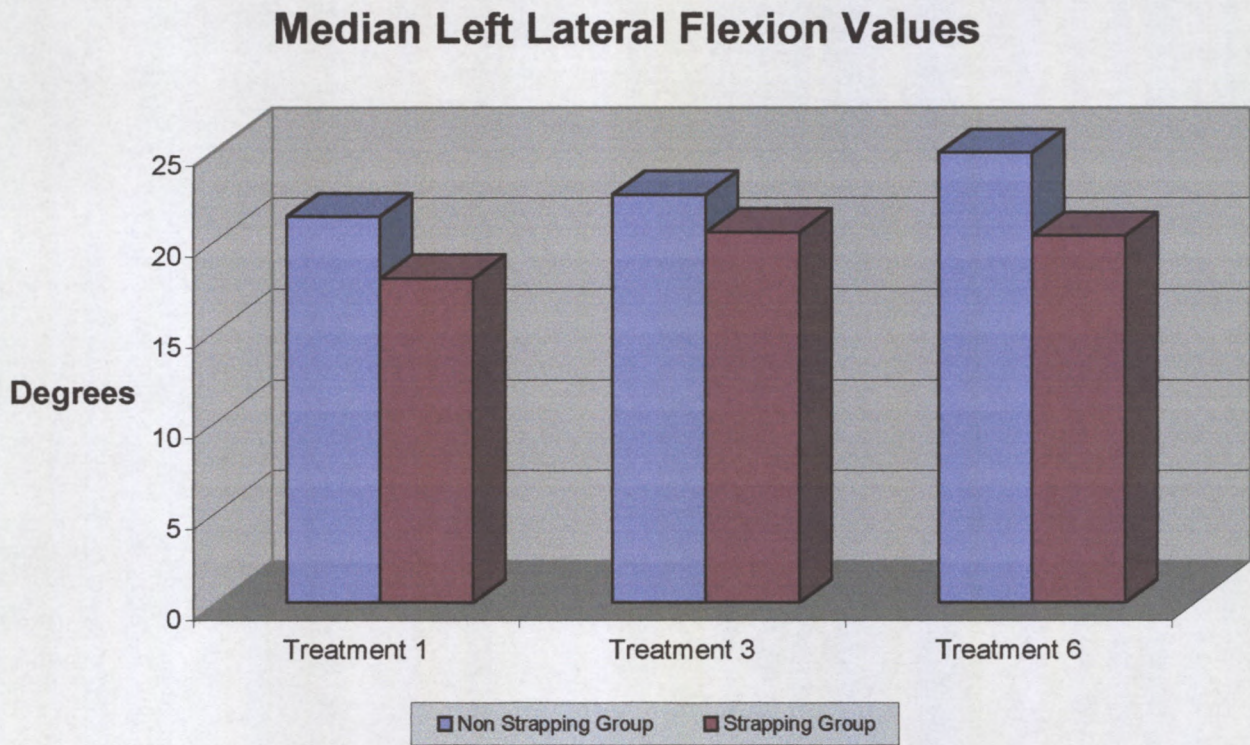
This figure indicates the changes in the median left rotation values.

Figure 4.5



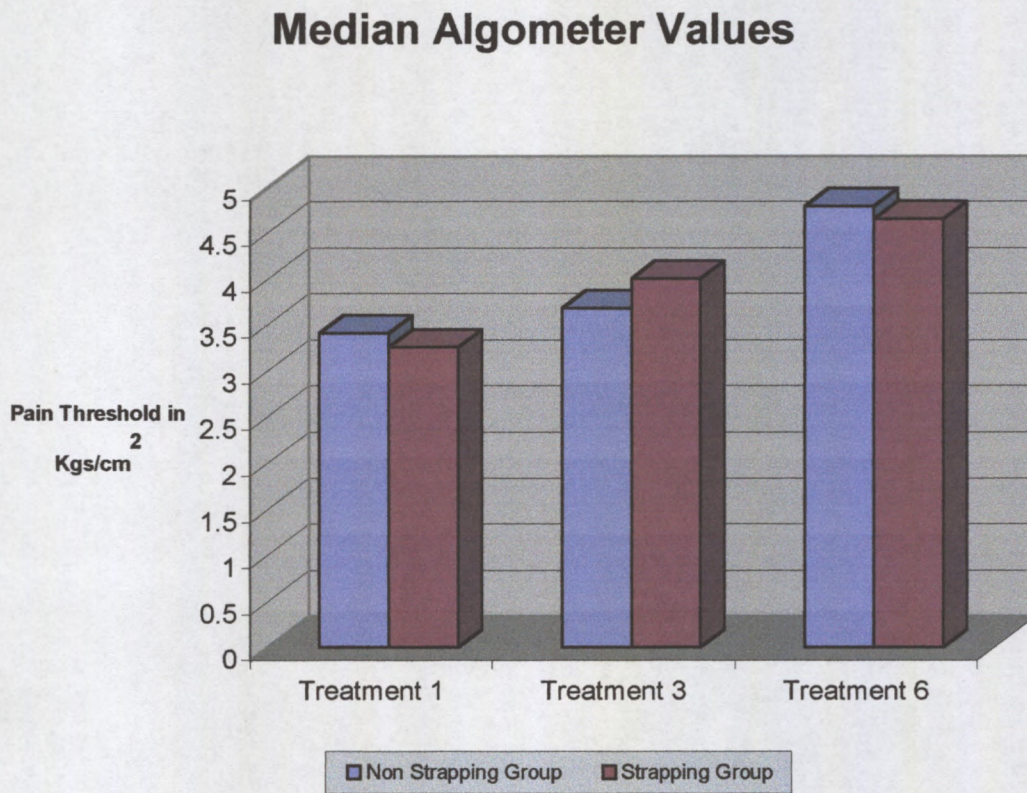
This figure indicates the changes in the median right lateral flexion values over the period of investigation.

Figure 4.6



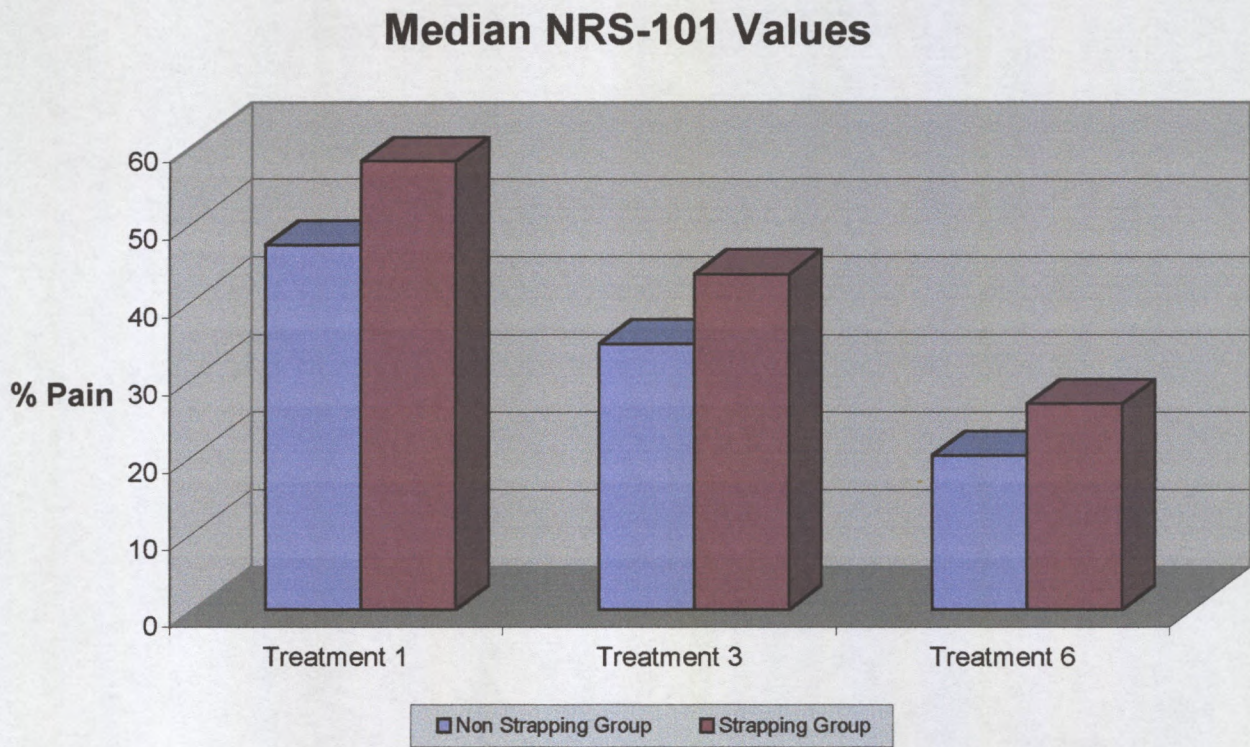
This figure indicates the changes in the median left lateral flexion values over the period of evaluation.

Figure 4.7



This figure indicates the changes in the median algometer values over the period of evaluation.

Figure 4.8



This figure indicates the changes in the median NRS-101 values over the period of evaluation.

Chapter five

5.0 Discussion of results

5.1 Introduction

This chapter involves the discussion of the results obtained from the subjective and objective data. This will be followed by the conclusions and recommendation for any future studies.

Intra-treatment comparisons: The assessment of the subjective and objective intra-treatment results of the first to third consultations represents whether the strapping, in addition to spinal manipulative therapy, increases the rate of improvement in the initial stages of treatment as this is the only period over which the strapping is applied. The comparison of the third to the sixth treatment indicates whether the treatment efficacy was maintained. The first to sixth treatment period shows the effectiveness of each of the two six-treatment protocols

Inter-treatment comparison: The comparison of subjective and objective data of both groups for the first consultation exhibits any differences between the two groups in terms of their original signs and symptoms. The comparison of the third consultation results indicates if the application of a low back strapping increases the efficacy of the treatment. Finally, the comparison of the sixth consultation results confirms which treatment protocol has a more favourable response to treatment.

5.2 Intra-group comparison

5.2.1 The objective data

The statistical data for the goniometer and algometer measurements can be observed in tables 4.7-4.9 and 4.12-4.14.

Lumbar ROM

The strapping group showed statistically significant improvements in all ranges of motion with the exception of rotation, during the period between visits one and three, while the non strapping group only showed statistically significant improvements in forward flexion and extension over the same period. This period was critical for the research, as it was the period over which the strapping was applied to those in the strapping group, there after the strapping was removed. Therefore a greater improvement in the ranges of motion of the strapping group, as compared to the non-strapping group, is significant to the research.

The period between the third and the sixth treatments show significant improvements for all ranges of motion in the group receiving manipulative therapy only, and improvements in only extension and right rotation in the group receiving both strapping and manipulative therapy. There was however an improvement in both groups in all ranges of motion over the entire period of treatment, visits one to six, with the exception only of left rotation in the strapping group.

Algometer

The period between the first and third treatments showed a statistically significant improvement in the strapping group and not in the non-strapping group. There was thus a significant reduction in pain over this period for those patients receiving the low back strapping in conjunction with spinal manipulative therapy. Once again one should note that this period is crucial to the research.

The remaining periods namely the third to the sixth treatments and the first to the sixth treatments showed statistically significant improvements for both the strapping and the non-strapping groups, indicating a substantial reduction in pain over these time periods.

On comparing the significant p-values (table 4.17), the strapping group showed a greater number of statistically significant findings and with higher degree of significance of each measurement, over the first to third treatments and over the first to sixth treatment periods. It is of potential clinical significance that the group receiving strapping in conjunction to spinal manipulative therapy showed statistically significant improvements in the early stages of the treatment, as compared to the results of the group receiving only manipulation.

The intra-group comparison suggests that the strapping group was more effective in increasing lumbar ranges of motion, as well as more effective in increasing the pain thresholds in the early stages of the treatment protocol.

However the end results of the two treatment protocol after the two week treatment periods was much the same.

When considering the power of the objective data, the power tests show up as extremely weak. As power is a function of the study sample size, one must question whether a larger sample size may have made statistically significant changes more evident, thereby allowing the null hypothesis to be rejected more often. It may also be said that the statistically significant changes with low power results may have proven insignificant with a larger study sample. There is a strong likelihood that a type II error could have occurred.

5.2.2 Subjective data

The statistical data can be found in tables 4.10/11 and 4.15/16.

Numerical Pain Rating Scale-101

Equally significant improvements were noted in both groups for all the assessment intervals, indicating that both groups were equally successful in significantly reducing the pain and disability of the patients from the patients perspective.

Patient Specific Functional Scale

Here again the statistically significant improvements in both the groups was equal, indicating that the patients in both groups felt that there was a significant improvement in their functional ability over the assessment periods.

Power analysis was done for continuous variables only and was thus not calculated for the PSFS.

The power values for both sets of results indicated a low power for the results gained from both groups, suggestive of a strong possibility that certain significant results were missed, and a type II error is possible.

5.3 Inter-group comparisons

5.3.1 Objective data

Lumbar ROM

Statistical comparisons between the two groups on the first and third consultations revealed that with the exception of extension the two groups lumbar spinal mobility and range of motion were much the same at the start of the treatment and at the third consultation. The comparisons of the groups on the final consultation showed no differences in all ranges of motion, with the discrepancies previously noted in extension, nullified by the final treatment. Thus it can be said that neither treatment protocol was more effective than the other in terms of range of motion.

Algometer

No significant difference was evident between the groups with respect to data from the first consultation, indicating that the groups were similar in terms of initial pain threshold levels (table 4.3).

Comparison of algometer readings for the third treatment also revealed no significant difference between the two groups thus the treatment effects up until this stage were much the same (table 4.4).

In terms of the pain threshold levels on the final consultation there was no significant difference between the groups thus neither of the groups was more effective in the reduction of pain over the six treatments period (table 4.5).

The standard deviation of the objective results revealed a relative familiarity around the mean therefore both groups may display a similar predictability and reliability over the treatment periods.

The power for all three assessment periods were weak, indicating that even if significant changes were present, they may not have been detected and there was a strong possibility of making a type II error.

5.3.2 Subjective data

Numerical Pain Rating Scale-101

Statistical comparison of all three of the assessment periods revealed a significant difference between the pain intensity levels of the two groups with respect to one another. The differences are maintained throughout the treatment protocol, from the initial consultation, indicating that the patients

perception of pain intensity between the two groups is different, but that the difference remained static.

The power for all three of the assessment periods were very weak, indicating that the significant differences present, may have been proven insignificant in a larger sample size.

Patient Specific Functional Scale

On statistical analysis, no significant difference was detected between the two groups, indicating that the functional assessment of the patients in both groups were very similar.

5.4 Limitations of the study

From the statistical analysis of this study there seems to be no significant difference in the over all treatment protocol of mechanical low back pain, in the stage of dysfunction, by means of spinal manipulation or by spinal manipulation in conjunction with low back strapping. Both treatment approaches improved the state of disease of the patient to such a degree that it was not possible to distinguish the better treatment modality over the six treatments given. The immediate response to treatment for those patients receiving the additional strapping was however superior to that of the other group.

The following factors should therefore be taken into consideration for future studies of this nature:

5.4.1 Homogeneity

It is said by Koes et al. (1995), that the greater the number of comparable baseline characteristics between the subjects, the better the study design. It is however somewhat difficult for a researcher to obtain a highly homogenous group of subjects in terms of age, sex and occupation, without a possible selection bias. In this study the time constraints and clinical setting made it difficult to achieve this, however as it turned out the age and sex of the patients seemed to have been fairly evenly distributed, between and within the groups.

5.4.2 Blinding

This study was conducted solely by the author and therefore the possibility of practitioner bias exists. There was no blinded assessment, which caused the possibility of observer bias. Assendelft et al. (1992) mentions these two factors as influencing the effect of the study in either direction, and states that for a pragmatic type study, where another treatment group is used as a reference, patient naivete has to be used as a substitute.

Pocock (1993: 32) states that to achieve a gold standard within a clinical trial, double blinding must be utilised within the study to prove that a therapy is

effective. It was however not practically possible to address these factors effectively within this study and as a result the significance of the study is reduced due to the lack of both single and double blinding.

5.4.3 Significance

From the method discussed in chapter 3 of this research, it is evident that the objective measurements of the goniometer and the algometer, as well as the Numerical Pain Rating Scale and the Patient Specific Functional Scale represent valid methods of capturing changes within the patient groups. It could however be questioned whether the true clinical changes in the dysfunctional joint of the lumbar spinal and/or sacroiliac joints, have been completely measured from both a clinical and a statistical point of view. One cannot be sure that the clinical phenomenon under investigation is being correctly measured and consequently the statistical outcome may not reveal the true impact of the treatment given.

Koes et al. (1995) states that there is consensus that outcome measures should be valid, precise and sensitive for measuring small, but clinically relevant changes. There is a debate as to whether the assessment should be left up to the patients in terms of subjective data, or whether it should be done by a blinded observer who decides the extent of the clinical changes based on physical examination (Koes et al. 1995). Were the facilities available it may

have proved beneficial to the research to have, had an independent observer assessing the patients' changes, a point to be considered when doing further research in this field.

5.4.4 Study size and power

The power of a statistical test is $1 - \beta$. This is the probability of detecting a statistically significant difference between the two groups (Bailler III and Mosteller 1992; 359, 387). There is a close connection between sample size and the power of a statistical test (Bailler III and Mosteller 1992: 195). The smaller the study size the greater the risk of a Type II error and thus a weaker power will probably be reflected. Ideally the power value should be as close to 1 as possible to decrease the chance of incidental results (Crichton 1993: 13).

In general the power of this study was poor. According to Portney and Watkins (1983: 351) when small sample sizes are used, as is often used in clinical research and was the case in this study, it is expected that power will be substantially low. Portney and Watkins (1983: 352) also mentioned that the clinical significance of a study could be greater than suggested by the statistical outcome if a poor power exists.

The constraints of time and finance did not allow the author the opportunity of using a larger sample size. This is arguably the greatest shortfall of this study.

5.5 Outcome commentary

In an inter-group comparison this study could not find a significant difference between the two treatment modalities, it did however show that both treatments were effective in the treatment of mechanical low back pain in the phase of dysfunction. Highly statistically significant changes were noted in the intra-group comparison for the strapping group in the early stages of treatment. Spinal manipulation in conjunction with low back strapping thus assisted in restoring lost range of motion, and reduced the perception of pain and disability, in the early stages of the treatment protocol.

The added benefits of the strapping did not seem to last longer than the duration of the application of the strapping, namely three to five days, after which both treatment groups were on a par and no significant difference could be detected. Whether these improvements in the strapping group were as a result of improved proprioception to the area, reduced muscle spasm and or inflammation, or whether placebo played an important role one cannot say.

An additional factors which one must bare in mind when noting the lack of definite outcome is that the natural history of the study conditions favour a spontaneous recovery, and the modes of intervention carry with them a strong placebo effect. It is thus essential that a study of this nature have effective placebo-controls, sensitive measurement instruments, stringent inclusion and

exclusion criteria and accurate measurements to show small, but clinically significant differences. This view is also held by Di Fabio (1992), Assendeft et al. (1992) and Koes et al. (1996) in their review of studies relating to this topic.

Chapter six

6.0 Recommendations and conclusions

6.1 Recommendations

There are a number of recommendations that the author feels could improve future studies investigating the treatment of mechanical low back pain with manipulation of the lumbar spine only, as opposed to manipulation in conjunction with a low back strapping. With greater time and financial freedom the following improvements could be implemented.

6.1.1 Sample size

A sample size of thirty allows you the statistical freedom to use paired as well as unpaired t-tests and thus the sensitivity to subtle changes is greater and trends in the data should be more apparent. The power of the study was nevertheless very weak, and as such predisposes the researcher to making Type II errors. The strength that a larger sample size lends to the study stems from the improved power value of the larger study or inversely the lack of power of a small sample size.

A sample-size of 100 as recommended by Assendelft (1992) should be used in future studies to be certain of a sample that is representative of the population as a whole. Time and budget constraints make this difficult.

6.1.2 Homogeneity

It is recommended that future studies in which a comparison is made, make use of random sampling method that takes the patients age, gender, race, religion, education and status, as well as the history of complaint, duration and concomitant or associated complaints into account. The inclusion and exclusion criteria should be more stringent and matched pairs with respect to the above factors to enhance the strength of the study should be used. One should also consider restricting future studies to acute, subacute or chronic mechanical low back pain, as well as perhaps limiting the diagnosis to either posterior facet syndrome or sacroiliac syndrome only.

6.1.3 Blinding

Keeping the examiner collecting and collating data uninformed, as to which treatment the patient is receiving, can incorporate observer bias.

6.1.4 Placebo group

A placebo group should be incorporated into the study. The author suggests the use of a sham ultrasound treatment for a control group. The group would receive no treatment but data would be collected at the same time intervals.

6.1.5 Accuracy

Future advances in technology may develop more accurate and sensitive instrumentation, allowing small, but significant changes to be detected.

6.2 Conclusion

This study comprised of 60 patients all diagnosed with mechanical low back pain in the phase of dysfunction, after a clinical and physical examination. The patients were randomly divided into two groups of thirty patients each. One group received spinal manipulation of the low back only while the second group received spinal manipulation in conjunction with a low back strapping for the initial three to five days. Each patient received six treatments within a two-week period, and was assessed on the first third and sixth treatments. For those receiving the strapping it was removed on the third consultation.

The statistical evidence revealed that both groups responded favourably to their respective treatments. The improvements for the strapping group between the first and the third treatments were significantly greater, both subjectively and objectively, than those of the manipulation only, over the same time period. The manipulation group did show its own improvements within the group, yet not as pronounced as the strapping group in the initial stages of treatment.

The overall improvements after six treatments were however much the same for the two groups. On intra-group analysis we can conclude that both treatment groups responded favourably in terms of objective and subjective measures.

It may have been of value to strap an additional group of patients for the full treatment period to assess whether the initial significant difference that the strapping made, was lasting. This may be considered in future studies.

Despite subtle clinical differences, this study thus indicates that spinal manipulation and spinal manipulation with low back strapping, applied for the initial three to five days, are equally effective in the management of dysfunction in the lumbar spine and sacro-iliac joints over a two-week treatment protocol in terms of objective and subjective clinical findings.

Practically speaking the author recommends that clinical judgement should dictate which treatment can be applied more effectively with respect to each individual, although this study revealed no significant difference in the overall treatment techniques. Medicine is a clinical art and each individual patient is different.

Reference list

Assendelft, W.J., Koes, B.S., Van der Heijden, G.J., Bouter, L.M. 1992. The efficacy of chiropractic manipulation for back pain: Blinded review of relevant randomised clinical trials. Journal of Manipulative and Physiological Therapeutics. 15(8) 487-494.

Bailer III, J.C., and Mosteller, F. 1992. Medical uses of statistics. Boston: NEJM Books. 449p. ISBN 0-910133-36-0.

Barrett, D.S., Cobb, A.G., Bently, G. 1991. Proprioception in normal , osteoarthritic and replaced knees. Journal of Bone and Joint Surgery. (Br) 73: 53-56.

Bergmann, B.W. and Cichoke, A.J. 1980. Cost effectiveness of medical versus chiropractic treatment of low back injuries. Journal of Manipulative and Physiological Therapeutics. 3: 143-147.

Bergmann, T.F., Peterson, D.H., Lawrence, D.J. 1993. Chiropractic technique- Principles and procedures. New York: Churchill-Livingstone Inc. 803p. ISBN 0-443-08752-0.

Bernard, T.N. and Kirkaldy-Willis, W.H. 1987. Recognising specific characteristics of non-specific low back pain. Clinical Orthopaedics. 217: 266-280.

Breum, J., Wilberg, J. Bolton, J.E. 1995. Reliability and concurrent validity of the Brom II for measuring lumbar mobility. Journal of Manipulative and Physiological Therapeutics. 18(8): 497-502.

Bronfort, G. 1986. Chiropractic treatment of low back pain: A prospective survey. Journal of Manipulative and Physiological Therapeutics. 9: 99-113.

Bronfort, G. 1992. Effectiveness of spinal manipulation and adjustments. In Haldeman, S. (Ed). Principles and Practice of Chiropractic. 2nd Ed. Connecticut: Appleton and Lange. 641p. ISBN 0-8385-6360-0.

Burks, R.T., Bean, B.G., Marcus, R., Barker, H.B. 1991. Analysis of athletic performance with prophylactic ankle devices. American Journal of Sports Medicine. 19: 104-106.

Caillet, R. 1981. Low back pain syndrome. 4th Ed. USA: F.A. Davis Company. 314p. ISBN 0-8036-1606-0.

Carey, T.S., Garrett, J., Jackman, A., McLaughlin, D.B., Fryer, J., Smucker, D.R. 1995. The outcomes and costs of care of acute low back pain among patients seen by primary care practitioners, chiropractors and orthopaedic surgeons. The New England Journal of Medicine. 333(14): 913-917.

Cherkin, D.C. and Deyo, R.A. 1993. Non-surgical hospitalisation of low back pain. Is it necessary? Spine. 18(13): 1728-1735.

Crichton, N.J. 1993. The importance of statistics in research design. In Lewith, G.T. and Aldridge, D. Clinical Research Methodology for Complimentary Therapeutics. London: Aodder and Stoughton. 476p. ISBN 0-340-55778-8.

DeRosa, C.P. and Porterfield, J.A. 1992. A physical therapy model for the treatment of low back pain. Physical Therapy. 72(4) April: 21-32.

Deyo, R.A., Diehl, A.K., Rosenthal, A. 1986. How many days bed rest for acute low back pain: A randomised clinical trial. New England Journal of Medicine. 315: 1064-1070.

Deyo, R.A., Cherkin, D., Conrad, D., Volinn, E. 1991. Controversy crisis: low back pain and the health of the public. Annual Review of Public Health. 12: 141-156.

Di Fabio, R.P. 1992. Efficacy of manual therapy. Physical Therapy. 72(12): 853-864.

Donelson, R.G. 1991. Identifying appropriate exercises for your low back pain patient. The Journal of Musculoskeletal Medicine. 8(12): 14-29.

Evans, D.H. 1994. The reliability of assessment parameters: Accuracy and palpation technique. In Boyling, J.D. and Palastanga, N. Grievess' Modern Manual Therapy: The vertabral column. 2nd Ed. New York: Churchill Livingstone. 870p. ISBN 0-443-04348-5.

Fischer, A.A. 1986. Pressure threshold meter: Its use for quantification of tender spots. Archives of Physical Medicine and Rehabilitation. 67: 836-838.

Frymoyer, J.W. 1991. The adult spine: Principles and Practice. (Vol 1) New York: Raven Press, LTD. 2178p. ISBN 0-88167-689-6.

Garrick, J.G. and Rayna, R.K. 1973. Role of external support in the prevention of ankle sprains. Medical Science of Sports. 5: 200.

Gatterman, M.I. 1990. Chiropractic management of spine related disorders. Baltimore: Williams and Wilkins. 437p. ISBN 0-683-03438-3.

Glick, J.M., Gordon, R.B., Nishimoto, D. 1976. The prevention and treatment of ankle injuries. American Journal of Sports Medicine. 4: 136-141.

Haldeman, S. 1992. Principles and practice of chiropractic. 2nd Ed. California: Appleton and Lange. 641p. ISBN 0-8385-6360-0.

Haldeman, S. 1992. The evolution and importance of spinal and chiropractic research. Journal of Manipulative and Physiological Therapeutics. 15(1): 31-35.

Haldeman, S. 1993. Research supporting the efficacy of chiropractic manipulation. Paper read at the South African International Chiropractic Conference, Sun City, South Africa, 11-14 Oct. 1993. Technikon Natal Library.

Hansen, F.R., Bendix, T., skov, P. Jensen, C.V., Kirstensen, J.H., Krohn, L., Schoieler, H. 1993. Intensive, dynamic back muscle exercises, conventional physiotherapy, or placebo-control treatment of low back pain. Spine. 18(1): 98-108.

Heit, E.J., Lephart, S.M., Rozzi, S.L. 1996. The effect of ankle bracing and taping on joint position sense in the stable ankle. Journal of Sports Rehabilitation. 5: 206-213.

Heliövaara, M., Sievers, K., Impivaara, O. 1989. Descriptive epidemiology and public health aspects of low back pain. Annals of Medicine. 21: 327-333.

Hurtwitz, E.L. 1994. The relative impact of chiropractic versus medical management of low back pain on health status in a multi-speciality group practice. Journal of Manipulative and Physiological Therapeutics. 17(2): 74-82.

Jensen, M.P., Karoly, P., Braver, S. 1986. The measurement of clinical pain intensity. A comparison of six methods. Pain. 27: 117-126.

Johnson, M.R., Schultz, M.K., Ferguson, A.C. 1989. A comparison of chiropractic, medical and osteopathic care of work related sprains and strains. Journal of Manipulative and Physiological Therapeutics. 12(5): 335-344.

Kanner, R. 1994. Low back pain. Seminars in Neurology. 14(3): 272-279.

Karlsson, J. and Andreasson, G.O. 1992. The effect of external support in chronic lateral ankle joint instability: An electromyographic study. American Journal of Sports Medicine. 20: 257-261.

Kent, E.T. 1994. A randomised-control study of active and passive treatment of chronic low back pain following L5 laminectomy. Journal of Sports Physical Therapy. 20(6) Dec: 276-286.

Kirkaldy-Willis, W.H. 1988. Managing low back pain. 2nd Ed. New York: Churchill Livingstone Inc. 403p. ISBN 0-443-08535-8.

Kirkaldy-Willis, W.H. and Cassidy, J.D. 1988. Manipulation in Kirkaldy-Willis, W.H. ed. Managing low back pain. 2nd Ed. New York: Churchill Livingstone Inc. 403p. ISBN 0-443-08535-8.

Kirkaldy-Willis, W.H. and Burton, C.V. 1992. Managing low back pain. 3rd Ed. New York: Churchill Livingstone Inc 419p. ISBN 0-443-08789-X.

Klimiuk, P.S., Pountain, G.D., Keegan, A.L., Jayson, M. 1987. Serial measurement of fibrinolytic activity in acute low back pain and sciatica. Spine. 12: 925-928.

Koes, B. W., Bouter, L.M., Van der Heijden, G.D. 1995. Methodological quality and randomised clinical trials on treatment efficacy in low back pain. Spine. 20(2): 228-235.

Koes, B.W., Assendelft, W.J., Van der Heijden, G.J., Bouter, L.M. 1996. Spinal manipulation for low back pain: an undated systematic review of randomised clinical trials. Spine. 21(24): 2860-2871.

Lephart, S.M., Kocher, M.S., Borsa, P.H., Fu, F.H., Harner, C.D. 1992. Proprioception following anterior cruciate ligamentous reconstruction. Journal of Sports Rehabilitation. 1: 188-196.

Magee, D.J. 1992. Orthopaedic assessment. 2nd Ed. Philadelphia: W.B. Saunders Company. 665p ISBN 0-7216-4344-2.

Manga, P., Angus, D., Papadopoulos, C., Swan, W. 1993. Chiropractic management of low back pain: The effectiveness and cost effectiveness.

University of Ottawa, Ontario, Canada. 104p. ISBN 0-9697-6150-3.

Manga, P., Angus, D.E., Swan, W.R. 1993. Effective management of low back pain: Its time to accept the evidence. Journal of Canadian Chiropractic Association. 37(4): 221-229.

Margo, K. 1994. Diagnosis, treatment and prognosis in patients with low back pain. American Family Physician. 49(1): 171-179.

Martin, D.R. and Wichmann, S. 1996. Bracing for activity. The Physician and Sports Medicine. 24(9) Sept: 88-92.

Meade, T.W., Dyer, S., Browne, W., Townsend, J., Frank, O. A. 1990. Low back pain of mechanical origin: Randomised comparison of chiropractic and hospital outpatient treatment. British Medical Journal. 300(2): 1431-1436.

Miers, D., Padratsky, S., Dean, W., Herrold, T., Bedillion, R., Denegar, C. 1992. Factors influencing return to work following physical therapy for mechanical low back pain. Physical Therapy. 72(6) (suppl) June: 76.

Mikheev, M. 1993. Welcoming address: World Chiropractic Congress. London. U.K. 27-29 May.

Nyeindo, J. 1991. Disabling low back pain, Oregon workers' compensation claims. Part III: Diagnostic and treatment procedures and associated costs. Journal of Manipulative and Physiological Therapeutics. 14(5): 287-297.

Nyeindo, J. and Lamm, L. 1991. Disabling low back Oregon workers' compensation claims. Part I: Methodology and clinical categorisation of chiropractic and medical costs. Journal of Manipulative and Physiological Therapeutics. 14(3): 177-184.

O'Donoghue, C.E. 1994. Manipulation trials. In Boyling, J.D. and Palastanga, N. (Eds). Grievess' modern manual therapy. The vertebral column. 2nd Ed. New York: Churchill Livingstone. 870p. ISBN 0-443-04348-5.

Ordet, S.M. and Grand, L.S. 1992. Dynamics of clinical rehabilitation exercise. USA: Williams and Wilkins. 283p. ISBN 0-683-06654-4.

Ottenbacher, K. and Difabio, R.P. 1985. Efficacy of spinal manipulation/ mobilisation therapy. Spine. 10(9): 833-837.

Pocock, S.J. 1993. Error and bias in single group and controlled data trials. In Lewith, G.T. and Aldridge, D. Clinical research methodology for complimentary therapies. London: Aodder and Stoughton. 476p. ISBN 0-340-55778-8.

Pope, M.H., Phillips, R.B., Haugh, L.D., Hsien, C.J., MacDonald, L., Haldeman, S. 1994. A prospective randomised three-week trial of spinal manipulation, transcutaneous muscle stimulation, massage and corset in the treatment of subacute low back pain. Spine. 19(22): 2571-2577.

Portney, L.G. and Watkins, M.P. 1993. Foundations of clinical research applications to practice. USA, East Norwalk, Connecticut: Appleton and Lange. 722p. ISBN 0-8385-1065-5.

Pustaver, M.R. 1994. Mechanical low back pain etiology and conservative management. Journal of Manipulative and Physiological Therapeutics. 17(6): 376-382.

Radin, E.L. 1987. Reasons for failure of L5-S1 intervertebral disc excisions. Internal Orthopaedics II : 255.

Rahlmann, J.F. 1987. Mechanisms of intervertebral joint fixation: A literature review. Journal of Manipulative and Physiological Therapeutics. 10(4): 177-187.

Reid, D.C. 1992. Sports injury assessment and rehabilitation. New York: Churchill Livingstone Inc. 1269p. ISBN 0-443-08662-1.

Robinson, M.E., Greene, A.F., O'Connor, P., Graves, J.E., Mac Millan, M. 1992. Reliability of lumbar isometric torque in patients with chronic low back pain. Physical Therapy. 72(3) Mar: 29-32.

Sandoz, R. 1976. Some physical mechanisms and effects of spinal manipulation. Annals of the Swiss Chiropractors Association. Volume VI: 91-142.

Schafer, R.C. and Faye, L.J. 1989. Motion palpation and chiropractic technique- Principles of dynamic chiropractic. California: The Motion Palpation Institute. 426p. ISBN 0-924-88900-4.

Shekelle, P.G. and Brook, R.H. 1991. A community-based study of the use of chiropractic services. American Journal of Public Health. 81(4): 439-442.

Stratford, P., Gill, C., Westaway, M., Binkley, J. 1995. Assessing disability and change in individual patients: A report of a patient specific measure.

Physiotherapy Canada. 47(4): 258-264.

SPSS Inc (1999). SPSS Base 9.0 users' guide. SPSS Inc.: Chicargo.

Szaraz, Z.T. 1990. Compendium of chiropractic technique. 2nd Ed. Toronto:

Vivian L.R. Associates Ltd. Technical Publications. Five parts.

Travel, J. and Simon, D.G. 1983. Myofascial pain and dysfunction. The trigger point manual. Volume 1: The lower extremities. Baltimore: Williams and Wilkins. 607p. ISBN 0-683-08367-8.

Triano, J.J., McGregor, M., Hondras, M.A., Brennan, P.C. 1995. Manipulative therapy versus education programs in chronic low back pain. Spine. 20(8): 948-955.

Videman, T. 1987. Experimental models of osteoarthritis: the role of immobilisation. Clinical Biomechanics. 2: 223-229.

Waagen. 1986. Short term trial of chiropractic treatment for relief of chronic low back pain. Manual Medicine. 2: 63-67.

Walker, B.F. and Buchbinder, R. 1997. Most commonly used method of detecting spinal subluxation and preferred terms of its description: A survey of chiropractors in Victoria, Australia. Journal of Manipulative and Physiological Therapeutics. 20(9): 583-589.

Weber, H. 1983. Lumbar disk herniation : A controlled prospective study with ten years of observation. Spine. 8: 131-140.

Winer, C.E.R. 1985. A survey of controlled trials of spinal manipulation. In Glasgow, E.F., Twomey, L.T., Scull, E.R., Kleynhans, A.M., Idczak, R.M. Aspects of manipulative therapy. 2nd Ed. Edinburgh: Churchill Livingstone. 194p. ISBN 0-7216-9592-2.

Wright, K.E. and Whitehill,W.R. 1991. The comprehensive manual of taping and wrapping techniques. Kansas: Cramer Products Inc. 156p. NJ 08558-9418.

Wyke, B.D. 1985. Articular neurology and manipulative therapy. Aspects of manipulative therapy. New York: Churchill Livingstone. 194p. ISBN 0-433-030367-7.

Zachazewski, J.E. and Geissler, G. 1992. When to prescribe a knee brace.

Physical Sports Medicine. 20(11): 91-99.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: _____ Date: _____
file #: _____ X-Ray#: _____
Age: _____ Sex: _____ Occupation: _____
Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: _____ Signature: _____

Case History:

Examination:

Previous:

Current:

X-Ray Studies:

Previous:

Current:

Clinical Path. lab:

Previous:

Current:

Case Status:

PTT:

Conditional:

Signed Off:

Final Sign out:

Recommendations:

Intern's Case History

1. Source of History:
2. Chief Complaint: (patient's own words)

3. Present Illness:

- ▶ Location
- ▶ Onset
- ▶ Duration
- ▶ Frequency
- ▶ Pain (Character)
- ▶ Progression
- ▶ Aggravating Factors
- ▶ Relieving Factors
- ▶ Associated S & S
- ▶ Previous Occurrences
- ▶ Past Treatment and Outcome

4. Other Complaints:

5. Past Medical History:

- ▶ General Health Status
- ▶ Childhood Illnesses
- ▶ Adult Illnesses
- ▶ Psychiatric Illnesses
- ▶ Accidents/Injuries
- ▶ Surgery
- ▶ Hospitalizations

6. Current health status and life-style:

- ▶ Allergies
- ▶ Immunizations
- ▶ Screening Tests
- ▶ Environmental Hazards (Home, School, Work)
- ▶ Safety Measures (seat belts, condoms)
- ▶ Exercise and Leisure
- ▶ Sleep Patterns
- ▶ Diet
- ▶ Current Medication
- ▶ Tobacco
- ▶ Alcohol
- ▶ Social Drugs

7. Immediate Family Medical History:

- ▶ Age
- ▶ Health
- ▶ Cause of Death
- ▶ DM
- ▶ Heart Disease
- ▶ TB
- ▶ Stroke
- ▶ Kidney Disease
- ▶ CA
- ▶ Arthritis
- ▶ Anaemia
- ▶ Headaches
- ▶ Thyroid Disease
- ▶ Epilepsy
- ▶ Mental Illness
- ▶ Alcoholism
- ▶ Drug Addiction
- ▶ Other

8. Psychosocial history:

- ▶ Home Situation and daily life
- ▶ Important experiences
- ▶ Religious Beliefs

9. Review of Systems:

- ▶ General
- ▶ Skin
- ▶ Head
- ▶ Eyes
- ▶ Ears
- ▶ Nose/Sinuses
- ▶ Mouth/Throat
- ▶ Neck
- ▶ Breasts
- ▶ Respiratory
- ▶ Cardiac
- ▶ Gastro-intestinal
- ▶ Urinary
- ▶ Genital
- ▶ Vascular
- ▶ Musculoskeletal
- ▶ Neurologic
- ▶ Haematologic
- ▶ Endocrine
- ▶ Psychiatric

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:

- Pupillary light reflexes = Direct:
= Consensual:

- Fundoscopy findings:

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

- V a. Sensory - Ophthalmic:
- Maxillary:
- Mandibular:
- b. Motor - Masseter:
- Jaw lateral movement:
- c. Reflexes - Corneal reflex
- Jaw jerk

VI Lateral movement of eyes

- VII a. Motor - Raise eyebrows:
- Frown:
- Close eyes against resistance:
- Show teeth:
- Blow out cheeks:
- b. Taste - Anterior two-thirds of tongue:

VIII General Hearing:
Rinnes = L: R:
Webers lateralisation:
Vestibular function - Nystagmus:
- Rombergs:
- Wallenbergs:
Otoscope examination:

IX & Gag reflex:

X Uvula deviation:
Speech quality:

XI Shoulder lift:
S.C.M. strength:

XII Inspection of tongue (deviation):

Motor System:

- a. Power
 - Shoulder = Abduction & Adduction:
= Flexion & Extension:
 - Elbow = Flexion & Extension:
 - Wrist = Flexion & Extension:

- 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:

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

PATIENT: _____

FILE #: _____ DATE: _____

INTERN/RESIDENT: _____

SUPERVISING CLINICIAN: _____

STANDING:

Posture	Spinous Percussion
Minor's Sign	Schober's Test (6cm)
Skin	Treadmill
Scars	Body Type
Discoloration	Attitude
Muscle Tone	
Bony & Soft Tissue Contours	

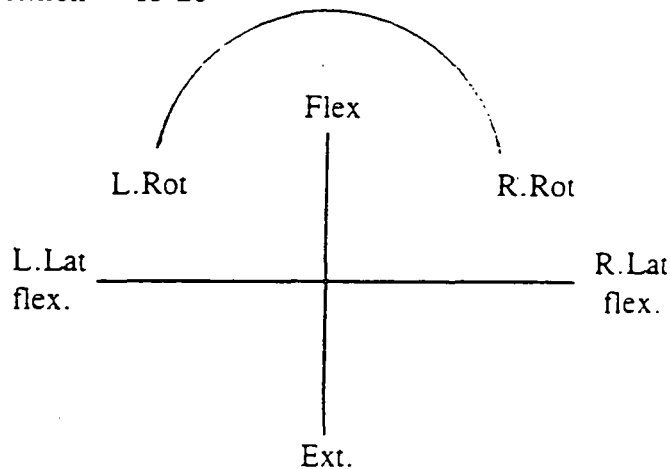
RANGE OF MOTION

Forward Flexion = 40-60° (15cm from floor)

Extension = 20-35°

L/R Rotation = 3-18°

L/R Lateral Flexion = 15-20°



SUPINE:

Skin	Observe abdomen
Hair	Fasciculations
Nails	Abdominal Reflexes
Palpate Abdomen/groin	
Pulses (abdomen)	

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

PATIENT: _____

FILE #: _____ DATE: _____

INTERN/RESIDENT: _____

SUPERVISING CLINICIAN: _____

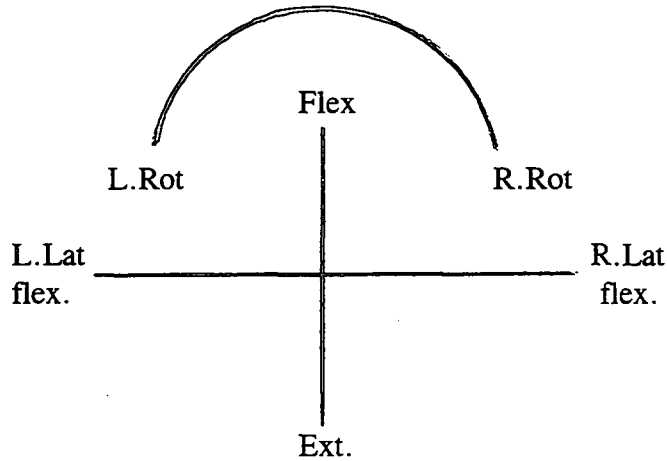
STANDING:

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

Pulses (extremities)
SLR
Bowstring
Plantar Reflex
Circumference (thigh, calf)
Leg Length:
 actual
 apparent
Sciatic Notch
Patrick FABERE
Gaenslen's Test
Gluteus Maximus Stretch
Hip Medial rotation
Psoas Test
Thomas' Test:
 hip joint
 Rectus Femoris

LATERAL RECUMBENT

S-I Compression
Ober's Test
Femoral Nerve stretch
Myotomes:
 QL
 Gluteus Medius

NON ORGANIC SIGNS

Pin Point Pain
Axial Compression
Trunk Rotation
Burn's Bench Test
Flip Test
Hoover's Test
Ankle Dorsiflexion Test.

GAIT

Rhythm
On toes (standing)
On Heels (standing)
Half squat on one leg

PRONE

Gluteal skyline
Skin rolling
Iliac crest compression
Facet joint challenge
S-I tenderness
Erichson's Test
Pheasant's Test
Myotome:
 Glut. Max
Active MF Trigger Pts:
 QL
 Glut. Med
 Glut. Min
 Glut. Max
 Piriformis
 Hamstrings
 TFL

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:

Basic Exam: Thoracic Spine
Case History:

ROM: Active:
 Passive:
 RIM:

ROM: Motion Palp:
 Active:
 Passive:

Orthopaedic/Neuro/
Vascular:

Orthopaedic/Neuro/
Vascular:

Observ/Palpation:

Observ/Palpation:

INFORMED CONSENT FORM

(To be completed in duplicate by patient/ subject) Delete whichever is not applicable

TITLE OF THE RESEARCH PROJECT _____

NAME OF SUPERVISOR _____

NAME OF RESEARCH STUDENT _____

DATE _____

PLEASE CIRCLE THE APPROPRIATE ANSWER

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 from this study? YES/ NO
a) at any time
b) without having to give a reason for withdrawing, and
c) without affecting your future health care.
9. Do you agree to voluntarily participate in the study? YES/NO

PATIENT NAME: _____

SIGNATURE: _____

PARENT/ GUARDIAN: _____

SIGNATURE: _____

WITNESS: _____

SIGNATURE: _____

RESEARCH STUDENT: _____

SIGNATURE: _____

Goniometer and Algometer Measurements

Patients Name: _____

Goniometer:

	Treatment 1	Treatment 3	Treatment 6
Flexion			
Extention			
R. Rotation			
L. Rotation			
R.Lat.Flexion			
L.Lat.Flexion			

Algometer:

Tender Point	Treatment 1	Treatment 3	Treatment 6

Numerical Rating Scale

Patients name _____

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, *when it is at its worst*. A zero (0) would mean “no pain at all” and one hundred (100) would mean “pain as bad as it could be.” Please write only one number.

0 _____ 100

Please indicate on the line below, the number between 0 and 100 that best describes the pain of your major problem at this point, *when it is at its least*. A zero (0) would mean “no pain at all” and one hundred (100) would mean “pain as bad as it could be.” Please write only one number.

0 _____ 100