THE EFFECT OF FREQUENT AND INFREQUENT CHIROPRACTIC TREATMENTS IN THE MANAGEMENT OF MECHANICAL LOW BACK PAIN

BY

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DEDICATION

For my Mum, Dad and Nanna with everlasting love

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ABSTRACT

This comparative, randomized, controlled clinical trial consisted of sixty patients, suffering from low back pain (LBP) attributable to sacroiliac and/or lumbar facet syndrome. The aim of the study was to determine the relative effectiveness of frequent and infrequent chiropractic treatments in the management of mechanical low back pain. It was hypothesised that the Frequent Treatment Group would produce better results than the Infrequent Treatment Group.

Treatments consisted of spinal manipulative therapy (SMT) using diversified techniques to dysfunctional sacroiliac (SI) and or lumbar facet joints. All treatments were preceded with 5 minutes soft tissue therapy to the lumbar region. The study population was randomly divided into two treatment groups. The Frequent Treatment Group received 9 treatments over a three-week period and the Infrequent Treatment Group received 3 treatments over the same treatment period.

Data was collected before the treatment commenced and again at the beginning of the second and third weeks of the trial and finally the week following the last treatment. Subjective data gathered included results from the Numerical Pain Rating Scale 101 and the Oswestry Low Back Pain Disability Questionnaires. Objective data included an orthopedic rating scale used to assess the sacroiliac and lumbar facet joints and lumbar spine range of motion (ROM) as measured with the BROM II goniometer.

Data obtained during the trial period was statistically analysed. No significant difference between the two treatment groups was found at the 95% level of confidence. These findings imply that once weekly treatments are as effective as three treatments per week in terms of the clinical measure employed in this study. The results from this study suggest that patients who receive treatments more than once a week could be receiving excessive treatments, which would make the cost of chiropractic treatment unnecessarily expensive.

Intra-group analysis of the results indicated that both treatment groups improved significantly (α =0.05) between the first and final consultation, for all measures. These

findings demonstrate that chiropractic treatment is beneficial to patients with mechanical LBP.

The mean values obtained for each group for the levels of pain intensity, disability, ROM and joint dysfunction show the Frequent Treatment Group to have improved slightly more than the Infrequent Treatment Group, however not significant at the 95 % level of confidence. The cost of more frequent treatment needs to be justified with superior long-term effects. Research into factors such as whether or not more frequent treatments maintain productivity and avoid chronicity may provide support for more frequent treatments.

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CHAPTER 1

INTRODUCTION

'The scientific literature is not helpful in deciding the appropriate frequency or duration of spinal manipulative care' (Shekelle et al., 1992). This being so, there is a need to address the lack of evidence on the effect different chiropractic treatment frequencies has in the management of painful spinal syndromes. Trials using chiropractic treatments to alleviate low back pain (LBP) have demonstrated that spinal manipulative therapy (SMT) is an effective means of reducing the signs and symptoms of LBP (Manga et al., 1993). However, there is no consistency in the number or dose of treatments reported as required to efficiently manage LBP and make it cost efficient to patients, employers and practitioners (Waddell, 1995).

The purpose of this study was to ascertain whether frequent chiropractic treatments, that is, three treatments per week were significantly more effective in the management of patients with mechanical low back pain than infrequent treatments of one treatment per week.

This study aimed to assist in the development of general guidelines relating to treatment frequency. Well-researched guidelines on treatment frequencies could enable chiropractors to make better clinical judgements when designing treatment programmes for patients with mechanical LBP. There is an ongoing discussion amongst the profession about the need for establishing such guidelines for chiropractic treatment, but the process of developing and the implications for the widespread use of such guidelines is uncertain (Meeker, 1995). For constructive guidelines to be drawn up, systematic observations of clinical experience and working judgements need to be recorded, then assessed and critically evaluated by the members of the profession itself (Triano et al., 1992). The most accessible arena for the publication of this information is the current chiropractic journals, which enable a public discussion in the profession. In order to expand the database articles from prospective studies should be encouraged in these journals. This dissertation addresses mechanical LBP with a view to developing the discussion around treatment frequency. Information which could lead to further discussion of the desired guidelines, would be data on the prescribed optimal number and duration of treatments required for effective recovery.

Various treatment frequencies could have significant cost implications for patients suffering from mechanical low back pain. Obviously less frequent treatments would be cheaper for patients, employers and medical aids, but more frequent treatments may reduce the time taken to recover from the condition. For chiropractic care to be the preferred form of treatment for back pain conditions there must be a clear cost advantage over other types of treatments. Potential savings on chiropractic treatment for back injuries in California were estimated to be up to 76 % of the total workers' compensation costs. Even the minimum savings calculated, namely 28 % would save millions of dollars annually. These potential savings are possible if among other things, excesses such as unnecessary treatments were eliminated (Johnson et al., 1996). It is presumed that a similar scenario exists in this country, but no similar study carried out in South Africa has been recorded in the literature.

The RAND Health Insurance Experiment found chiropractic care to be less expensive than other types of care providers although they exhibited longer contact (Shekelle et al., 1995b). They cited the absence of hospital costs as the main reason why chiropractic care was less expensive. When hospital costs are excluded, the total outpatient costs per episode of care showed chiropractic care to be more expensive than that of general practitioners. Although chiropractic costs per visit were the lowest among all providers, their higher costs were attributable to the greater number of visits.

The cost-effectiveness of chiropractic over episodes of LBP and over long periods of usage of chiropractic is particularly apparent when more comprehensive measures of cost and outcomes are examined. Factors such as the avoidance of hospital care and rapid return to work contribute positively to the benefits of chiropractic care versus other forms of treatment. When combined with strong evidence of high levels of patient satisfaction, it is difficult to ignore the potential of chiropractic (Smith and Stano, 1997).

Mathews (1995) examined different treatment frequencies in the management of mechanical low back pain and concluded that chiropractic treatment administered once weekly for a period of three weeks is as effective as chiropractic treatment administered three times weekly for three weeks. Mathews (1995) utilised a study population of 30 patients with a wide range of ages (18 to 65 years).

Improvements in this study were made in the methodological design of the Mathews' (1995) study, as follows:

- a larger sample size was taken, which improves the power to detect clinically relevant differences,
- a narrower age range of patients was important so that there was some homogeneity between the groups,
- improved outcome measurements were used, including an objective orthopaedic rating scale and lumbar spine range of motion measurements.

Data has been statistically evaluated using both parametric and non parametric tests. Despite the improved outcome measures of this study, similar results to those of Mathews (1995) were found. These are that although both groups improved significantly, neither treatment frequency was significantly superior in the management of mechanical LBP. The implications arising from this study suggest that patients may be receiving unnecessary treatments. Further studies on issues surrounding this topic are necessary.

CHAPTER 2

LITERATURE REVIEW

The understanding and management of low back pain by the chiropractic profession is reviewed and discussed here. Various treatment frequencies other than those used in this dissertation are cited.

2.1 PREVALENCE OF LOW BACK PAIN

The high cost for both patient and employer that result from LBP related disability has led to epidemiological investigations into the condition. The problem is of concern as 60% to 80 % of the population will suffer from low back pain at some point in their life time (Burton and Cassidy, 1992:2). More recent studies illustrate the magnitude and variability of the problem (Table 2.1).

Table 2.1 Prevalence and incidence of low back pain

		PREVALENCE		INCIDENCE
Reference	**Population**	**Point[a]; Monthly[b]; 1-year[c]**	**Lifetime**	**Lifetime**
Docrat, 1999	South Africa – Indian community		45.0 %	78.2 %
	– Coloured community		32.6 %	76.6 %
Walker, 1999	Non-specific	12 – 33 %[a] 22 – 65 %[b]	11 – 84 %	
Van der Mulen, 1997	South Africa – formal black township		53.1 %	57.6 %
Papageorgiou et al., 1995	South Manchester (UK)	35 – 39 %[c]		
Kirkaldy-Willis, 1988:2	Canada		60 – 80 %	

The variations in the results obtained in studies on prevalence can be attributed to differences in study populations, as a wide range of factors would seem to influence low back pain. Such factors include history of back injury, job satisfaction, emotional distress, occupation, prolonged sitting or standing, vibration, smoking, obesity, height, physical fitness, sex, age, anthrometry, lumbar mobility, trunk strength and radiographic structural abnormalities (Shekelle, 1995a).

The high prevalence and resulting expenses of LBP on the country's economy mean that an efficient and cost effective treatment is needed.

2.2 CHIROPRACTIC VERSUS OTHER TREATMENTS

To improve the growth and popularity of the profession, chiropractic treatment should compare favourably with other forms of treatments offered for low back pain. Comparisons drawn between LBP treated by chiropractors and the same treated by general practitioners showed that patients undergoing chiropractic manipulation revealed greater improvement and satisfaction in general with their treatment (Nyiendo et al., 2000).

SMT was also found to be significantly more effective than acupuncture and non-steroidal anti-inflammatory drugs for the treatment of chronic spinal pain syndromes (Giles and Muller, 1999). Giles and Muller's (1999) study confirms the conclusions of the Meade et al. (1990) trial which supports the use of spinal manipulative therapy in the treatment of low back pain. This trial (Meade et al., 1990), which compared chiropractic and hospital outpatient management of low back pain, found chiropractic treatment to be more effective, particularly for patients suffering from chronic or severe low back pain. The Meade et al. (1990) trial however, adopted a pragmatic approach as the type, frequency or duration of treatment was left to the discretion of the therapist.

Meade et al. (1990) suggested that more trials were necessary to identify the specific components responsible for the effectiveness of chiropractic treatment. This motivated this study in which an attempt was made to assess the difference between frequent and infrequent chiropractic treatments over a three-week period to 60 patients with mechanical low back pain. Results are intended to facilitate a balanced reflection of the best possible relation between cost of treatments and costs due to disability resulting from LBP.

2.3 FREQUENCY OF TREATMENTS

Studies concerned with chiropractic management of LBP vary widely as can be seen below (Table 2.2). The lack of consistency in treatment frequency relates to inadequate evidence as to the most effective frequency (dose) to attain the maximum benefit from chiropractic treatment for a specific condition (Vernon, 2000).

Table 2.2 Various treatment frequencies

PROSPECTIVE TRIALS WITH SPECIFIED NUMBER OF TREATMENTS		
Reference	**No. of treatments**	**Treatment period**
Nyiendo, 2000	4	4 weeks
Giles and Muller, 1999	6	3-4 weeks
Russell, 1996	10	4 weeks
Triano, 1995	(mean) 10.5	2 weeks
Mathews, 1995	3	3 weeks
	9	3 weeks
Pope et al. 1994	9	3 weeks
Meade, 1990	10	52 weeks
RETROSPECTIVE TRIALS		
Reference	**Mean Number of treatments**	
Herwitz et al., 1998	12.4	
Johnson et al., 1996	13.0 – Workman's Compensation	
	4.0 – Health insurance patients	
Koes et al., 1993	5.4	
Triano et al., 1992	8.2	
Cox and Shreiner, 1984	19.0	
Cox et al., 1983	16.1	
Phillips and Butler, 1982	12.5	

The duration of the complaint is a factor that greatly influences the number of treatments needed to restore normal functioning (Waddell, 1995). Triano et al. (1992) reported that the mean number of treatments for chronic complaints was 8.2, and for acute conditions the mean was 5.3 treatments.

Treatments that are applied aggressively and at an early stage of the condition have the best chance of success with LBP patients (Liebenson, 1992). Chronic complaints account for up to 80 % of the costs involved in LBP (Burton and Cassidy, 1992:2). It therefore makes sound economic sense to avoid chronicity by instigating aggressive treatment at an early stage of a LBP episode.

The benefit of seeking care relatively early in the pain episode is supported by the Swedish study on chiropractic treatment for LBP (Leboef-Yde et al., 1997). They found the maximum number of treatments per episode was 7, and 3 % of patients receiving the maximum number of treatments were patients with problems which had lasted a comparatively long time.

2.4 MECHANICAL LOW BACK PAIN

The majority of back pain is mechanical, that is, it exists without overt structural pathologies. Mechanical LBP is caused by joint dysfunction and deconditioning syndromes, which involve nociceptive processes rather than nerve injury (Waddell, 1995). Nociceptive pain is often more devastating than the perceived severity of the initiating lesion; this is due to peripheral and central sensitisation. Sensitisation is defined as the lowering of nociceptor thresholds (Casey, 1992:13).

Nociceptors are excited by noxious chemical and mechanical stimuli which are typically associated with tissue injury. Tissue injury disrupts the integrity of the local structures, permitting the release of various chemical mediators of inflammation and nociception, such as substance P, histamine, 5 hydroxytryptamine, prostaglandin E2, and bradykinin. These chemicals lower the threshold of nociceptor activation, which can then be stimulated by innocuous stimuli or even discharge spontaneously. The term 'peripheral-sensitisation' is used when referring to this sort of tissue nociceptor stimulation (Wright, 1999).

The sensitisation of central nervous system neurons (dorsal horn, intermediate region and ventral horn of the spinal cord) is called central sensitisation. Central sensitisation manifests in the central nervous system (CNS) neurons as increased spontaneous activity. There is also increased response to afferent inputs, prolonged after discharges to repeated stimulation, and the expansion of the receptive fields of the dorsal horn neurons (Coderre et al., 1993).

Mechanical stimuli which excite nociceptors include stretching and compressing of connective tissue. Precisely how mechanical irritation causes pain remains obscure, but Bogduc and Twomey, (1991:153) suggest that an array of collagen fibres (in ligament and periosteum of joint capsule) placed under tension will deform and close the available space between individual collagen fibers. In this way, nerve endings within the array would be stimulated by being squeezed between encroaching fibres. Structural distortions interfere way with the nerve supply resulting in altered functioning (Homewood, 1977:73).

Sensitisation of the nociceptive system can lead to exaggerated forms of pain, such as allodonia and hyperalgesia. Allodonia is defined as 'pain produced by a stimulus that is normally not painful', (such as normal joint movement or spinal palpation). Hyperalgesia is defined as 'increased pain produced by a stimulus that is normally painful' (Willis, 1992). Both states of hyper-excitable nociceptive activity occur with mechanical LBP.

Mechanical LBP conditions, include posterior facet syndrome, sacroiliac (SI) syndrome, Maigne's syndrome, disc herniation, facet and disc degeneration, central and lateral canal stenosis, myofascial pain and dysfunction syndromes (Kirkaldy-Willis et al., 1992:121).

This study included patients with either SI syndrome and/or lumbar facet syndrome, as they are relatively common conditions. The prevalence of SI joint dysfunction in the population has been noted in the medical literature to be between 19.3 % and 47.9 % (Toussaint et al., 1999). The primary source of pain arose from the sacroiliac joint in 23 % of the patient population and from the lumbar facet joints for 22 % (Bernard and Kirkaldy-Willis, 1987). Due to the relatively common occurrence of these lesions, this study will consider only the dysfunction of the SI joint and lumbar facet joint.

2.4.1 SACROILIAC JOINT

There is no single, simple axis of movement of the SI joint. Rather, motion occurs as coupling in 6 degrees of freedom (Walker, 1992; White and Punjabi, 1990:112-5). The review of 96 articles by Walker (1992) concluded that joint motions are very small and complex, involving simultaneous rotations of 3 degrees or less and translation of 2 mm or less, in three dimensions. Jacob and Kissling (1995) found that the axes of motion for the SI joints are not simple and depend largely on joint surface topography. Motion at the SI joint is necessary to dampen the forces transferred through the region (Jacob and Kissling, 1995).

The ligaments of the SI joint and lumbar spine 'fuse' with the thoracolumbar fascia. These ligaments and fascia are the primary attachment sites for the main muscle groups which move and stabilise the spine and lower extremity. Muscle activity in the area causes compression of the SI joint surfaces which allows for effective load transfer between the upper and lower body (Dorman and Vleeming, 1995). Spasms in the low back and pelvic muscles result in increased stress and strain on the innervated ligamentous tissue of the SI joint, which results in inflammation, pain and reduced motion (Harrison et al., 1997).

Postural loading and structural asymmetries have profound effects on the stresses and strains on the SI joint tissues (Dorman and Vleeming, 1995). Biomechanical models of SI joint stability indicate that the area is strained in poor postures, such as unsupported sitting, which causes kyphotic lumbar configurations and posterior translation of the thorax. These postures have increased muscle activity in order to maintain equilibrium, which causes the components of the SI joint to become chronically strained. It is possible that inflammation and pain in the area may develop from such stressed tissues (Snijders et al., 1993).

Increased stress may contribute to the presence of accessory SI joints. These have been noted in 8% to 50 % of the populations sampled and occur unilaterally or bilaterally, and may be single or multiple. There are two different forms of this joint: an axial and an accessory joint. The axial joint is considered to be a syndesmosis, but the accessory joint is surrounded by a joint capsule and is considered to be a true synovial joint. This joint may be responsible for the claimed cavitations of the SI joint during manipulation (Walker, 1992)

Various tests have been proposed for assessing the SI joint dysfunction. The posterior shear test has good sensitivity (80 %) and specificity (100 %) ratings for sacroiliac pathology (Broadhurst and Bond, 1998). This test was used in this trial to assess SI joint dysfunction as well Patrick Faber test, Gaenslen's test and Ericksons test. The following criteria were described by Kirkaldy-Willis and Benard (1988:135-157) as useful for assessment of the clinical presentation of SI syndrome:

- pain and tenderness over the sacroiliac joints,
- may refer pain to the groin, greater trochanter, posterior thigh and posterior lateral calf,
- -movement of the joint is reduced, as accessed by motion palpation,
- -Patrick Faber test, Gaenslen's test, Yeoman's test and the lateral recumbent sacroiliac compression tests are normally positive.

2.4.2 LUMBAR FACET JOINTS

The motion segment consists of an articular triad that is made up of a fibrocartilagenous intervertebral joint (i.e. disc) and two facet joints. The motion segment can be divided into anterior and posterior elements. The anterior elements include the vertebral body, the disc and anterior and posterior longitudinal ligaments; the anterior elements provide stability and shock absorption. The posterior elements are composed of the pedicles, the facet joints, and the posterior ligamentous and muscular attachments. The posterior elements control the spinal movements (Anderson et al., 1992).

The facet joints are typical synovial joints containing cartilage, synovium and synovial capsules. These joints in the lumbar spine are in the saggital plane (vertical), they essentially allow flexion and extension, and markedly restrict rotation and lateral flexion. The facet joints, their capsules, and the interspinous ligament provide approximately 40% to 50 % torque strength of the motion segment. The facet joints bear 15% to 24 % of the weight of the erect vertebral column (Anderson et al., 1992).

The structures in the lumbar spine which receive a nociceptive nerve supply are the zygapophyseal joints (synovial membrane and capsule), the ligaments of the posterior elements, the paravertebral muscles, the duramater, the anterior and posterior longitudinal ligaments and the intervertebral disc. These structures have each been implicated as sources of low back pain (Bogduk and Twomey, 1991:152).

The clinical presentation of lumbar facet joint dysfunction is described by (Kirkaldy-Willis and Benard 1988:133-135) as:

- patient presents with localized low back pain, usually unilateral,
- pain may refer to the buttock, posterior and lateral thigh, rarely to below the knee,
- pain is sclerotogenous in nature, that is dull, deep and poorly defined,
- pain is relieved by rest and aggravated by movements, especially extension,
- tenderness on palpation of the affected areas, and hypertonic paraspinal musculature,
- decreased range of motion,
- Kemp's test and lumbar facet joint challenge are usually positive.

2.5 VERTEBRAL SUBLUXATION

Tissue injury often as a result of microtrauma leads to inflammation, nociception and pain, all of which can reduce joint mobility and promote pathological or degenerative changes in and around a joint (Seaman and Cleveland, 1999). These changes can occur in the joint capsule, spinal ligaments, disc. tendons, muscles and blood vessels (Seaman and Cleveland, 1999).

Seaman (1997) suggests the term 'joint complex dysfunction' to describe the negative effects of joint immobilization, inflammation and muscle imbalance. This term is more descriptive than the pre-existing term for the same disorder, namely 'vertebral subluxation.'

Rome (1996) reviews the literature relating to the subluxation and finds 296 synonyms for this biomechanical condition. However, most definitions of the subluxation recognize that the involved lesion has a primary biomechanical component and an associated neurophysiological component (Haldeman, 1992:250).

2.5.1 BIOMECHANICAL COMPONENTS OF A SUBLUXATION

A major constituent of the subluxation complex is restricted movement or joint fixation (Rome, 1996). Motion palpation as described by (Evans, 1994:545) is used to detect the joint restrictions/fixations. Some causes of this restricted movement are discussed below:

i) Muscular spasm

Reflex para-vertebral muscle guarding or splintering as a cause of joint locking, has been implicated by Korr (1975:188) and Rahlmann (1987).

Stimulation of mechanoreceptors, by joint loading and movement, results in inhibition of sympathetic efferent innervation to muscle spindles (Hubbard and Berkoff, 1993). This feedback system controls muscle tone and allows for coordinated movements. When a joint is strained and not moving easily there is insufficient inhibition of the sympathetic system, which results in muscle spasm. Gatterman, (1990:42) found increased electromyographic activity and tenderness of paraspinal muscles around strained joints.

Emotional disturbance such as stress, fear, resentment and depression can contribute to the development of local vasoconstriction and ischaemia (Calliet, 1988:71). The resulting accumulation of metabolites and sustained muscular contraction causes muscle fatigue and nociception. Changes in the recruitment of motor units in muscle groups can alter patterns of muscle contraction, commonly thought to occur in the multifidus muscle (Kirkaldy-Willis et al., 1992:49-53). Over time, muscle alterations result in painful, restricted movement, learned restriction as well as fibrosis, ultimately leading to chronic pain syndromes.

SI joint dysfunction may be responsible for quadratus lumborum and gluteal muscle spasms, and hence treatment aimed at the dysfunctional joint may reduce the painful muscle spasm (Indahl et al., 1999).

ii) Meniscoid/Synovial fold entrapment

There is controversy on the nomeclature of 'synovial folds' and 'menisci' in the lumbar facet joints. According to Giles (1989:37) there are no true menisci, but dense fibrous intra-articular inclusions projecting from the ligamentum flavum in the medial upper one-third of the joints.

These synovial folds function as packing that allows for easier movement of adjacent facet joints, whilst providing greater stability and distribution of joint load (Bogduk and Engel, 1984). These innervated structures are sometimes called 'meniscoid inclusions' and are susceptible to mechanical pinching which results in tissue damage and traction on pain sensitive structures (Giles, 1989:68). The subsequent release of inflammatory substances results in pain and muscle spasm. Repetitive trauma to these joints accelerates osteoarthritic changes and fibrosis of the synovial tips. This can cause mechanical dysfunction with joint locking and reflex muscle spasms at the level, which restricts joint motion (Bogduk and Twomey, 1991:34).

Synovial pinching or meniscoid entrapment is accompanied by oedema, synovitis and distension of the joint capsule causing nerve root irritation (Kirkaldy-Willis et al., 1988:94). This nerve irritation results in increased neural activity through facilitation or sensitisation.

Chronic inflammation and fibrosis in the synovium and capsule of the zygopophyseal joints may produce persistent severe back pain (Giles, 1989:159). Decreased blood fibrinolytic activity is found in patients with severe chronic back pain (Jayson et al., 1984). This defective fibrinolysis is possibly associated with fibrin deposition and scar formation. Inflammation and scar formation may be responsible for the development and/or perpetuation of chronic pain at the site of joint damage.

iii) Internal disc disruption

A joint can become suddenly fixed within its normal range, due to an internal derangement of the disc (Cyriax, 1977:57-66). Besides these mechanical factors in joint restriction, inflammation caused by immunologic and biochemical responses to disc degeneration can account for the pain and loss of function associated with LBP (Saal, 1995).

Significant proportions (39 %) of patients with chronic low back pain have degenerative disc disease (Schwarzer et al., 1995). No conventional clinical tests can discriminate between patients with internal disc disruption from patients with other conditions (Schwarzer et al., 1995).

However, joint locking also occurs in the spine at joints that have no discs, i.e. atlanto-occipital and atlanto-axial joints (Bourdillon et al., 1992:305; Rahlmann, 1987). This emphasises the possibility that more that one type of mechanism may be involved in joint locking, and that different mechanisms may be regionally variable (Rahlmann, 1987).

iv) Periarticular connective tissue adhesions

Shortening or contracture formation within periarticular ligaments has been implicated as a cause of intervertebral joint fixation (Gatterman, 1990:45). Adhesions can form as a result of trauma, which causes inflammation, scar tissue formation and ultimately reduced movement (Rahlmann, 1987). The negative effects of immobilisation include shrinking of the joint capsules, contractures and increased periarticular fibrosis, all of which result in increased compressive loading which in turn cause rapid joint degeneration (Liebenson, 1992).

As pain perception is enhanced, learned protective mechanisms lead to a vicious cycle of inactivity and disuse. As physical capacity decreases, the likelihood of fresh sprains or strains to unprotected joints, muscles, ligaments and discs increases. These inevitable alterations of pain and function are perceived by the patient as a 'recurrence' or 're-injury' (Haldeman, 1992:535).

2.5.2 NEUROPHYSIOLOGY OF THE SUBLUXATION

The chiropractic profession recognises the hypothesis that the subluxation complex causes nerve compression (Leach, 1994:49). The pressure, which produces nerve compression and irritation, leads to tissue degeneration (Gatterman, 1990:41).

Neural structures normally have ample room as they exit the foramen, being protected by loose areola and adipose tissue, however, several factors may compromise this safety margin. The most widely acknowledged cause of nerve compression at the intervertebral foramen is disc pathology (Anderson, 1985).

Anatomical changes can cause narrowing of the central canal and lateral recesses, such as, osteophytes on the vertebral body and facet joints, calcification of the posterior longitudinal ligament and ligamentum flavum hypertrophy or buckling (Giles, 2000). Restricted movement and inflammation associated with the subluxation complex may cause venous congestion and oedema, which may interfere with neural transmission (Sunderland, 1978:160).

The spinal cord segments adjacent to a subluxated segment may have neurons mediating sensory, motor and autonomic functions maintained in a state of hyper-excitability (Korr, 1979).

This state of hyper-excitability or central sensitisation has various effects according to the location of the facilitated nerve (Gatterman, 1990:41):

- Facilitated *anterior* horn cells - affect motor outflow, resulting in sustained muscular tensions, postural asymmetries and limited, painful motion. The richly innervated muscles, tendons, ligaments and joint capsules may subsequently produce intense and exaggerated streams of afferent impulses with resultant pain.

- Facilitated *posterior* horn cells - expedite impulses to the central nervous system causing magnification of noxious or painful stimuli.

- Facilitated *lateral* horn cells - affect autonomic outflow, which may have deleterious effects on target tissues, including the viscera, blood vessels and glands.

There has been no evidence that a change in the relation of adjacent vertebrae of the type described in the chiropractic literature can result in nerve root or spinal cord compression. There is also minimal evidence that an adjustment of a subluxation or manipulation of any spinal lesion can result in reduced nerve root compression (Haldeman, 2000). Seaman (1997) recommends that chiropractors use the term 'nerve interference' only for the rare patient who demonstrates signs and symptoms of nerve compression.

An important neurophysiological component of subluxated/dysfunctional joints is the altered mechanoreceptor activity in and around the joint. Reduced mechanoreceptive activity (as occurs with subluxated/fixated joints), decreases nociceptive inhibition, thereby augmenting the perception of pain (Woolf, 1989). The word 'dysafferentation' is suggested by Seaman (1997) to describe the reduced mechanoreceptive input and the consequent increase in nociceptive activity which is associated with joint subluxation.

Symptoms of LBP are not only related to functional pathology, but environmental stresses and psychological factors also play a significant role in the course of the condition. The chiropractic adjustment or SMT is an aspect of chiropractic treatment, which focuses only on the functional pathology of LBP (Liebenson, 1992).

2.6.1 MECHANISMS OF ACTION OF SPINAL MANIPULATIVE THERAPY

The manipulation used in this trial was high velocity short lever adjustments, which were aimed at the dysfunctional lumbar facet joints and/or SI joints. These techniques are described by (Szaraz 1990: 9.9,9.4, 9.2. 9.3). The dysfunctional joints were found using motion palpation techniques as described by Schafer and Faye (1989:211-216,

256-259).

There is some scientific research explaining the effects of the adjustment, but it remains controversial and inconclusive (Haldeman, 2000). Some of the more popular theories explaining the healing mechanisms of an adjustment are discussed below.

2.6.1 INCREASED RANGE OF MOTION (ROM)

According to Geiringer et al. (1988:38) an adjustment restores motion to the joint complex. Furthermore, the restoration of normal spinal motion is thought to result in the elimination of pain secondary to disturbed biomechanics. Patterson (1993) states that adjustments can reduce motion restrictions by improving fluid infusion and reducing nociceptive inputs to the spinal cord. Haldeman (1993) and Waagen et al. (1986) demonstrated an increase in gross range of motion of the lumbar spine following manipulation.

The two commonly accepted explanations for the short term increase in ROM following an adjustment to a joint are firstly, increased joint volume resulting from a bubble of gas forming within the joint capsule (Brodeur, 1995), and secondly, the visco-elastic nature of the surrounding tissues (Unsworth et al., 1972). Cramer et al. (2000) demonstrated, using MRI scans, that the joint space after an adjustment is wider than the pre-adjustment measurement.

The long-term effects of an adjustment on ROM are due to reflexes. These reflexes either directly cause muscle relaxation, or they inhibit pain and thereby allow an indirect increase in the ROM (Brodeur, 1995).

Lehmann and McGill (1999) found that a sophisticated means of measuring spinal ROM yielded more information on the short-term effects SMT has on lumbar ROM. Their assessments included measurements of coupled motions in the minor axes. The ROM measurements used in this dissertation included only three degrees of freedom as measured using the available equipment, namely the BROM II goniometer.

2.6.2 RELEASE OF MUSCLE SPASM

Stretching of the capsule and other periarticular ligaments and tendons, as occurs during an adjustment, initiates afferent stimuli, which attenuate a hyper-excitable gamma system. This reflex mechanism which normalises muscle spindle activity explains the relaxation of periarticular muscles following an adjustment (Haldeman, 1993a).

Muscle spasms in the lower back limit lumbar spine ROM (Brodeur, 1995). The effect an adjustment has on reducing muscle spasm was recorded by measuring lumbar spine flexion.

Muscle spasms are capable of causing ischaemic pain (Travel and Simons, 1983). Thus if the spasms are released there will be an improvement in pain. In this study pain intensity was measured using the Numerical Pain Rating Scale 101 (NRS-101) questionnaire.

2.6.3 CHANGES IN PAIN THRESHOLD

According to Geiringer et al. (1988:450-451) spinal manipulation possibly produces an afferent signal to the cord that directly diminishes pain awareness by a gate control effect. This effect is mediated by the mechanoreceptors of the spinal joints, which are activated by the stretch of the manipulative procedure. These afferent impulses exert an inhibitory effect on the dorsal horn nerves, thereby reducing the amount of pain (Gillette, 1987).

Adjustments are thought to affect the amount of central and peripheral facilitation and so alter the perceived amount of pain (Cavanaugh, 1995). Terret and Vernon (1984) demonstrated a rise (140 %) in cutaneous pain thresholds following the adjustment as opposed to the control group. Patients receiving a rotary manipulation had a statistically significant reduction in the size of the cutaneous receptive field 15 minutes after receiving an adjustment when compared with the control group subjects (Glover et al., 1974). Glover et al. (1974) raised the question of whether or not more frequent treatments would make adjustments more effective in reducing pain.

The possibility that there may be a release of endorphins following spinal manipulative therapy has been raised but not confirmed (Halderman, 1993a). The study by Vernon (1986) found an increase in β-endorphin levels 5 minutes after receiving an adjustment to the cervical spine.

The NRS 101 pain scale was used in this trial to measure the intensity of the pain at the prescribed times of data collection.

2.6.4 REDUCTION OF DISC PROTRUSION

Disc disruption is thought to initiate an inflammatory response via an immune reaction to nucleus palposis material (Saal, 1995). The beneficial effect chiropractic adjustments can have in treating pain arising from disc pathologies is probably due to reflex pain reducing mechanisms (Vernon, 2000).

According to Cyriax (1977:59) the goal of spinal manipulation is to put a disc fragment back into place and therefore restore movement to a 'jammed joint'. Sandos (1976) describes the role of a rotatory manipulative thrust coupled with traction in returning a fragment to its 'normal' position. However, the purely mechanical benefits of an adjustment are less likely to be responsible for improvement than the reflex mechanisms involved in inflammation and pain reduction (Bourdillon et al., 1992:303). These reflex mechanisms being similar to that described above in SMT's effects in reducing muscle spasm, increasing ROM and changing the pain threshold.

2.6.5 PSYCHOLOGICAL EFFECTS OF MANIPULATION

There is growing recognition of the close relationship between psychological factors in back pain and disability. The strong enthusiasm and positive attitude of both patients and practitioners to manipulation may do more to reduce pain and disability than the other proposed mechanisms (Haldeman, 1993).

2.7 CONTRA-INDICATIONS TO SPINAL MANIPULATIVE THERAPY

Despite the proposed benefits of SMT a chiropractor needs to recognise that certain patients may suffer from conditions that will be aggravated by such therapy. The conditions particular to the low back, in which SMT is contra-indicated are listed by Gatterman (1990:67) as:

- atherosclerosis of major blood vessels; abdominal aneurism; tumours (e.g. lung, thyroid, prostate, breast and bone tumours),
- bone infections (e.g. turberculosis, osteomyelitis),
- traumatic injuries (e.g. fractures, instability),
- arthritis (e.g. ankylosing spondylitis),
- psychological disorders (e.g. malingering),
- metabolic disorders (e.g. clotting disorders),
- neurologic disorders (e.g. space occupying lesions),
- certain musculoskeletal system diseases.

SUMMARY

The magnitude and costs incurred by LBP suggest a need for an urgent and effective treatment for this condition. Chiropractic has demonstrated its potential in combating the problem, however, there are many gaps in understanding the condition. Some questions on how treatment frequency effects the rates of recovery were addressed in this dissertation.

CHAPTER 3

METHODOLOGY

Reproducibility of results is a requirement of modern science. It is therefore important to describe the processes involved in the trial so that it can be repeated. With this in mind the criteria and procedures for treating patients, as well as data collected are described in this chapter.

3.1 EXPERIMENTAL DESIGN

This clinical trial proposed to evaluate the effect of frequent spinal adjustments (three times per week) as opposed to infrequent adjustments (once a week) over a three-week treatment period, in the management of mechanical LBP. The first objective was to appraise the change in the patients' responses to pain intensity and resultant disabilities over the trial period. The second objective was to evaluate treatment frequencies in terms of the level of joint functioning as measured by range of motion and orthopaedic tests. Lastly, to determine the most effective treatment frequency for managing LBP, both subjective and objective outcome measures from each consultation were compared.

Subjects were recruited by advertising in local newspapers, radio stations, at the Technikon Natal Campus and at local sports clubs and gyms. The advert indicated free treatment would be given to patients suffering from mechanical LBP. When they replied, the applicants had the research programme explained to them and the initial consultation was arranged. At this consultation the applicants were screened for compliance with the inclusion and exclusion criteria. These criteria were as follows:

INCLUSION CRITERIA

- patients currently suffering from mechanical LBP.
- patients diagnosed with lumbar facet syndrome, SI syndrome or a combination of these two conditions as set out by Kirkaldy-Willis (1988:133-137) - described in Chapter 2.

EXCLUSION CRITERIA

- subjects who exhibited contra-indications to spinal manipulative therapy (Gatterman, 1990:67) – described in Chapter 2,
- subjects presenting with hard neurological signs (Gatterman, 1990:70),
- subjects younger than 21 years and older than 55 years were excluded from the study. This criterion ensured greater homogeneity of the two treatment groups.
- subjects currently receiving either physical therapy and/or drug therapy for their LBP were excluded from the trial.
- Subjects unable to present at the Natal Tecknikon Chiropractic Day Clinic for their prescribed appointments were excluded from the trial.

Sixty subjects were selected who complied with the inclusion and exclusion criteria. A method of simple consecutive randomisation resulted in two samples of 30 subjects each. One group was the three times per week treatment group (Frequent Treatment Group) and the other the once a week treatment group (Infrequent Treatment Group). Treatments were scheduled for the following three weeks. Patients in the Frequent Treatment Group were scheduled nine treatments and those in the Infrequent Treatment Group were scheduled three treatments in total.

The dysfunctional joints were identified using orthopaedic tests and by motion palpation as described by Schafer and Faye, (1989:211-216; 256-259). The orthopaedic tests utilised to diagnose facet syndrome were Kemp's test (Gatterman, 1990:141) and the lumbar facet challenge (Gatterman, 1990:29 and 84). Diagnosis of sacroiliac syndrome was made using the Patrick Faber test (Magee, 1992:343), Gaenslen's test (Magee, 1992:319) and the Posterior Shear test (Broadhurst and Bond, 1997).

Motion palpation of the lumbar spine was used before each treatment to distinguish dysfunctional joints at the time (Schafer and Faye, 1989:211-216; 256-259). Motion palpation was accepted as a sufficiently precise technique for the assessment of intervertebral movement (Evans, 1994:545). Both groups received 5 minutes' soft tissue therapy to the low back and an adjustment to the fixated vertebrae.

For facet joint dysfunction the 'lumbar roll/pisiform-mamillary' technique was used (Szaraz, 1990:9.1). If on two attempts there was no audible release from the joint, then the sitting lumbar technique was attempted (Szaraz, 1990:9.4). If still no release was obtained using this technique, the lumbar roll was tried again, first with the dysfunctional side up and then on the opposite side. After five attempts the joint was considered to be sufficiently mobilised for the first treatment. If at the second consultation five attempts failed to obtain an audible release then the clinician on duty was called in to assist. If the clinician failed to obtain an audible release from the joint the patient was excluded from the trial. The cavitation process was accepted, for this trial. as a prerequisite to initiate the reflex actions that result from an adjustment (Brodeur, 1995).

Depending on the motion palpation findings, either the flexed or the extended innominate technique was used for sacroiliac joint dysfunction (Szaraz, 1990:9.2-9.3). Again, if after five attempts on the second consultation there was no audible release and the clinician failed to obtain an audible release, the patient was excluded from the trial.

3.2 DATA COLLECTION

Primary data was obtained directly from the patients and consisted of each patient's disability, pain intensity and their lumbar spine ROM, as well as the results of orthopaedic tests. These measurements were used to record the response of the patients to the treatment received. Other information stored in each patients' personal file included:

- a case history (Appendix A),
- details of the physical examination (Appendix B),
- details of the lumbar spine regional examination (Appendix C),
- a signed a consent form (Appendix D);

The former are all used in the Natal Technikon Chiropractic Day Clinic, whilst the consent form is necessary to comply with research regulations.

Journal articles, published reports and books containing information relevant to the research being conducted were utilised. This secondary data was used to contextualise the research, as well as to gain a broader understanding of LBP and conservative treatment for this condition.

Recording of the signs and symptoms of LBP enabled a comparison to be drawn between the two treatment groups. Symptoms recorded were the pain intensity and the level of disability resulting from the low back pain. An indication of the functioning of the SI and facet joints was obtained by measuring lumbar spine range of motion and the number of positive orthopaedic tests.

Data were collected once a week, which resulted in four readings for each outcome measure (Table 3.).

Table 3.	**Times of Data Collection**	
Week	**Frequent Treatment Group**	**Infrequent Treatment Group**
1	First consultation	First consultation
2	Before 4th treatment	Before 2nd treatment
3	Before 9th treatment	Before 3rd treatment
4	Week following last consultation	Week following last consultation

3.2.1 SUBJECTIVE OUTCOME MEASURES

Questionnaires assessing the patient's disability and intensity of pain reflect the patient's perceived discomfort. It is these symptoms which motivate the patient to seek treatment, hence monitoring the symptoms' changes gives an indication of treatment success. The Numerical Pain Rating Scale-101 and the Oswestry Low Back Pain Index, have been accepted as valid and reliable measurement criteria when assessing the management of LBP (Triano et al., 1992).

i) The Numerical Pain Rating Scale-101 (NRS-101)

This questionnaire requires patients to mark on a scale when their pain is at its worst and when it is at its least. The scale runs from zero (indicating 'no pain at all') to one hundred (indicating 'pain as bad as it could be'). The value used in this trial was the average of the two scores which reflects the mean pain intensity level experienced (Appendix E). The NRS-101 is suggested as the most practical index to use, when compared to six other methods of measuring clinical pain intensity, according to Jenson et al. (1986).

ii) The Oswestry Low Back Pain Disability Questionnaire

The Oswestry Low back Pain Disability Questionnaire is a well-tested and established means of assessing disability (Fairbank et al., 1980). It shows satisfactory reliability and validity when compared to other disability questionnaires (Enebo, 1998). This questionnaire consists of ten sections of six questions each. The point distribution ranging from zero (if the first statement was chosen), to a maximum of 5 points for each section. A total of 50 points was the maximum for the entire questionnaire. Upon completion, the sum of the points was converted to a percentage for each patient, for the particular consultation (Appendix F). In the event that one section, or more, was not completed, the total score was then reduced by 5 fewer points per unanswered section before converting to a percentage (Fairbank et al., 1980). These scores were calculated and recorded in the patient's file at the time of data collection.

3.2.2 OBJECTIVE OUTCOME MEASURES

Objective measures evaluated the effect the different treatment frequencies had on altering SI and facet joint dysfunction. Objective measures are not affected by the patient's perception of their condition hence responses cannot be exaggerated or underplayed. However, the researcher must bear in mind the patient's susceptibility to motivation (Bolton, 1994). Objective measures used in conjunction with subjective measures represent the condition more completely than either process alone.

i) Lumbar Spine Range Of Motion (ROM)

Mcgregor et al. (1998) found that the diagnosis, pain characteristics, symptom severity, and level of disruption were related to the resulting motion measurements. The strength of these relationships was not as strong as anticipated (accounting for 16-45% of the variability). Thus the other outcome measures need to be used in conjunction with ROM measurements. The BROM II goniometer (Performance Attainment Associates, 3600 LaBore Road, Suit 6, St. Paul, MN 55110-4144) was used to measure lumbar spine ROM. Forward flexion and lateral bending were measured, as these movements were shown to be the most reliable measurements using the BROM II goniometer (Breum et al., 1995). An increase in the numerical value from the goniometer readings indicated an increase in ROM. This increase was interpreted as positive response to treatment.

ii) Orthopaedic Rating Scale

Orthopaedic tests were used to identify the clinical lesions of lumbar facet syndrome and sacroiliac syndrome. Each of the tests used is described below.

- **Kemp's test** includes a combined extension and lateral bending over the facet joints (Giles, 1997:346). This was carried out with the patient in a seated position. The examiner reaches around the patient's shoulders from behind and extends the patient maximally to the right, then to the left. Axial compression is then applied with the patient in this position. Pain in the lumbar region is indicative of a positive test (Gatterman, 1990:141).

- **Lumbar facet joint challenge** is performed with the patient prone. 'Springing' the spinous process discerns the status of the facet joints. The examiner places a thumb on the spinous process tip and pushes, varying the force. If there is no pain response to gentle pressure the examiner applies more pressure over the joint. It is this 'springiness' of the joint which one palpates for when performing facet joint challenge. The patient tests positive if there is tenderness and pain when light pressure is applied (Gatterman, 1990:84).

- The **Patrick Faber test** is carried out with the patient lying supine. The examiner positions the patient's test leg so that the foot of the test leg is on top of the knee of the opposite straight leg. The examiner then slowly lowers the test leg in abduction towards the examining table, while the opposite hand stabilises the pelvis at the anterior superior iliac spine (Magee, 1997:473). A negative test is indicated when the patient experiences no pain as the test leg is lowered towards the table. A false positive indicates possible hip joint or thigh adductor pathologies. A true positive test is when the patient experiences pain in the SI joint on abduction of the test knee. If positive, pain is located over the SI joint thus indicating SI dysfunction.

- The **Gaenslen's test** is described by Magee (1997:446), with the patient lying supine. 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 into extension. The other leg is tested in a similar fashion for comparison. Pain in the SI joints is indicative of a positive test.

- The patient lies prone for the **Yeoman's test**. The examiner applies a firm pressure over the patient's SI joint with one hand, whilst the other hand flexes the patient's leg on the same side. The patient's other thigh is hyperextended by lifting the patient's knee off the examining table (Schafer and Faye, 1990:271). If pain is increased in the SI area, it indicates a SI dysfunction, and a positive test result.

- The **Posterior Shear test** requires the patient to be supine. The hip is flexed and adducted while the examiner applies a force by pushing posteriorly along the line of the femur, thus stressing the SI joint (Laslett and Williams, 1995). The test is positive when there is pain over the SI joint or a reproduction of the patient's symptoms.

There were twice as many tests for the SI syndrome as for the facet syndrome. Hence a positive test for SI syndrome scored 10 points, whilst the two tests for lumbar facet syndrome each scored 20 points when positive. The total possible score for the orthopaedic rating scale was thus 80 (40 possible points for all positive SI tests, and 40 possible points for all positive facet tests). A decrease in the numerical value from the orthopaedic rating scale correlated with a decrease in positive orthopaedic tests and therefore an improvement in the patient's condition. The benefit of developing such a scale was to enable an objective recording of the orthopaedic test results and consequentially a comparison of joint function could be drawn between different treatments and between the two treatment groups.

3.3 DATA ANALYSIS

Inter and intra group comparisons were made using the computer statistical package SPSS version 9.0 (SPSS inc. 1999. SPSS base 9.0. users guide SPSS inc.: Chicago. 740p. ISBN: 0-13-02030-4). Parametric tests (unpaired t-test and the paired t-test) were used to analyse data from the NRS-101 questionnaire, the Oswestry Low Back Pain Disability questionnaire and data obtained from the BROM II goniometer. The sample size of the orthopaedic rating scale subgroups was less than 30 and this necessitated the use of non-parametric tests (Wilcoxin Signed Rank test and the Mann-Whitney U-test).

The procedures, treatment and outcome measures describe the proceedings of this trial so that reproducibility can be obtained.

CHAPTER 4

RESULTS

Statistical analyses of the patient recovery parameters were carried out to assess the clinical effects of the two different treatment frequencies. Both inter and intra group comparisons were drawn. At a 95 % level of confidence there was no statistical difference between the amount of pain, disability, ROM or joint dysfunction recorded for either treatment group. Mean measurement values for each group indicated greater improvement was made by the Frequent Treatment Group than by the Infrequent Treatment Group.

4.1 DATA COLLECTED

Data was collected before the trial commenced (*week*$_1$), after each week of treatment (*week*$_2$ and *week*$_3$), and in the week following the last treatment (*week*$_4$). Subjective and objective data were collected for each patient. Subjective data included measurements on pain intensity and level of disability experienced by the patient. Objective data were obtained from the goniometer readings (ROM) and an orthopaedic rating scale (joint dysfunction). Tests and questionnaires used in this dissertation are tabulated below .

<table>
<tr><th colspan="4">Table 4.1 Tests and questionnaires employed for data collection</th></tr>
<tr><th>Data type</th><th>Variables measured</th><th colspan="2">Tests</th></tr>
<tr><td rowspan="2">Subjective</td><td>Pain Intensity</td><td colspan="2">Numerical Rating Scale 101</td></tr>
<tr><td>Disability</td><td colspan="2">Oswestry Low Back Pain Disability Index</td></tr>
<tr><td rowspan="9">Objective</td><td rowspan="3">Lumbar Spine Range of Motion</td><td colspan="2">Forward flexion</td></tr>
<tr><td colspan="2">Right lateral flexion</td></tr>
<tr><td colspan="2">Left lateral flexion</td></tr>
<tr><td rowspan="6">Orthopaedic Rating Scale</td><td rowspan="4">Sacroiliac tests:</td><td>Patrick Faber</td></tr>
<tr><td>Yeoman's test</td></tr>
<tr><td>Gaenslen's test</td></tr>
<tr><td>Posterior Shear test</td></tr>
<tr><td rowspan="2">Lumbar Facet tests:</td><td>Kemp's test</td></tr>
<tr><td>Facet Challenge test</td></tr>
</table>

Homogeneity of the two samples is necessary for a valid comparison of the effect treatment frequency has on LBP. Variables that may affect the response to treatment are difficult to control. However, the age and sex of the patients were recorded to analyse any irregularity in these two variables which may have occurred.

The majority (43.3%) of the study population was between 40 and 49 years of age. Age ranges found in this study are in keeping with Burton and Cassidy (1992), who state that back pain reaches a maximal frequency during middle age. The Frequent Treatment Group had a majority of patients between 30 and 39 years of age, whereas the Infrequent Treatment Group had a predominance of patients over 40 years (Figure 4.1).

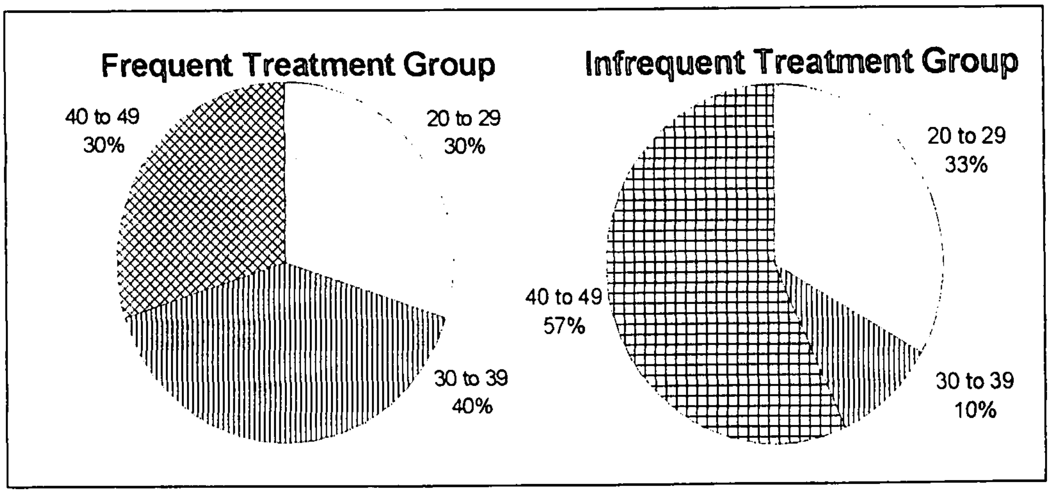

Figure 4.1 **Age distribution of the patients in the Frequent and Infrequent Treatment Groups**

Although the age distribution between the two groups was different the mean age of the two groups was similar. The mean age of the Frequent Treatment Groups was 34 years and of the Infrequent Treatment Group was 38 years. Hence, age is unlikely to have skewed the results significantly.

Mathews (1995) used a wider age range (18 to 65 years of age), which accounts for the older mean age. The narrower age range of this study has improved homogeneity of the groups. With regard to gender, Mathews (1995) had a predominance of males (60%). The slight predominance of female patients in this study is in keeping with the findings of

Gemmel and Jacobson (1990) with a greater proportion of females (58.3%) suffering from LBP.

The study population of this trial was fairly homogeneous in terms of age and sex. However, there are other variables which can affect the efficiency of treatment. Duration of the complaint is an important consideration, as chronic complaints take longer to heal than acute conditions (Triano, 1995). Occupations which cause repetitive trauma to the lumbar spine may also interfere with the recovery process (Pustaver, 1994). The specific clinical diagnosis and joints involved in the condition need to be homogenous, in this case either only SI syndrome or lumbar facet syndrome patients should be accepted onto the trial. To avoid one group having a predominance of these factors it is recommended that they be controlled in future studies.

4.2 INTER-GROUP ANALYSIS OF PAIN INTENSITY AND DISABILITY

The first objective was to determine if the patients' experience of pain and disability associated with the LBP was significantly different between the two groups.

Data from the Numerical Rating Scale 101 (NRS-101) were used to analyse the change in pain intensity experienced over the treatment period. Patient disability was examined using the Oswestry Low Back Pain Disability Index. A statistical analysis determined whether there was a significant difference between the two groups at the time of the initial ($week_1$) and final ($week_4$) consultations. The average of the four readings taken for each patient was calculated and inter-group comparisons were then also made with these data.

The unpaired t-test (two sample analysis) was used as the NRS-101 data is a continuous outcome measurement and the sample size was 30, ($n \geq 30$) (Table 4.2). The level of confidence in the difference between the two groups was accepted as 95 % (5 % level of significance). The null hypothesis (H_0) states there is no difference in the pain intensity and daily function experienced by the two groups, over the treatment period. If however, one groups' results differ significantly from the other group's, then the alternative hypothesis (H_1) will be accepted.

Table 4.2 Inter-group analysis of Numerical Rating Scale 101 and Oswestry Disability Questionnaire data		
Time of data collection	**P Value (unpaired t-test)**	
	NRS 101	**OSWESTY**
Before treatment - *week*$_1$	0.167	0.278
After treatment - *week*$_4$	0.057	0.083
Average - $(week_1+_2+_3+_4)$ / 4)	0.575	0.667
Decision rule: If $p < 0.05$, reject H_0	If $p \geq 0.05$, accept H_0	

Despite the Frequent Treatment Group receiving 6 more treatments than the Infrequent Treatment Group, the relief from pain and disability experienced was similar. Thus, the null hypothesis is accepted at the 95 % level of confidence. If patients perceive infrequent treatments as efficient as frequent treatments in reducing pain and disability, then fewer treatments would be preferred because of possible financial savings. However, in assessing the efficiency of treatment the objective findings also need to be considered because they do not simply record the palliative effects of treatment but the functioning of the joint. In this way the problem can be assessed for more longterm benefits from treatment.

4.3 INTER-GROUP ANALYSIS OF JOINT DYSFUNCTION

The second objective was to determine whether or not joint function was significantly different between the two groups after treatment. Joint function was assessed using measurements of lumbar spine mobility and orthopaedic tests.

The unpaired t-test (two sample analysis) analysed the difference in mobility between the two treatment groups. Data evaluated using this test were recorded before the treatment commenced (*week*$_1$), after the treatment concluded (*week*$_4$) and an average of each patient's four readings was also examined. A parametric test was utilised, as the sample size was 30 patients and the outcome measure (goniometer readings) was continuous (Table 4.3). A difference between the two groups was accepted at a 95 % level of confidence. The null hypothesis (H_0) states there is no difference between the amount of flexion measured in either group after treatment. On the contrary, if there is a significant difference between the recorded mobility of either group, then the alternate hypothesis (H_1) will be accepted.

Table 4.3 Inter-group analysis of the lumbar spine range of motion			
Time of data collection	P-Value (unpaired t-test)		
	Forward Flexion	Right Lateral Flexion	Left Lateral Flexion
Before treatment - $week_1$	0.592	0.833	0.933
After treatment - $week_4$	0.708	0.333	0.183
Average - $(week_1+_2+_3+_4) / 4$	0.364	0.134	0.532
Decision rule: If $p < 0.05$, reject H_0	If $p \geq 0.05$, accept H_0		

There is no statistical difference between the two groups for the three degrees of freedom measured. Thus the null hypothesis is accepted at the 5 % level of significance. It is clear that frequent chiropractic treatment does not significantly increase the amount of forward and lateral flexion than less frequent treatment does. An average of each patient's four readings shows no significant difference, suggesting the amount of flexion is not particularly affected by treatment frequency.

Joint dysfunction was also measured by recording the number of positive orthopaedic tests. Numerical values were assigned to the positive orthopaedic tests conducted. The Mann-Whitney U-test compared the effect treatment frequency had on dysfunctional joints as monitored on the orthopaedic rating scale (Table 4.4). This test was used as subgroups had fewer than 30 patients and the rating scale was an ordinal outcome measurement. Averages for each patient in each subgroup were calculated and compared between the groups. The initial and final consultation scores were also analysed at a 5 % level of significance. The null hypothesis (H_0) states that there is no significant difference between the measured joint dysfunction of either group. If one group experiences significantly less pain when the joints are stressed after the treatment period than the other group, then the alternative hypothesis (H_1) will be accepted.

Table 4.4 Inter-group comparison of Orthopaedic Rating Scale results			
Time of data collection	**P-value (Mann-Whitney U-test)**		
	SI joint Subgroup	**Facet joint Subgroup**	**Combination Subgroup**
Before treatment - *$week_1$*	0.662	0.114	0.156
After treatment - *$week_4$*	0.004	0.888	0.439
Average - $(week_{1+2+3+4}) / 4$	0.312	0.792	0.753
Decision rule: If $p < 0.05$, reject H_0		If $p \geq 0.05$, accept H_0	

Before the trial, the study population demonstrated similar pain provocation when the facet and SI joints were stressed. When the scores obtained from the initial consultation (*$week_1$*) were analysed there was no significant difference between the two groups. This suggests that the amount of joint dysfunction for either group was comparable.

Analysis of scores from the final consultation (*$week_4$*) for the SI subgroup indicates a difference between the two groups at the 5 % level of significance. Thus the alternative hypothesis is accepted, namely, that there is a difference between the effects of treatment frequency visible in the two groups. Hence, for patients with SI dysfunction. more frequent treatments reduce SI joint pathology more quickly than infrequent treatments.

A comparison of the averages of the four readings, taken for each patient suffering from SI syndrome indicates no significant difference. This implies that a significant difference between the number of positive orthopaedic tests is only apparent after the three-week treatment period, and not at the 2^{nd} or 3^{rd} week consultations.

For the other two subgroups the null hypothesis is accepted, as there is no significant difference in the number of positive orthopaedic tests when comparing the two groups. This implies that less frequent treatments are as effective as frequent treatments in restoring joint function to the lumbar facet and the combination of SI joint and lumbar facet joints.

Statistical analyses of objective outcome measures, assessing ROM and joint function, have similar results to the analysis of the subjective data. Treatments once a week are as effective in reducing the signs and symptoms of LBP as are more frequent treatments. Findings of the SI subgroup are the exception, demonstrating a significant improvement in SI function after receiving more frequent treatment. The small sample size for each of the three subgroups, SI joint, lumbar facet joint and the combination of each, may cause a statistical error (Type II Error). Such an error would result in incorrectly rejecting the null hypothesis and erroneously recording measured joint dysfunction as being significantly different, when it is not.

4.4 INTRA-GROUP ANALYSIS

Frequent and Infrequent Treatment Groups were analysed for significant improvements that occurred during the trial. Changes that occurred for each outcome measure were compared to the changes made by the other treatment group. Mean values obtained for pain intensity, disability, ROM and joint dysfunction were calculated for each treatment group. The pattern that emerges from the mean values is that the Frequent Treatment Group improved more than the Infrequent Treatment Group did.

4.4.1 INTRA-GROUP ANALYSIS OF PAIN AND DISABILITY

Pain intensity and disability were the two symptoms measured. Data obtained on the changes in these two symptoms were analysed by comparing the initial consultation results with those gathered after the treatment period (Table 4.5). Perceived reduction in pain intensity and the patients' capacity to perform specific tasks was assessed. The null hypothesis (H_0) states that there is no significant improvement in joint function or in the reduction in pain experienced by either group. A significant improvement by the final consultation when compared with the initial consultation, is the alternative hypothesis (H_1). The level of significance was again set at 5 %, ($\alpha = 0.05$).

Table 4.5 Intra- group analysis of Numerical Pain Rating Scale-101 Pain and Oswestry Disability Questionnaire data		
Treatment Group	**P Value (paired t-test)**	
	NRS 101	**OSWESTRY**
Frequent	0.000	0.000
Infrequent	0.000	0.000

Decision rule: **If $p < \alpha$, reject H0** **If $p \geq \alpha$, accept H0**

(i) p = (reported p-value) /2 If H1 is of form > and z is positive

If H1 is of form < and z is negative

(ii) p= 1 – (reported p-value) /2 If H1 is of form > and z is negative

If H1 is of form < and z is positive

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

Both the Frequent and Infrequent Treatment Groups show a significant decrease in the amount of pain and disability experienced after the treatment period. Thus the null hypothesis is rejected and the alternative hypothesis accepted for both groups at the 95 % level of confidence.

Considering the mean figures obtained from the NRS-101 questionnaires at the initial (*week*$_1$), during (*week*$_3$) and after treatment (*week*$_4$) consultations, it is evident that patients experienced less pain after receiving more frequent treatments (Figure 4.2).

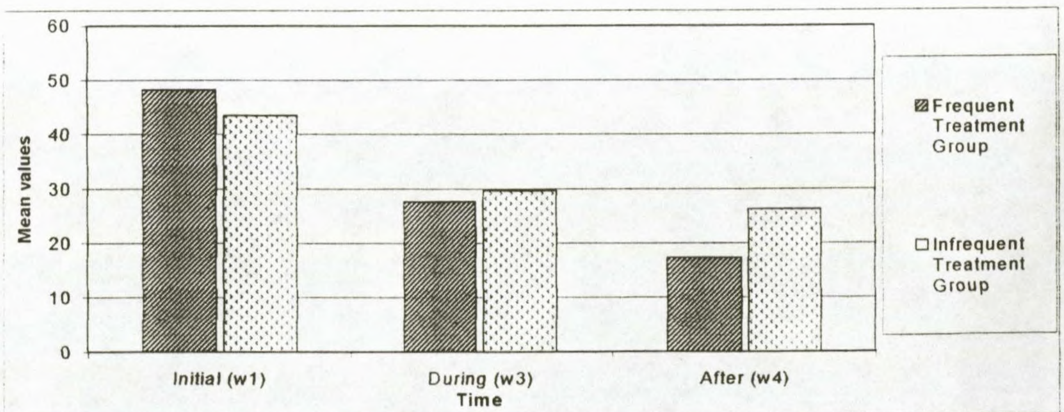

Figure 4.2 **Mean values of the Numerial Pain Rating Scale-101 Questionnaire**

The mean improvement in pain intensity levels over the three-week trial period was 31 % for the Frequent Treatment Group and 17.2 % for the Infrequent Treatment Group. Although the Frequent Treatment Group received three times the number of treatments, their relief from pain was only double that experienced by the Infrequent Treatment Group. Number of treatments and amount of pain reduction are therefore not in direct proportion.

When the mean values for each group's disability are compared, the Frequent Treatment Group was able to perform their daily activities with greater ease than the Infrequent Treatment Group was (Figure 4.3).

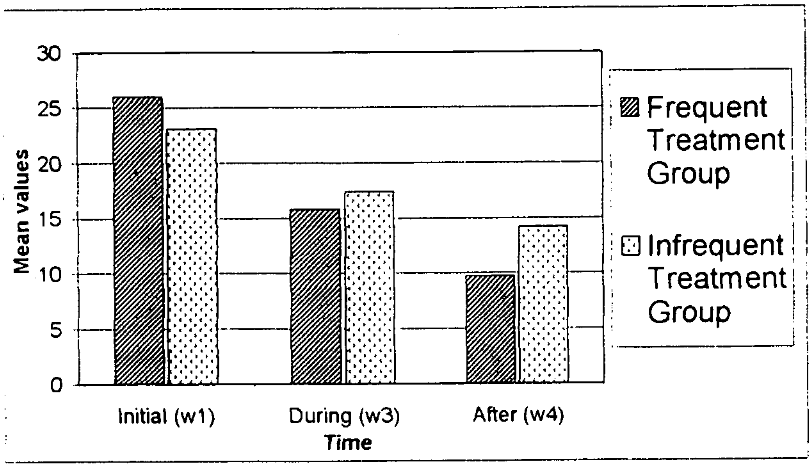

Figure 4.3 **Mean values of the Oswestry Low Back Pain Disability Index**

Mean performance improvement of routine daily activities for the Frequent Treatment Group was 32.5 % and for the Infrequent Treatment Group was 17.8 %. Reduction in disability was greatest for the Frequent Treatment Group. This indicated that frequent treatments were more effective in improving functionality than infrequent treatments. However, like the NRS-101 mean results, the number of treatments is not in direct proportion to the decrease in disability. Further information is required in order to determine the superior treatment frequency. A comprehensive evaluation of costs incurred from absence from work and reduced productivity resulting from LBP need to be considered. Only with this information can the superior treatment frequency be determined.

4.4.2 INTRA-GROUP ANALYSIS OF RANGE OF MOTION AND JOINT DYSFUNCTIONS

Signs of LBP, namely lumbar facet and SI joint dysfunction, were measured. This enabled comparisons to be drawn on the effect the two treatment frequencies have on joint dysfunction. An orthopaedic rating scale and goniometer readings were used to quantify the reduction of dysfunction. Improvement in joint functioning for each group was assessed by a comparison of data from the final consultation (*$week_4$*) with initial data (*$week_1$*).

The paired t-test was used to compare the goniometer readings recorded for each group (Table 4.6). Confidence in the statistical tests was set at the 95 % level. The null hypothesis (H_0) states that there is no significant increase in the amount of flexion and number of negative orthopaedic tests on the final consultation as compared to the initial consultation. If there is a significant improvement in these factors then the alternative hypothesis (H_1) is accepted.

Table 4.6 Intra-group comparison of the goniometer readings.

Treatment Group	P-values (paired t-test)		
	Forward Flexion:	Right Lateral Flexion	Left Lateral Flexion
Frequent	0.000	0.000	0.000
Infrequent	0.004	0.001	0.006

Decision rule: If $p < \alpha$, reject H_0 If $p \geq \alpha$, accept H_0

(i) $p = {}^{(\text{reported p-value})}/_2$ If H_1 is of form > and z is positive

If H_1 is of form < and z is negative

(ii) b $p = {}^{1 - (\text{reported p-value})}/_2$ If H_1 is of form > and z is negative

If H_1 is of form < and z is positive

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

Significant improvement is evident in the goniometer readings of the lumbar spine ROM of both groups in all three degrees of freedom measured. Thus the alternative hypothesis is accepted at the 95 % level of confidence. Both treatment frequencies have a beneficial effect on lumbar spine ROM.

The frequent treatment programme however enabled a larger amount of flexion than the infrequent treatment programme, although insufficient to be significant at the 95% level of confidence (Figure 4.4).

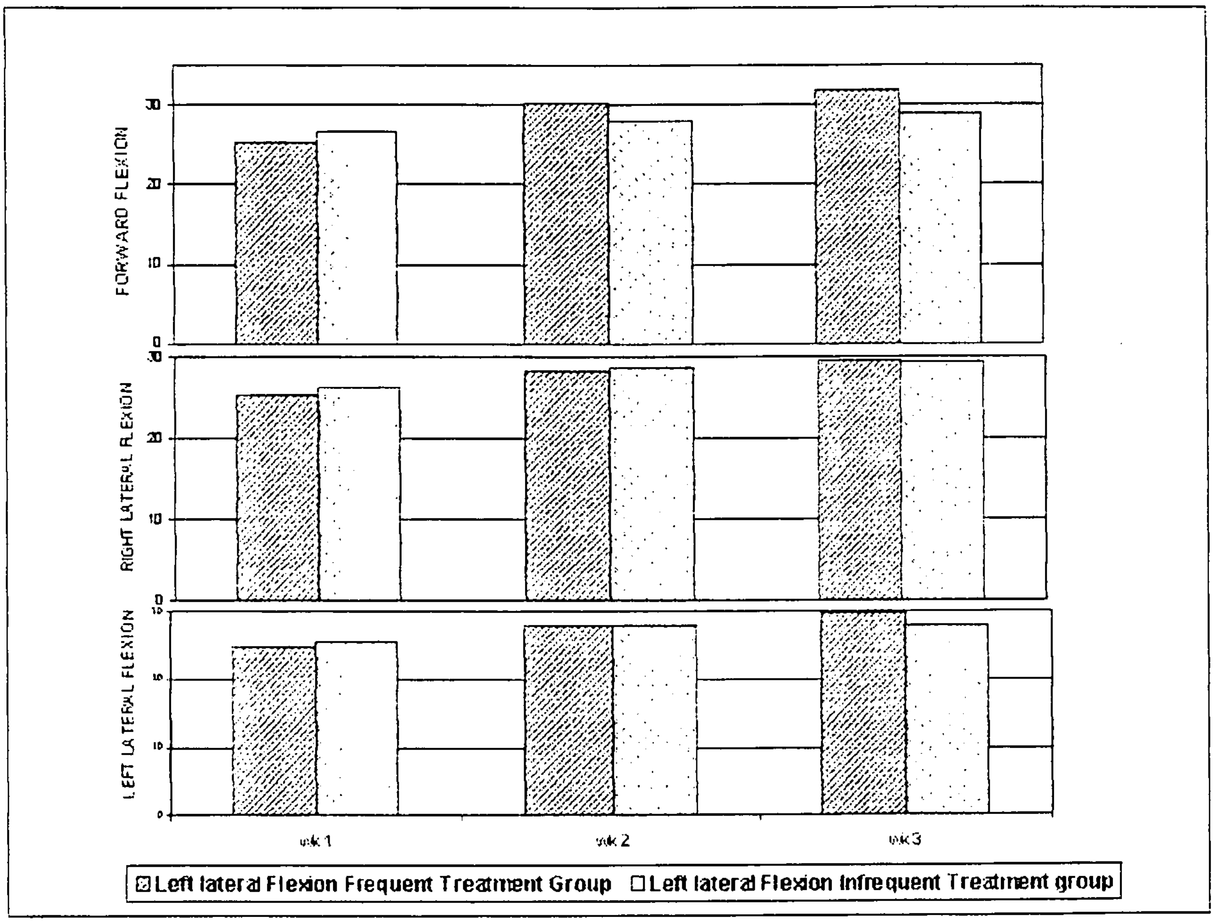

Figure 4.4 Mean of the goniometer readings of the lumbar spine ROM of both groups in all three degrees of freedom measured, (a) forward flexion; (b) right lateral flexion and (c) left lateral flexion

Joint function was also measured by recording the number of positive orthopaedic tests which assessed the lumbar facet and SI joints. The Frequent and Infrequent Treatment Groups were divided into three subgroups, namely the SI subgroup, the facet subgroup and a combination subgroup. Sample size of each subgroup was less than 30 so non-parametric tests were used to analyse the data. Wilcoxin Signed Rank Test was used to compare the final (*week*$_4$) and initial (*week*$_1$) scores on the orthopaedic rating scale obtained for each subgroup of each Treatment Group (Table 4.7).

Table 4.7 Intra-group comparisons of the orthopaedic rating scale scores

Treatment Group	P-values (Wilcoxin Signed Rank test)		
	SI joint Subgroup	Facet Subgroup	Combination Subgroup
Frequent	0.024	0.039	0.001
Infrequent	0.180	0.001	0.010
Decision rule:	If $p < \alpha$, reject H_0	If $p \geq \alpha$, accept H_0	
(i)	$p = {}^{(\text{reported p-value})}/_2$	If H_1 is of form > and z is positive If H_1 is of form < and z is negative	
(ii) b	$p = {}^{1-(\text{reported p-value})}/_2$	If H_1 is of form > and z is negative If H_1 is of form < and z is positive	
(The reported p-value is the SPSS print out value of p).			

The SI subgroup in the Frequent Treatment Group showed a significant improvement in the measurable joint dysfunction, thus the alternative hypothesis is accepted. Frequent treatments appear to be more effective than infrequent treatments in reducing SI joint dysfunction. For the Infrequent Treatment Group the null hypothesis is accepted, as the difference in joint function was below the 95 % level of statistical significance.

Results from the orthopaedic rating scale for the SI subgroup was the only measure in which a significant difference was found between the two treatment groups. The number of patients in this subgroup was small (11), thus there is a chance of incorrectly rejecting the null hypothesis (Type II Error). However, mean values depict that the Frequent Treatment Group had fewer positive orthopaedic tests than the Infrequent Treatment Group did at the end of the trial period (Figure 4.5). It is therefore unlikely that a Type II Error occurred.

Figure 4.5 **Mean values of the orthopaedic rating scale for the sacroiliac joint subgroup.**

In the lumbar facet subgroup the inverse applies, as the null hypothesis is accepted for the Frequent Treatment Group and rejected for the Infrequent Treatment Group. There was no significant improvement in the facet joint dysfunction for the Frequent Treatment Group. However, for the Infrequent Treatment Group facet joint dysfunction improved significantly. These findings imply that less regular treatment is more effective in reducing facet joint dysfunction than frequent treatments.

In contrast to the results of the statistical test, the mean number of positive orthopaedic tests for the facet subgroup of the Frequent Treatment Group show a greater improvement than the Infrequent Treatment Group (Figure 4.6). This disparity in results may be due to the small sample size of the subgroup and uneven distribution of patients between the treatment groups (6 patients in the Frequent Treatment Group and 15 patients in the Infrequent Treatment Group). The small number of patients may have resulted in incorrectly rejecting the null hypothesis (Type II Error).

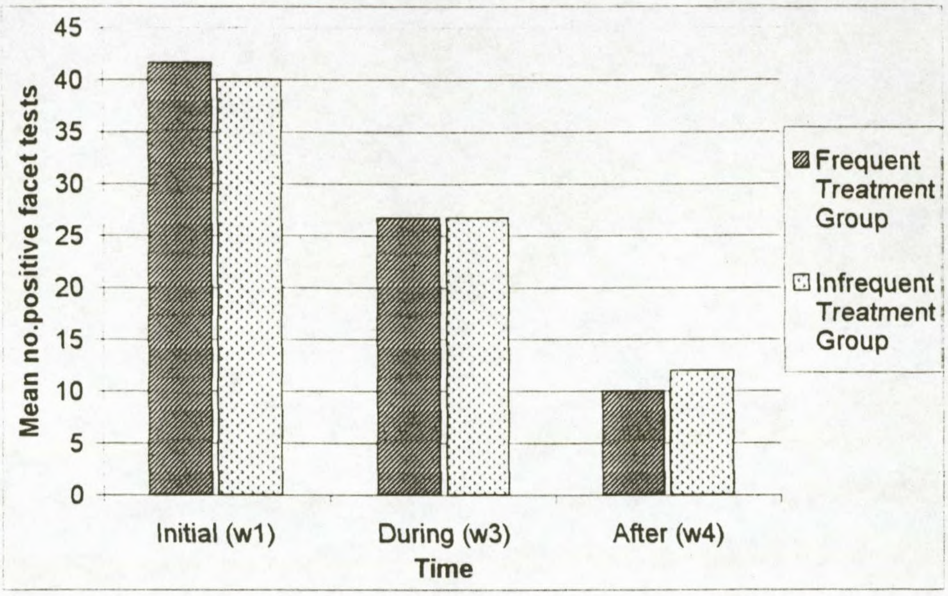

Figure 4.6 **Mean values of the orthopaedic rating scale for the lumbar facet subgroup.**

The combination subgroup showed significant improvements in the number of positive orthopaedic tests after the trial for both treatment groups (Table 4.7). Thus both treatment frequencies were effective in reducing joint dysfunction in patients suffering from a combination of SI joint and facet joint dysfunction.

The Frequent Treatment Group however, shows a greater improvement in the mean number of positive tests (Figure 4.7). This suggests that the more frequent treatments enable quicker improvements in joint function than the less frequent treatments.

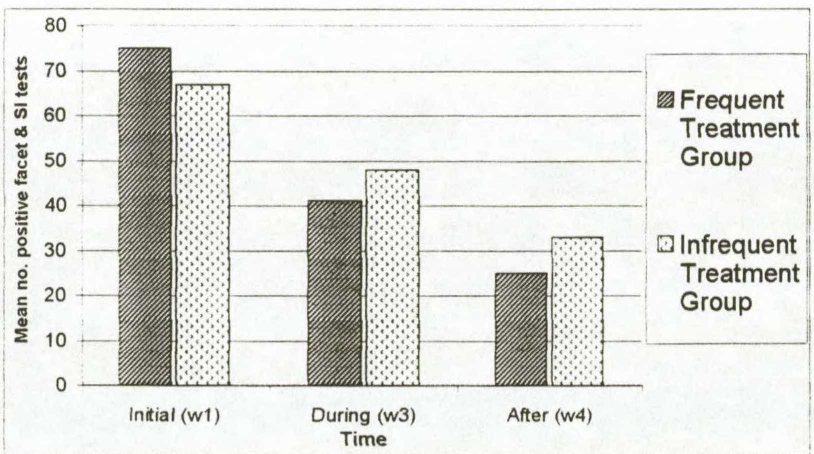

Figure 4.7 **Mean values of the orthopaedic rating scale for the combination (sacroiliac and lumbar facet syndrome) subgroup.**

Lumbar spine ROM and results from the orthopaedic rating scale which assessed joint function recorded a significant improvement for both treatment groups over the trial period. The two exceptions, without significant joint function improvement, were the SI subgroup of the Infrequent Treatment Group and the facet subgroup of the Frequent Treatment Group. Sample size of the subgroups was small ($n < 15$) and so statistical errors were possible (Type II Error).

Analysis of treatment frequency indicates there is no significant difference between the frequent and infrequent treatment protocols, in terms of either subjective or objective results.

The orthopaedic rating scale and specifically the SI joint subgroup was the only measurement to indicate a significant difference between the efficiency of the two treatment protocols. Significantly fewer positive orthopaedic tests were recorded for the Frequent Treatment Group after the trial than for the Infrequent Treatment Group. If the alternative hypothesis was correctly accepted then the Frequent Treatment Group experienced significantly SI better joint functioning than the Infrequent Treatment Group did after the trial. For patients with SI syndrome more frequent treatments are superior to infrequent treatments in restoring joint function.

Research to date is inconclusive on the issue of treatment frequency. Further research into the longterm and financial benefits of various treatment frequencies is needed to make the debate on treatment frequency more convincing.

CHAPTER 5

DISCUSSION

Comparisons made with data obtained from this dissertation and other similar studies contextualise this trial's findings within the established database. Cost implications, longterm benefits and other issues surrounding different treatment frequencies are discussed. Included in this discussion is the impact treatment frequency has on the rate of absenteeism and reduced productivity, as well as reoccurrence rates and the prevention of chronicity. These factors need further investigation as they dictate the choice of treatment frequency. Other patient related factors thought to affect the choice of treatment frequency are cited and an attempt is made to define the optimum treatment frequency for mechanical LBP.

5.1 SUBJECTIVE MEASURES

Measurement of pain is essential. as the alleviation of pain is what patients expect from treatment (Bolton, 1994). Accurate measurements are difficult as pain is an experience comprising many parts, having sensory, cognitive and affective dimensions. Patients can exaggerate or underplay their responses to a pain questionnaire for many reasons, some are wanting to 'get better', wanting to 'help' or 'please' the practitioner, wanting sympathy, or less clear secondary gains. From the patients perspective, evaluation of pain and disability levels are the primary means of assessing the success of treatment. These subjective measures are therefore vital in determining the best frequency for efficient and cost effective treatment of mechanical LBP.

5.1.1 NUMERICAL RATING SCALE 101

Results from the unpaired t-test (Table 4.2) are similar to Mathews' (1995) findings, which suggest that neither treatment frequency is superior in reducing pain.

The extra six treatments the Frequent Treatment Group received did not significantly reduce the intensity of pain as compared to the Infrequent Treatment Group. Benefits of frequent treatments are therefore questionable. Balance between cost of treatment and costs owing to absenteeism need to be carefully calculated in conjunction with the patient's interests. Issues that require examination to determine whether or not there are benefits from frequent treatments are:

- any longterm effects, such as the possibility of avoiding chronicity,
- possible reduction in the reoccurrence rate,
- significant differences in functioning and productivity.

Investigations into the possible savings resulting from intensive treatment protocols are required because they may hasten the return of the patients to work (Johnson et al., 1996).

Mathews (1995) had a follow up consultation one month after the last treatment. Data collected at this consultation revealed that the once weekly treatment group had significantly less pain than the three times weekly treatment group. These findings suggest that the pain intensity continued to decrease after the treatment period for the once weekly treatment group.

Benefits of certain treatments which extend beyond the treatment period have been demonstrated in other studies (Meade et al., 1995; Triano et al., 1995). However, the longterm benefits of SMT are still uncertain and require specific investigation.

5.1.2 OSWESTRY LOW BACK DISSABILITY INDEX

SMT has been shown to significantly improve levels of daily functioning, as was found in this dissertation and other trials (Giles and Muller 1999; Triano 1995 and Mathews 1995). The trial by Pope et al. (1994) found no significant differences between SMT and the other forms of treatment used in their trial. They may have found SMT to be a superior means of treating LBP if they had measured disability.

Disability is a vital measurement because the ability to perform daily functions could give an indication of the possible productivity level of the patient. Since there was no significant difference between the two treatment groups of this dissertation, it is unlikely that more frequent treatments would significantly improve productivity levels. Because the study population consisted of patients of varying occupations and varying levels of disability, no direct calculation of productivity rates could be made.

The symptoms of LBP improved slightly more in the Frequent Treatment Group than the Infrequent Treatment Group, although not significantly. The value of these differences needs to be weighed up against the cost of the greater number of treatments. Issues needing investigation to enable this evaluation to be made include, reoccurrence rates, possible prevention of chronicity and productivity rates of patients receiving different treatment frequencies.

5.2 OBJECTIVE DATA

Objective measurements aim to investigate functional changes, which exclude the palliative effects of the treatment received. These measurements help both patient and practitioner to view changes that may have occurred, but which may have been overlooked by the patient due to their preoccupation with their pain. Joint dysfunction as measured using the orthopaedic rating scale and goniometer readings of lumbar flexion were used in conjunction with the pain and functional measurements.

5.2.1 RANGE OF MOTION

Using the modified Schrober technique to measure ROM, Pope et al. (1994) recorded contradictory findings to that of this dissertation regarding the effect SMT has on increasing forward flexion. Although their trial had the same frequency and duration of treatments that the Frequent Treatment Group of this trial did (9 treatments over three weeks) the different means of measuring ROM may be the reason they did not find a significant improvement in forward flexion.

At the one month follow up consultation Mathews (1995) found the once weekly treatment group had continued to improve, but the three times weekly group had not. His findings of continued improvements made by the once weekly treatment group suggest that when less frequent treatments are given the natural history of the condition continues at a measurable rate. In his study the pattern of continued improvements made by the once weekly treatment group was also found in the subjective measures of, although the difference between the treatment groups was not significant at the 95% level of confidence.

5.2.2 ORTHOPAEDIC RATING SCALE

The orthopaedic rating scale, as a means of assessing joint pathology, is as yet untested. There needs to be further development of this measure to ensure the reliability and validity of these results.

Mathews (1995) used a similar means of assessing joint pathology and found no significant difference between the treatment groups after the treatment period. But, on the one month follow up consultation the once-weekly treatment group did improve significantly and the three times weekly treatment group did not. The fact that Mathews (1995) instructed all patients to do two home exercises (pelvic tilt and knee to chest raise) over the duration of the study, may have contributed to the improvements measured at the one month follow up consultation.

The design of this dissertation did not include a follow up consultation, therefore any changes that took place after the treatment period were not recorded. However, within the scope of this trial the superior treatment frequency is once-weekly treatments as the improvement in pain intensity, disability, joint dysfunction and lumbar spine ROM achieved by the Infrequent Treatment Group were comparable to those achieved by the Frequent Treatment Group. Thus the costs of the additional treatments incurred by more frequent treatments were not accounted for with significantly superior recovery rates.

5.3 TREATMENT FREQUENCY GUIDELINES

The development of guidelines must be approached with caution because although guidelines are valuable for providers of care those with other roles other than therapeutic ones, such as employers and medical aid schemes could use them for non-beneficial purposes. The importance of individualised/holistic care could be overlooked if all treatments were prescribed solely in accordance with guidelines based on economical considerations as most important.

Cost implications of LBP are an important consideration, as an economical means of treating LBP will ensure the growth and popularity of the profession. The balance between cost of treatment and costs resulting from decreased productivity due to the LBP need to be carefully calculated. It is not yet certain whether more intensive treatment will enable LBP patients to return to work earlier than those receiving less intensive treatment (Johnson et al., 1996). The study population of this trial consisted of patients with varying levels of disability and occupations. It was therefore not constructive to compare the two treatment group's ability to be productive in their work. Future trials should aim their investigation at patients with similar occupations in order to address the question of economic viability of different treatment frequencies.

Mean results for all clinical measures demonstrated that the Frequent Treatment Group fared better than the Infrequent Treatment Group in post-trial measurements of pain intensity, disability, lumbar spine flexion and joint dysfunction (Figure 4.3; Figure 4.4; Figure 4.5 a, b and c; and Figure 4.6 a, b and c). Although the Frequent Treatment Group had a slightly faster recovery rate, the extra expense of more treatment needs to be justified. Factors justifying extra expenses vary according to the individual. However, certain criteria are applicable, which could guide the practitioner in prescribing the best-suited frequency for that particular patient. These criteria depend on the patient and include:

- **Duration of the complaint** - a factor that greatly influences the number of treatments needed to restore normal functioning (Waddell, 1995). Treatments for LBP patients which are applied at an early stage have the best chance of success (Liebenson, 1992).
- **Occupation of the patient** - does their pain prevent them from functioning sufficiently in their work? Patients who can continue to function productively in their work despite having LBP, may not need the same amount of treatment as those who are prevented from functioning at work. The severity of pain and level of dysfunction needs to be considered within the context of work demands.
- **Patient's attitudes towards their health** - will the patient comply with advice given on rehabilitation techniques, e.g. Williams flexion exercises? Patients who do not make time to care for their backs need more treatment than those who adhere to constructive rehabilitation regimes.
- **Patient's economic situation** - whether or not they are able to afford the extra expenses of more frequent treatments?
- **Patients' personal time limitations** - may call for extra treatments. For example, a patient who is planning to go away for some time may require a short period of intensive treatment before departing. If a patient lives very far from the chiropractor, they may

benefit from a short intensive treatment period during which time they stay in town rather than travel in weekly.

- **Stress levels –** patients undergoing a crisis. such as moving house or preparing for sporting events should receive more frequent treatments than those who are not experiencing a period of heightened anxiety.

The following case summary (Mrs. P.) is an example of when less frequent treatments would be suitable:

<u>Mrs. P.</u>

A 47 year old home executive, with LBP especially over right SI joint and buttock. Vital signs within the normal range. She had a routine check-up including a mammogram 2 months ago, which showed no abnormalities.

Mrs. P. was sewing 12 days ago, when she became aware of a dull ache in her lower back, which she thought would go away. Nearly 2 weeks later she has a constant aching pain in her lower back. The pain is mostly on the right side. There is tenderness over the right SI joint, and a 'burning' pain in her right buttock. The pain is aggravated by sitting, especially on standing up after sitting on the sofa. Her pain is relieved by a hot bath and resting with pillow supporting her knees and hot water bottle on her lower back. She has no leg pain. Previously (7 years ago) she received chiropractic care for LBP, which helped substantially. Mrs. P. has a healthy diet, is a non-smoker and exercises regularly.

On examination: Her right SI joint was tender to touch. Tripod test and straight leg raise tests (SLR) were negative. Patrick Faber, Erickson's, Gaenslen's and the Posterior Shear tests were positive on right. Neurologically she was intact. On the right Gluteus Maximus trigger point 2 was active, as was Gluteus Medius trigger point 1. Motion palpation of the lumbar spine and SI joints revealed a lack of flexion of the right SI joint.

Diagnosis: Acute, moderate, non-traumatic SI syndrome, with concomitant Gluteal trigger points.

The prognosis is good, with resolution expected within 4 to 6 weeks.

The treatment plan designed by the author for Mrs. P. consists of: two treatments in the first week followed by once weekly treatments consisting of mobilization and adjustments to her right SI joint. Myofascial therapy and daily flexion exercises prescribed. Advice would be given on correct sitting posture and how to ensure adequate lumbar support when sewing.

A less intensive treatment frequency was decided upon because the advantages of more frequent treatments are not justified in Mrs. P's specific case. This judgement is based on the fact that her LBP is not preventing her from earning her living and she is able to enjoy reasonable quality of life. She is able to make the time to care for herself as well as being likely to comply with the advice and exercises given to her.

The following case summary (Mrs. T.) is an example of when more frequent treatments would be preferable:

Mrs. T.

A 32-year-old sales representative, presenting with pain in her right buttock and SI area. Her vital signs within the normal range.

Mrs. T. played a squash match on the weekend. Prior to this she had not exercised regularly for 3 years. Her pain is a constant aching pain over her right SI joint and buttock area. Sitting in the car aggravates the pain. She has a demanding job, which involves travelling long distances daily. She makes little or no time to relax and care for her self. Her diet consists of one large meal at night and 5 to 6 cups of coffee during the day; she also smokes 30 cigarettes daily. She has had one previous episode of LBP, which was after the birth of her son 2 years ago. She received chiropractic care then and has been pain free for 18 months.

On examination: Tender right SI joint. Patrick Faber, Erickson's, Gaenslen's, Posterior Shear tests positive on right. SLR and Tripod tests negative, no leg pain, neurologically intact. Right lateral piriformis trigger point active, on motion palpation the right SI joint was found to be fixed in flexion.

Diagnosed with acute moderate, traumatic SI syndrome and concomitant piriformis myofascitis.

Her prognosis is good with resolution expected within 4 to 6 weeks.

The treatment plan designed for Mrs. T. consists of: 3 treatments the first week followed by twice weekly treatments for the next 3 to 4 weeks, consisting of mobilization and adjustments to her right SI joint. Myofascial therapy and daily flexion exercises prescribed. She also received advice on correct sitting posture and how to ensure adequate lumbar support when driving.

The advantages of the more frequent treatments are justified in Mrs. T's case because her quality of life is substantially reduced as a result of the LBP. She is unlikely to comply with the advice and exercises prescribed for her, because of her busy lifestyle and attitude towards her health. The effects of the treatments received may not be sustained due to possible re-injury and guarding of the vulnerable joint, as a result of 'pushing' herself to keep up with the demands she places on herself.

In order to accurately develop clinical guidelines the diagnosis of the dysfunctional joints would have to be specific. Differentiating the source of the mechanical LBP is important as the specific components may respond differently to treatment. Numerous environmental and psychological factors such as occupation, economic situation, stress levels and the patient's attitude to health, need investigation to determine to what degree they affect the efficiency of treatment.

Historically the profession has encouraged a holistic and individualised approach to health care. The advantage of this individualised treatment is beneficial to both patient and practitioner. From the patient's perspective they have greater chance of receiving treatment which will meet their needs. The chiropractor is constantly challenged to exercise judgement on what the best approach will be in treating a specific patient. In order to achieve the freedom to make informed decisions regarding treatment issues such as treatment frequency, the practitioner needs to be constantly updated on trials investigating the various treatment options. The most appropriate means both for observing and upgrading clinical judgements is from the evaluation of prospective data (Triano et al., 1992).

CHAPTER 6

RECOMMENDATIONS AND CONCLUSIONS

Questions patients often ask the chiropractor is how long and how many treatments are required to treat their specific condition. By gathering data on the effect once weekly treatment and three times weekly treatments had on pain, disability, lumbar flexion and joint dysfunction, this trial investigated the clinical effects of different treatment frequencies on mechanical LBP. This research is aimed at extending the present data which is useful for developing profession-wide consensus on treatment frequency. Treatment guidelines established from a database similar to, but more extensive in scope than this one, will benefit both patients and practitioner. The practitioner will be able to estimate with greater confidence the amount of treatment required for their patient's specific condition.

6.1 TREATMENT FREQUENCY RECOMMENDATIONS

Some factors which need to be investigated/researched before conclusive treatment frequency guidelines can be made include:

Duration of the complaint - Treatments that are applied aggressively and at an early stage of the condition have the best chance of success with LBP patients (Liebenson, 1992). It is therefore recommended that future studies separate acute and chronic conditions in order to eliminate the differences in the amount of treatment needed by each of these conditions.

Absenteeism and productivity rates - The effect various treatment frequencies have on patient's productivity needs investigation. Studies monitoring patient absenteeism and productivity within similar occupations may reveal a difference in the benefits derived from varying treatment frequencies. Occupations of patients included in the trial need to be controlled because different occupations expose patients to different stresses and these affect the rate of recovery. The balance between cost of treatment needs to be weighed up against the indirect cost resulting from reduced production and absenteeism (Johnson et al., 1996). This would have financial implications, which could determine the most cost effective treatment frequency.

Chronicity and rates of reoccurrence - The effect treatment frequency has on reoccurrence rates and prevention of chronicity needs to be addressed. Studies with follow up consultations, which assess developments that take place after the treatment period, are vital in determining the most effective treatment frequency. Mathews (1995) found that the once weekly treatment group continued to improve after the treatment period but the three times weekly treatment group did not. The effect treatment frequency has on the continuation of improvements is uncertain and needs further investigation.

Specific clinical conditions - The effect different treatment frequencies has on specific clinical syndromes needs further investigation. This dissertation found that for patients with SI syndrome more frequent treatments were superior to infrequent treatments in restoring SI joint function. Conditions other than SI and facet syndromes, but also classified as mechanical LBP, need to be investigated to determine if they respond to different treatment frequencies in a similar way as that found in this dissertation.

Advice on lifestyle modifications - Treatments which include advice on lifestyle modifications and techniques such as strengthening and stretching of the lower back region may result in different findings to that of this dissertation.

Reproducibility of results - The findings of this trial, namely that there is no significant difference between frequent and infrequent treatment frequencies in the management of mechanical low back pain, need to be reproduced to test the validity of these findings.

Until the above points are clarified, the guidelines set out by Haldeman et al. (1993b), of 'initially aggressive treatment for 1-2 weeks followed by gradual reduction to elective care' appears to be logical and in agreement with the findings of this trial.

6.2 METHODOLOGICAL RECOMMENDATIONS

Findings of this trial suggest that in terms of treatment costs, once weekly treatments are superior to three times weekly treatments. However, the validity of the trial depends on factors such as, outcome measures used, randomization, demographic and clinical description of the patients, and a description of the intervention (Manga, et al., 1993). Some flaws in this trial are discussed and possible solutions suggested.

6.2.1 OUTCOME MEASURES

At present the 'success' of treatment often reflects the agenda of the parties determining treatment efficacy (Bolton, 1994). Consensus is required among health disciplines on a rational approach to assessment methods. This would allow for a direct comparison between different studies, which would then provide convincing evidence on the specific matters concerned.

The NRS-101 measures the intensity of the pain, but does not measure the time period of the pain. Although the severity of the pain was unaltered, some of the patients verbally reported that their pain was not lasting as long as prior to the treatment. In future studies it is recommended that frequency of pain be measured using a scale similar to that used by Giles and Muller (1999). In this way a more accurate assessment of the patients' response to treatment could be made.

The author recommends that the revised Oswestry questionnaire be used rather than the original questionnaire as was used in this study. This is because the revised version is more sensitive to small changes in patient function than the original questionnaire. Sensitivity to small changes is ensured by assessing the patient's perception of their changing pain pattern (Beurkens et al., 1995). The patient's perception of their pain relates to the level of anxiety about their condition, which can potentially alter recovery (Verhoef, 1997). Furthermore, measuring a patient's satisfaction with their treatment is useful, however, it must be considered within context of their functional ability (Smith and Stano, 1997).

According to Kirkaldy-Willis (1988:134) one of the characteristics of lumbar facet syndrome is that 'pain is aggravated by movements, especially extension'. On these grounds it seems logical that for the facet and combination subgroups, extension measurements would be useful data.

The reliability and validity of the orthopaedic rating scale is not known and needs to be investigated. Recording the amount of pain produced when the joints are stressed would improve the sensitivity of this measure. The pain could be graded as mild, moderate or severe, instead of simply being recorded as present or not. In this way subtle changes which occur in the joint can be measured. Furthermore, it is recommended that blinded assessment of the objective outcome measurements is used as it would eliminate observer bias.

The time at which data was collected could have affected the results drawn from this trial. Comparisons between the two treatment groups were made with the data recorded at the end of the treatment period (*$week_4$*) and the average of the four readings taken (*$week_{1+2+3+4}/4$*). Possible differences which occurred after the first (*$week_2$*) and second (*$week_3$*) weeks of treatment were not statistically analysed. Different rates of improvement, as was found in the trial by Koes et al. (1992) may have been more significant at an earlier stage than what was seen after the treatment period. Furthermore, a follow up consultation in which measurements were taken to assess how the patients had progressed or deteriorated since their last treatment, may have revealed significant differences between the two treatment groups.

6.2.2 RANDOMIZATION

A clinically homogenous study population would have avoided the division of the groups into subgroups for the orthopaedic rating scale measurements. The number of patients in each group of the subgroups was not even, for example, in the facet subgroup there were 15 patients in the Infrequent Treatment Group and only 6 patients in the Frequent Treatment Group. The small sample size and uneven distribution within the subgroups could be avoided by stratifying the patients according to their diagnosis, or only accepting patients of one clinical condition. This would avoid the chance of incorrectly accepting or rejecting the null hypothesis (Type II Error).

6.2.3 DEMOGRAPHIC AND CLINICAL DESCRIPTIONS OF THE PATIENTS

Psychological stresses, environmental stresses and the duration of the complaint, are prognostic factors which can modify the effect of manipulation (Assendeft et al., 1992). Future studies on similar topics should stratify the patients according to these factors, which will improve the homogeneity of the treatment groups.

With undifferentiated or 'simple back ache' Langworth and Breen (1997) suggests two subgroups (cyclic and mechanical) which may reduce the heterogeneity within the group. More research into similar categorising techniques as described by Langworth and Breen (1997) is needed. Benefits of refined categorisation may enable a better understanding of the responses to specific treatments, which will enable results to be less contradictory and more conclusive.

6.2.4 DESCRIPTION OF THE INTERVENTION

Chiropractic treatments referred to in this trial included only adjustments according to the diversified technique. Lumbar spine dysfunction was treated using the 'lumbar roll/pisiform-mamillary' technique (Szaraz, 1990:9.1), and the sitting lumbar technique (Szaraz, 1990:9.4). SI joint dysfunction was treated using either the flexed or the extended innominate techniques (Szaraz, 1990:9.2-9.3), depending on the motion palpation findings. All treatments were preceded by 5 minutes of soft tissue therapy to the lumbar spine and SI joint regions.

Anatomically SI joints are larger than facet joints and the ligaments surrounding the SI joint are stronger hence the former requires more force to adjust than the latter. Hence, it is possible that each individual SI adjustment was not as proficient and effective as a singular facet adjustment, so the SI syndrome subgroup required more treatments to achieve measurable benefits. Thus more frequent treatments for the SI joint subgroup resulted in significantly fewer positive orthopaedic tests after the trial. This indicates that for SI joint dysfunction intensive treatment is superior, whilst for lumbar facet syndrome less frequent adjustments appear to be as effective as more regular treatment.

The author recognises that this style of treatment is only an aspect of the numerous techniques available to the chiropractor. Therefore findings may be different if other techniques were incorporated into the treatments such as stretches and exercises aimed at the lower back musculature.

6.3 CONCLUSION

This trial found chiropractic treatment to be beneficial to patients suffering with LBP, but it failed to demonstrate that the frequency of the treatments was a factor that significantly altered the outcomes. Less frequent treatments, that is, once weekly treatments are more economical than treatments three times a week in the management of mechanical LBP. Implications arising from this study suggest that patients may be receiving unnecessary treatments that make the cost of chiropractic care more expensive than necessary. However, this is only true if the possibility that more frequent treatments may result in a reduced chance of chronicity and time off work are ignored, or proven incorrect.

Mean values obtained from the Frequent Treatment Group indicate that more frequent treatments improve the recovery rate more quickly than less frequent treatments. However the difference between the two groups was not significant at the 95% level of confidence. It is possible that if factors such as, duration of complaint, occupation, advice on lifestyle modification and strengthening and stretching exercises were considered, then the difference between the two treatment groups would be more significant.

Until such time that convincing research can demonstrate the superiority of a certain treatment frequency, the clinician should tailor the treatment programme to suit the individual patient.

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APPENDIX A

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient:... Date: ....

File # :... Age : ....

Sex :.......................... Occupation:...

Intern :...Signature:..

FOR CLINICIANS USE ONLY:

Initial visit

Clinician:... Signature :...

Case History:

Examination:

Previous: Current:

X-Ray Studies:

Previous: Current:

Clinical Path. lab:

Previous: Current:

Case Status:

PTT:...

Signature:... **Date:**...............................

Conditional:

Reason for Conditional:...

Signature: .... **Date:** ....

All Conditions met in Visit No.:..

To be signed into PTT:..

Signature:... **Date:** ....

Signed off:..

Intern's Case History:

1. **Source of History:**

2. **Chief Complaint** : (patient's own words):

3. **Present Illness:**

	Complaint 1	Complaint 2
▸ Location		
▸ Onset : Initial:		
Recent:		
▸ Cause:		
▸ Duration		
▸ Frequency		
▸ Pain (Character)		
▸ Progression		
▸ Aggravating Factors		
▸ Relieving Factors		
▸ Associated S & S		
▸ Previous Occurrences		
▸ Past Treatment		
▸ **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 incl. xrays
- Environmental Hazards (Home, School, Work)
- Exercise and Leisure
- Sleep Patterns
- Diet
- Current Medication
  Analgesics/week:

- 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

APPENDIX B

TECHNIKON NATAL

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:______________________File#: ______________________Date:__________
Clinician:____________________Signature:____________________
Intern:______________________Signature:____________________

1. VITALS

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

2. GENERAL EXAMINATION

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

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

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

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

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

Pulses:
- General Impression:
- Radio-femoral delay:
- Carotid:
- Radial:
- Dorsalis pedis:
- Posterior tibial:
- Popliteal:
- Femoral:

Percussion: - borders of heart

Auscultation: - heart valves (mitral. aortic, tricuspid, pulmonary)
- Murmurs (timing,systolic/diastolic, site, radiation, grade).

4. RESPIRATORY EXAMINATION

1) Is this patient in **Respiratory Distress** ?

Inspection
- Barrel chest:
- Pectus carinatum/cavinatum:
- Left precordial bulge:
- Symmetry of movement:
- Scars:

Palpation
- Tracheal symmetry:
- Tracheal tug:
- Thyroid Gland:
- Symmetry of movement (ant + post)
- Tactile fremitus:

Percussion
- Percussion note:
- Cardiac dullness:
- Liver dullness:

Auscultation
- Normal breath sounds bilat.:
- Adventitious sounds (crackles, wheezes, crepitations)
- Pleural frictional rub:
- Vocal resonance
  - Whispering pectoriloquy:
  - Bronchophony:
  - Egophony:

5. ABDOMINAL EXAMINATION

1) Is this patient in **Liver Failure** ?

Inspection
- Shape:
- Scars:
- Hernias:

Palpation
- Superficial:
- Deep = Organomegally:

- 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 & X Gag reflex:
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:

Finger-nose test (Dysmetria):
Rapid alternating movements (Dysdiadochokinesia):
Heel-shin test:
Heel-toe gait:
Reflexes:
Signs of Parkinsons:

8. **SPINAL EXAMINATION:**(See Regional examination)

Obvious Abnormalities:
Spinous Percussion:
R.O.M:
Other:

9. **BREAST EXAMINATION:**

Summon female chaperon.

Inspection - Hands rested in lap:
- Hands pressed on hips:
- Arms above head:
- Leaning forward:

Palpation - masses:
- tenderness:
- axillary tail:
- nipple:
- regional lymph nodes:

APPENDIX C

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION - *LUMBAR SPINE AND PELVIS.*

PATIENT: ______________________________

FILE #: ________________ DATE: ____________

INTERN/RESIDENT: ______________________

SUPERVISING CLINICIAN: ______________________

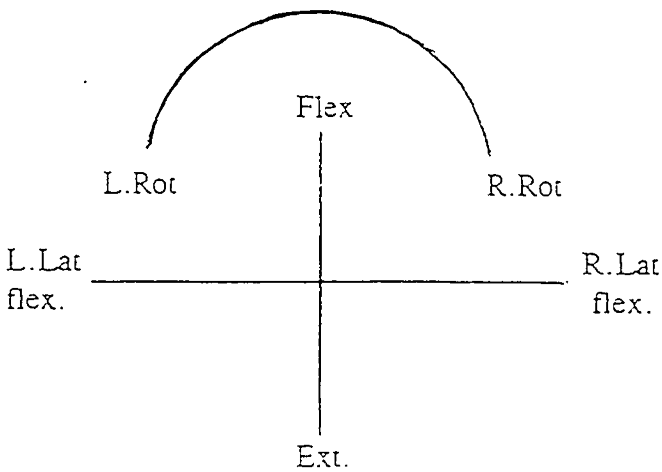
STANDING:

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:

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

Observ/Palpation:

Basic Exam: Thoracic Spine
Case History:

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

Observ/Palpation:

APPENDIX D

INFORMED CONSENT FORM

(To be completed by patient / subject)

Date :

Title of research project :**The Effect of Treatment Frequency in the Management of Mechanical Low Back Pain**

Name of supervisor :**Dr Robert Mathews**

Name of research student :**Megan Macleod**

<u>**Please circle the appropriate answer**</u>	**YES**	**NO**
1. Have you read the research information sheet?	Yes	No
2. Have you had an opportunity to ask questions regarding this study?	Yes	No
3. Have you received satisfactory answers to your questions?	Yes	No
4. Have you had an opportunity to discuss this study?	Yes	No
5. Have you received enough information about this study?	Yes	No
6. Do you understand the implications of your involvement in this study?	Yes	No
7. Do you understand that you are free to withdraw from this study? a) at any time b) without having to give any a reason for withdrawing, and c) without affecting your future health care.	Yes	No
8. Do you agree to voluntarily participate in this study	Yes	No

9. Who have you spoken to?..

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

<u>**Please Print in block letters:**</u>

Patient /Subject Name:.. Signature:..

Parent/ Guardian:.. Signature:..

Witness Name:.. Signature:..

Research Student Name:.. Signature:..

APPENDIX E

Numerical Rating Scale - 101 Questionnaire

Date:____________ **File no:** ____________ **Visit no:** ____________

Patient Name:

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience **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.

____

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience **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.

____

APPENDIX F

Low back pain and Disability Questionaire (Revised Oswestry)

atient Name:______________________ File no:__________ Date__________

his questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage everyday life. Please nswer every section and mark in each section only ONE box as it applies to you. We realize you may consider that two of the statements in any one ection relate to you, but please just mark the box which most closely describes your problem right now.

Section 1 - Pain Intensity

- ☐ The pain comes and goes and is very mild.
- ☐ The pain is mild and does not vary much.
- ☐ The pain comes and goes and is moderate.
- ☐ The pain is moderate and does not vary much.
- ☐ The pain comes and goes and is very severe.
- ☐ The pain is severe and does not vary much.

Section 2 - Personal Care

- ☐ I would not have to change my way of washing or dressing in order to avoid pain.
- ☐ I do not normally change my way of washing or dressing even though it causes some pain.
- ☐ Washing and dressing increase the pain but I manage not to change my way of doing it.
- ☐ Washing and dressing increase the pain and I find it necessary to change my way of doing it.
- ☐ Because of the pain I am unable to do some washing and dressing without help.
- ☐ Because of the pain I am unable to do any washing and dressing without help.

Section 3 - Lifting

- ☐ I can lift heavy weights without extra pain.
- ☐ I can lift heavy weights but it gives extra pain.
- ☐ Pain prevents me from lifting heavy weights off the floor.
- ☐ Pain prevents me from lifting heavy weights off the floor, but I manage if they are conveniently positioned (e.g. on a table).
- ☐ Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned.
- ☐ I can only lift very light weights at the most.

Section 4 - Walking

- ☐ I have no pain on walking.
- ☐ I have some pain on walking but it does not increase with distance.
- ☐ I cannot walk more than one mile without increasing pain.
- ☐ I cannot walk more than ½ mile without increasing pain.
- ☐ I cannot walk more than ¼ mile without increasing pain.
- ☐ I cannot walk at all without increasing pain.

Section 5 - Sitting

- ☐ I can sit in any chair as long as I like.
- ☐ I can only sit in my favorite chair as long as I like.
- ☐ Pain prevents me from sitting more than 1 hour.
- ☐ Pain prevents me from sitting for more than ½ hour.
- ☐ Pain prevents me from sitting for more than 10 minutes.
- ☐ I avoid sitting because it increases pain straight away.

Section 6 - Standing

- ☐ I can stand as long as I want without pain.
- ☐ I have some pain on standing but it does not increase with time.
- ☐ I cannot stand for longer than one hour without increasing pain.
- ☐ I cannot stand for longer than ½ hour without increasing pain.
- ☐ I cannot stand for longer than 10 minutes without increasing pain.
- ☐ I avoid standing because it increases the pain straight away..

Section 7 -Sleeping

- ☐ I get no pain in bed.
- ☐ I get pain in bed but it does not prevent me from sleeping well.
- ☐ Because of pain my normal night's sleep is reduced by less than ¼
- ☐ Because of pain my normal night's sleep is reduced by less than ½
- ☐ Because of pain my normal night's sleep is reduced by less than ¾
- ☐ Pain prevents me from.sleeping at all.

Section 8 - Social life

- ☐ My social life is normal and gives me no pain.
- ☐ My social life is normal but increases the degree of pain.
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g. dancing, etc
- ☐ Pain has restricted my social life and I do not go out very often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have hardly any social life because of the pain.

Section 9 - Travelling

- ☐ I get no pain whilst travelling.
- ☐ I get some pain whilst travelling but none of my usual forms of travel make it any worse.
- ☐ I get extra pain whilst travelling but it does not compel me to seek alternative form of travel.
- ☐ I get extra pain whilst travelling which compels me to seek alternative forms of travel.
- ☐ Pain restricts all forms of travel.
- ☐ Pain prevents all forms of travel except that done lying down.

Section 10 - Changing degree of pain

- ☐ My pain is rapidly getting better.
- ☐ My pain fluctuates but overall is definitely getting better.
- ☐ My pain seems to be getting better but improvement is slow at present.
- ☐ My pain is neither getting better nor worse.
- ☐ My pain is gradually worsening.
- ☐ My pain is rapidly worsening.

Pain Severity Scale:

ate your usual level of pain today by checking one box on the following scale

0	1	2	3	4	5	6	7	8	9	10

No pain **Excruciating pain**

Adapted from Hsieh et al 1992