A STUDY OF THE EFFECTIVENESS OF RELIEF PULSE AS COMPARED TO TENS WITHIN THE REALM OF CHIROPRACTIC HEALTH CARE.

by

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Dissertation submitted in partial compliance with the requirements for the Masters Degree in Technology: Chiropractic, at the Technikon Natal Department of Chiropractic.

I, Michael Allan Buchholtz, do declare that this dissertation is representative of my own work.

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Approved for final submission

------- ---------- 12-12-97

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SUPERVISOR

I dedicate this work to my family. To my parents Douglas and Trudy Buchholtz, who have made this all possible. To my grandparents: Joyce and the late Edward Buchholtz ,to John "Boz" and the late Patricia Dixon and Dr Marge "Mim" Courtney-Latimer, who have always given me the greatest support. And finally to my wife, Estelle, who has helped me through the tough times. Many thanks and love to all of you.

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ABSTRACT

The purpose of this study was to evaluate the most effective electrotherapy waveform, in the treatment of mechanical low back pain, by comparing a Relief Pulse waveform to that of Transcutaneous Electrical Nerve Stimulation waveform, in combination with a chiropractic lumbar roll adjustment. This was accomplished by means of objective and subjective assessments.

This study was conducted by means of a clinical trial with two experimental groups. Thirty subjects who suffered from mechanical low back pain were chosen from a general population who responded to advertisements within the greater Durban area. Each of these subjects had to suffer from chronic (longer than 6 weeks duration) posterior facet syndrome, Maigne's syndrome and/or Sacro-iliac syndrome and were examined by the researcher in order to be excepted into the study. Each subject was treated ten times over a one month period. Subjects in one group received TENS treatment for ten minutes followed by a lumbar roll adjustment. Subjects in the other group received Relief Pulse treatment for ten minutes followed by a lumbar roll adjustment. The subjective assessment was by means of 3 questionnaires which are widely accepted in the research community namely: Oswestry Low Back Pain Disability Questionnaire, Numerical Rating Scale 101 and Short-Form McGill Pain Questionnaire. The objective assessment was measured by means of a pressure algometer (a pain threshold meter) manufactured by Wagner Instruments and a low back range of motion goniometer (BROM-Back range of motion instrument) manufactured by Performance Attainment Associates. The results which were obtained were then statistically analyzed using the Mann-Whitney U-test (inter-group comparison) and the Wilcoxon Signed rank test (intra-group comparison). Bar charts were created using the medians obtained.

The study concluded that neither waveform in combination with chiropractic adjustment proved to be more effective than the other.

The subjective assessments which were obtained by the questionnaires showed that both groups improved equally in terms of pain reduction. The objective assessments showed that TENS proved more beneficial in increasing the pain tolerance. Neither waveform proved more beneficial than the other in terms of increasing the subjects low back range of motion.

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DEFINITION OF TERMS

Chiropractic Adjustment

A specific form of direct articular manipulation, utilizing a short lever, and characterised by a dynamic, forceful, high velocity thrust of controlled amplitude (Kirk et al. 1991: 229).

Chiropractic Management

The diagnosis, treatment and prophylaxis of functional disturbances of particularly the spine and pelvis (Gatterman 1990: xv).

Electrotherapy

The treatment of disease by means of electricity (Dorland's Medical Dictionary: 538).

Lumbar roll

A side-lying adjustment using a mamilliary contact in order to restore lateral flexion and/or rotation in the lumbar spine (Gatterman 1990: 143).

Lumbar Facet Syndrome

Low back pain due to zygapophyseal joint dysfunction and inflammation which causes local or referred pain (Gatterman 1990: 161).

Maigne's Syndrome

Joint dysfunction in the T12 and/or L1 facet joint which causes superior cluneal nerve irritation with subsequent pain over the iliac crests (Kirkaldy-Willis & Burton 1992: 161).

Mechanical Low Back Pain

Pain due to mechanical dysfunction of the joints of the lower spine (Kirkaldy-Willis & Burton 1992: 161), in this study it included dysfunction of T12-L5 and Sacro-iliac joints.

Most Effective

A change, which is the greatest in quantity or intensity produced by an action or cause (Hawkins 1988: 256). In this study it was the waveform that produced the greatest pain relief in the same period of time.

Objective

Measurements taken to assess patients' clinical improvement by using their external senses (Dorland's Medical Dictionary: 1164).

Relief Pulse

An electrotherapy device which simulated nerve action potentials in order to decrease pain and swelling in joints (Relief Pulse Users Manual: 2).

Sacro-iliac Syndrome

Dysfunction of the Sacro-iliac joints causing local or referred pain (Gatterman 1990: 114).

Subjective

An individuals perception of treatment and improvement (Hawkins 1988: 815).

TENS

Transcutaneous electrical nerve stimulation utilised for the relief of chronic pain (Gatterman 1990: 345).

CHAPTER 1

INTRODUCTION

1.1 HISTORICAL REVIEW

Since the dawn of time, man has strived to find ways to rid himself of pain. It appears that the use of electrical current for therapeutic applications began in the time of Socrates (as early as 2750 B.C). The earliest documented case belonging to Scribonius Largus in the first century AD, who used an electrical torpedo fish on a patient suffering from chronic headaches. (Gatterman 1990: 345; Neumann 1993.) A Greek physician, AEtius, was also reputed to have treated patients suffering from gout with a torpedo fish around the same period. (Neumann 1993) Much time passed with little occurring in the field of electrotherapy, however in the middle of the 18th century Pieter Van Mussenbroek discovered that electricity could be stored in what has come to be known as a Leyden jar, and the possibility of using electricity within treatment protocols was once again explored, as it had become possible to give relatively controlled electrical treatments. (Baldry 1989: 1-10; Neumann 1993.) The Reverend John Wesley used the Leydon jar to treat illness amongst his parish. In 1745 a german physician, Krotzenstein, wrote the first book on electrotherapy. The therapy was certainly crude by today's standards, with the patient seated on a wooden stool and the electrical current being generated by a revolving frictional glass globe. However because of the indiscriminate use of electrotherapy, this led to it becoming discredited. Dr Golding-Bird, at that time a physician at Guy's hospital recommended that it be confined to mainly neurological problems (Neumann 1993). Largus hospital, headed by Dr Golding Bird was the first hospital in 1840 to have an electrical department within the physical therapy ward (Shriber 1981: 1-7).

The understanding of electrophysiology progressed rapidly over the next

100 years but electrical treatment remained relatively under-investigated (Gatterman 1990: 345).

That was until in 1965, Melzack and Wall published their "Gate - Control Theory", in which they attempted to explain the physiological mechanisms by which electrotherapy worked. (Gatterman 1990: 345; Neumann 1993.)

1.2 IMPORTANCE OF THE STUDY

Practitioners treating low back pain are confronted with one of the most difficult and troublesome of conditions. Taking part in the health care of millions of people each year, unfortunately with very little to show for our efforts. At best, non-operative treatment of low back pain still remains highly controversial. (Weinstein 1992: 1-2.) Back pain is within epidemic proportions with as many as 70% to 80% of all adults being affected during their lives (Deyo et al. 1991). The use of electrical energy, electrotherapy, in the treatment of patients is a very important part of physical therapy (Shriber 1981: 1). One of the greatest advances in the management of low back pain management has been the introduction of Transcutaneous Electrical Nerve Stimulation (TENS).

It should be noted that TENS is a term which should be applied to all forms of electrical stimulation that is applied through the use of surface electrodes. However, today it appears that the term is used only for small portable stimulators that can be attached to clothing and which are used for various time periods for the relief of pain. (Gatterman 1990: 345.) Devices that generate many waveforms have been developed by different manufacturers, often under the assumption that the new wave-form will prove superior to the others (Ottoson & Lundeberg 1988: 22; Gatterman 1990: 346). The electrical wave-forms have shown wide variations in practice, with one clinic even giving patients a variety of stimulators with different wave-forms in order to try to find which one "suited" the patient best (Neumann 1993). Because the most effective waveform has not yet been established, comparison of pain relief with several units of different waveforms are needed (Gatterman 1990: 343-347). To date no systematic analysis has been carried out on the relative efficacy of the various waveforms in different pain

syndromes, and it is therefore not possible to determine the most effective pulse configuration (Ottoson & Lundeberg 1988: 22; Finlay 1992).

Electricity can help control spinal pain but, as with any isolated measure, it may not be effective alone. It is therefore a physical modality to be considered in combination with other forms of treatment. (Mayer et al.: 1-12.) A study by Coxhead et al. in 1981 suggested that combination treatments were far more effective than just utilizing a single treatment protocol (Frymoyer 1991: 1582). Unfortunately today there is no one accepted treatment of patients with chronic pain as no one treatment appears to be superior to another (Caillet 1991: 304; Koes et al. 1993). This study will evaluate the effectiveness of the different waveforms by utilizing expertly developed survey questionnaires. The information that is gathered will be fed back to the physicians and to the patients. This should enable the physicians and the patients to make better (more informed) decisions about the risks and benefits of these electrical waveforms. (Weinstein 1992: 6.)

1.3 AIM

The aim of this study is to evaluate the efficacy of Relief Pulse in comparison to the efficacy of Transcutaneous Electrical Nerve Stimulation (TENS) both in combination with a chiropractic adjustment,- the lumbar roll- in terms of objective and subjective assessment, in order to determine the most effective electrotherapy waveform for the treatment of Lumbar Spine Posterior Facet Syndrome, Maigne's Syndrome and/or Sacro-iliac Syndrome.

1.4 OBJECTIVES

The first objective is to determine the response of subjects to Relief Pulse in combination with a lumbar roll adjustment, in terms of objective and subjective assessment, in order to determine the effectiveness of this waveform in chiropractic management of mechanical low back pain.

The second objective is to determine the response of subjects to TENS treatment in combination with a lumbar roll adjustment, in terms of

objective and subjective assessment, in order to determine the effectiveness of this wave-form in chiropractic management of mechanical low back pain.

The third objective is to integrate the data from the first and second objectives in order to determine which waveform, in combination with a lumbar roll adjustment, is more effective in the management of mechanical low back pain.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

The incidence and prevalence of back pain, especially chronic low back pain seems to be increasing. The accompanying economic implications are staggering with, as much as $12.9 billion dollars having been spent in the U.S.A. during 1977 alone. (Deyo et al. 1991.) Electrotherapy is used for treating a wide range of painful conditions, but back pain is the most common condition which is seen in pain clinics around the world, and hence is the most common application of electrotherapy (Deyo et al. 1990b). Even with studies taking place, unfortunately there is no one accepted form of treatment for patients with chronic pain. It is therefore vital that much energy and funding be channelled into low back pain research. (Calliet 1991: 304.) In comparison with many recent advances in medical sciences, most forms of electrotherapy are in fact somewhat old (Gattermann 1990: 345). All forms of electrotherapy (different variety of stimulators) have but one common purpose and that is to stimulate tissues for therapeutic responses. (Kahn 1994: 2-75.) It is clear that there is still considerable scope for improved design of commercially available stimulators. There is also good evidence mounting that each patient seems to prefer a unique pulse frequency to treat his or her particular pain. (Johnson et al. 1991a.)

2.2 TREATMENT MODALITIES

2.2.1 ELECTROTHERAPY

Electrical generators of many types are utilized for clinical electrical stimulation. Even today we are not certain how electrotherapy evokes analgesia, however it is hypothesised, according to the gate control theory proposed by Melzack and Wall in 1965 that electrotherapy induces

analgesia by stimulating the peripheral nerve fibres (large diameter afferent fibres Aß) with low voltage electrical impulses through electrodes placed on the skin. Thus inhibiting transmission of nociceptive impulses within the spinal cord. Thus this theory proposes a gating mechanism at the spinal cord level which alters ascending transmissions of nociceptive input. The gate is opened by increased activity from small diameter nerve fibres, that transmit impulses to the spinal cord and brain. The gate is closed by high levels of activity of large diameter nerve fibres which inhibit pain transmission. As the skin is heavily endowed with large diameter nerve fibres, it was Woolf in 1978, that suggested that this may indeed be the way in which electrotherapy devices work (Kahn 1994: 35). Another theory which was proposed by Newton in 1990 was that electrotherapy caused an increase in the release of endorphins which are the body's natural opiates (Kahn 1994: 37). In fact it was reported that electrotherapy did not alter the pain threshold nor the ß-endorphin levels, implying that electrotherapy is largely placebo (Gatterman 1990: 346; Johnson et al. 1991b; Finlay 1992). No evidence exists to indicate that any one model, brand, or system is suited to all cases (Kahn 1994: 85). Today these cutaneous modalities are available for comfort, as well as pain relief and are all low-risk techniques. They are also very easy to use and are relatively inexpensive. Most patients welcome such modalities as they give them a non-drug method of controlling their pain. (McCafferty & Wolff 1992.) TENS and Relief Pulse were the two types of electrotherapy which were utilised in this study.

2.2.1.1 TENS

In 1987 the Medicare charges for TENS treatment amounted to more than $40 million (Barr 1990). In 1986 the veterans administration spent nearly $2 million on TENS units. And despite its widespread use and its theoretical rationale, according to gate control theory, there is very little evidence from controlled clinical trials of its efficacy in the treatment of chronic back disorders, there is in fact growing evidence against TENS' efficacy in the treatment of chronic low back pain (Frymoyer : 1574-1578). According to Weinstein in more than eleven

studies using TENS only one was randomised. Most of these studies involved low back pain conditions but they had a variety of diagnosis and psychosocial features. Weinstein (1992: 49) reports that in the most vigorous of TENS studies on chronic low back pain it appears that TENS was no more effective than a placebo treatment. Stoddard (1979) believes that the purpose of TENS is to increase the blood circulation. He believes that this is of limited application on the spine. He does however state that it may be useful in helping back pain which has not yielded to any other method. (Stoddard 1979: 10-11; Coming & O'Leary 1987: 931; Rothman & Simeone 1992: 1958). A study at Newcastle Pain Relief Clinic by Johnson et al. in 1992 in which they were looking at long term TENS effectiveness showed that 67% of patients with low back pain continued to use their TENS devices, this study however did not determine the amount of pain relief experienced nor that the patients were indeed using their units regularly. It appears that much emphasis has been placed upon the Deyo et al. study. In their study Deyo et al. (1990b) reported that there were no clinically important or statistically significant differences in the outcome of those subjects who received TENS treatment and those who received sham TENS (placebo); this study suggested that TENS was largely placebo. A study by Herman et al. in 1994 found like Deyo et al. (1990b), that no benefit of TENS in low back rehabilitation could be found. Barr (1990) felt that the optimal TENS treatment was not employed; he states that the frequency used by Deyo et al. (80 Hertz) has been shown to worsen the pain, he suggested using 60 Hertz instead, as it is often found to alleviate pain. Winter (1990) and Cornwill (1990) believed that Deyo's research was flawed because of the electrode placements, whereas Merry (1990) felt that Deyo's treatment duration was too short. Marchand et al. (1993), tried to re-evaluate TENS treatment on low back pain, and found that TENS was more effective than placebo-TENS in reducing the low back pain intensity immediately after each treatment, as well as one week after the end of the treatment. They found that TENS reduced the perceived pain intensity more than placebo-TENS, however both reduced pain unpleasantness equally. However, there was no significant difference between the two groups three or six months after the

treatment. These researchers stated that a large portion of TENS treatment is placebo, but that placebo can be used advantageously within a clinical setting, and hence TENS (even if largely placebo) should not be discarded (Marchand et al. 1993.)

According to Sotosky and Lindsay (1991), the appropriate application of the unit, electrical parameters and patient adherence are all factors which affect the effectiveness of TENS. They also believe that frequency, amplitude and pulse duration (wave-form) are crucial parameters and they that they may need to be individualised for each patient's optimal response. Also other variables such as aetiology of pain, chronicity of pain, the type of TENS equipment, types of electrodes, frequency of the treatment and evaluation measures all interfere with a clear comparison of TENS studies. The biggest problem facing researchers is that even if a study shows that TENS results in greater reductions in pain than sham TENS, sceptics however, may discount the treatment effect by arguing that TENS treatment only resulted in a greater placebo effect. (Mendel & Fish 1991.)

2.2.1.2 Relief Pulse

Very little data today exists on the efficacy of Relief Pulse. In a clinical trial on the prototype by Liggins in 1993, it was found that Relief Pulse compared well with pain relief obtained with the use of TENS and Interferential therapy. However it was noted that Relief Pulse was more effective than these two modalities in the case of deep seated pain. It was also noted that several patients with shoulder pain said that they preferred the Relief Pulse to Interferential current. It was proven that Relief Pulse often reduced the pain quickly and the relief obtained was sustained between treatments (Liggins 1993).This report however used only 12 patients with different shoulder pain conditions. No mention was made about electrode placement. The only evaluator was the subjective numerical pain rating scale (NPRS), no objective measures were recorded. In another clinical trial on the prototype with Relief Pulse on painful knees it was found that 40% of the cases required only one treatment to relieve pain completely, and 80% of the cases had

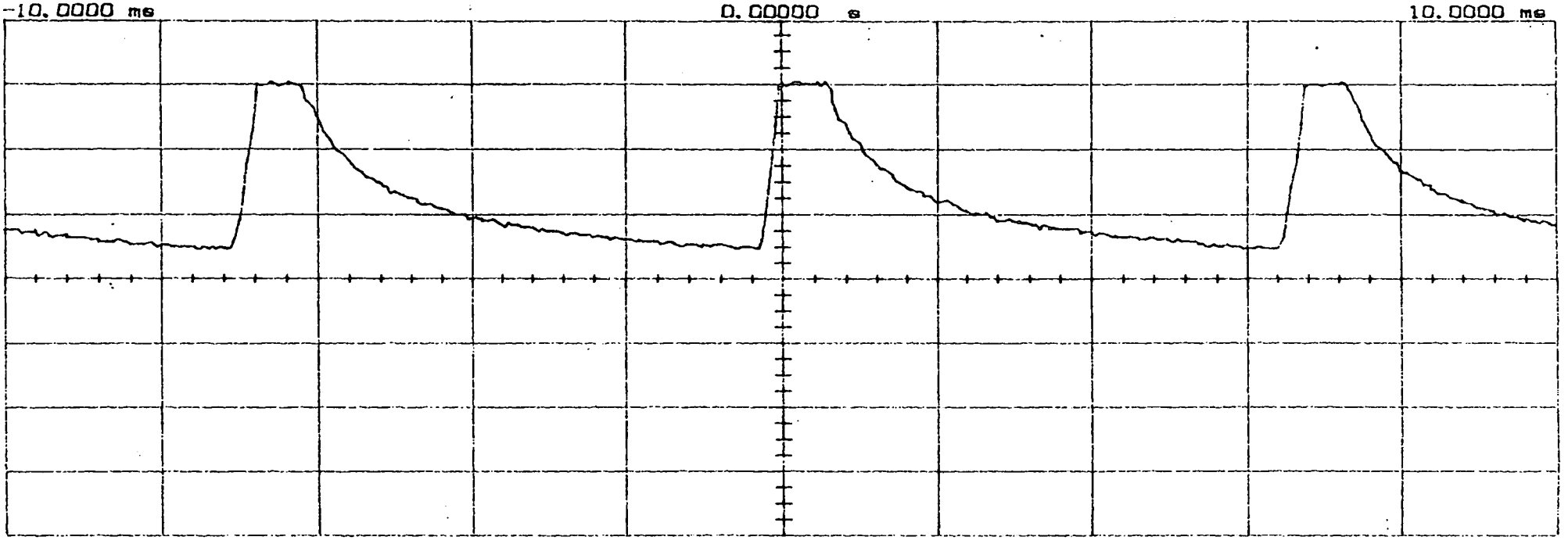
minimal pain by the end of two treatment sessions (Pillay 1993).
This study also utilized only 10 patients with knee pain, all varying in their chronicity as well as diagnostic criteria. Again only NPRS was utilized with no objective assessment being mentioned. The duration between the treatments was also not mentioned. No data could be found on Relief Pulse's efficacy in the treatment of low back pain.

2.2.1.3 Electrical Waveforms

The most effective electrotherapy waveform for analgesia has not yet been established (Relief Pulse Users Manual: 8). To date there has been little or no clear evidence of a physiological benefit of any specific waveform (Kahn 1994: 100-111).

Most TENS units favour biphasic waveforms, containing both a positive (+) and a negative (-) phase (fig 2). Relief Pulse waveform as seen in (fig 1) contains only a positive phase. (Fig 1 and 2 waveforms obtained by placing electro-therapy devices on an oscilloscope.) In most instances efforts are made to equalise the positive and negative phases so as to have no electrochemical effect which is due to excessive polarity (Kahn 1994: 100-111).
The TENS waveform (fig 2) also appears to be more spiked, whereas the Relief Pulse waveform (fig 1) is more square. Kahn (1994: 100-111) states that in his experience, he has found that generally intense stimulation with spike waves did not produce as long lasting relief as that produced by a square or rectangular waveform. This however could not be validated by a study of any kind. It is reported that in a study by Jensen et al. (1986) in Vienna, in which they tried to find the optimal waveform for TENS, that no waveform proved to be far superior to another. They did this by stimulating the sympathetic nerves of fifty patients and forty volunteers and recording rheoencephelographic tracings. (Jaskovlak & Scahfer 1986: 284.) Johnson et al. (1991b) attempted to find which frequencies and pulse patterns (i.e. waveforms) patients were utilizing to treat their chronic pain, and found that each individual patient preferred his or her own settings. It was hypothesised that pathology dictates the waveform which is used.

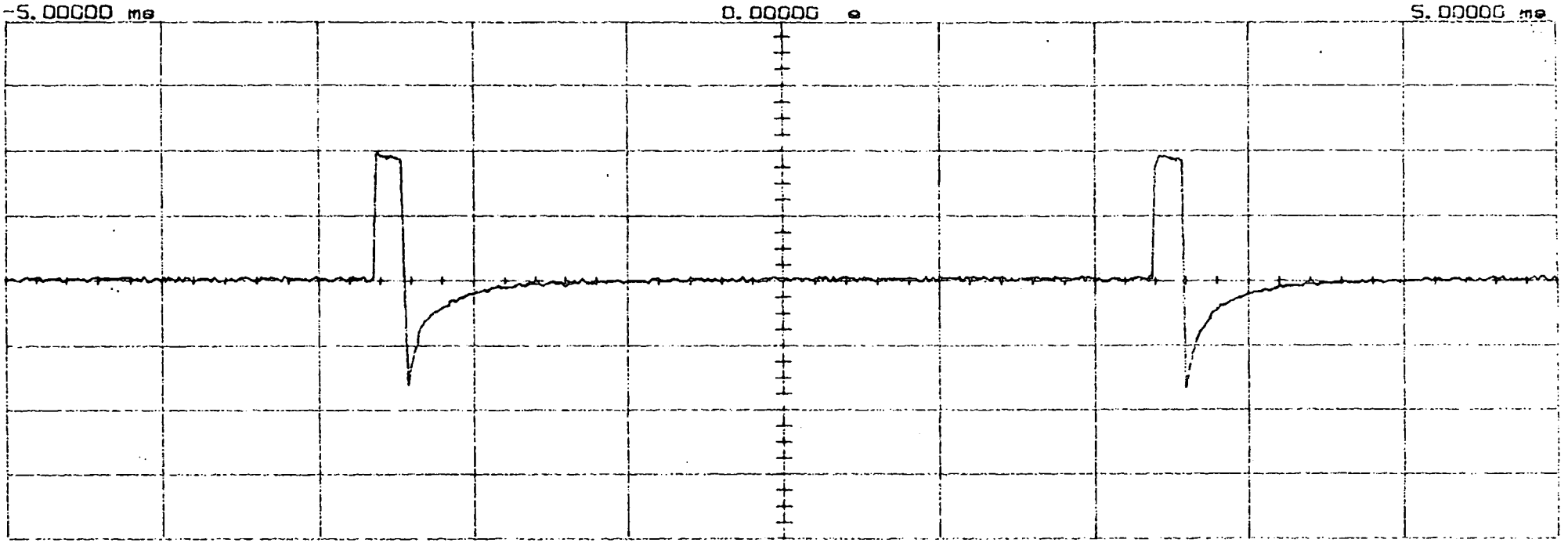
Fig. 1: Relief Pulse Wave-form



	Timebase	Delay/Pos	Reference		
Main	2.00 ms/div	0.00000 s	Center		
	Sensitivity	**Offset**	**Probe**	**Coupling**	
Channel 1	15.0 V/div	0.00000 V	10.00 : 1	dc (1M ohm)	

Trigger mode : Edge
On Positive Edge Of Chan1
Trigger Level
Chan1 = 41.3700 V (noise reject OFF)
Holdoff = 40.000 ns

Fig. 2: TENS Wave-form



	Timebase	Delay/Pos	Reference	
Main	1.00 ms/div	0.00000 s	Center	
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	10.0 V/div	0.00000 V	10.00 : 1	dc (1M ohm)

Trigger mode : Edge
On Positive Edge Of Chan1
Trigger Level
Chan1 = 41.3700 V (noise reject OFF)
Holdoff = 40.000 ns

2.2.1.4 Side effects of electrotherapy

An allergic skin reaction has been noted in 10% of patients undergoing TENS treatment (Ottoson & Lundeberg 1988: 3-20). The majority are a result of prolonged or excessive use of the machine. Inadequate electrical contact between the electrode pad and the skin may result in a micropapular eruption, furthermore failure to clean the electrode pads with alcohol may give rise to these skin reactions. Some of the electro-coupling gels contain irritants such as silicon oxide. Most of the skin reactions or allergic reactions appear as a result of the gel type which is used, such as methacrylate and propylene glycol. There does not seem to be any reaction to shavings from the carbon rubber electrodes. (Warren 1991; Dwyer 1994.)

Of importance to this study is that a waveform that is spiked, generally, is more irritating to the skin and requires frequent movement of the electrodes. As the waveform becomes a sine-wave the skin is less irritated. (Kahn 1994: 111.)

Oedema is known to occur in patients who have had radiation treatment or a mastectomy (Ottoson & Lundeberg 1988: 3-20). No explanation for this could be found.

2.2.1.5 Contraindications to electrotherapy

- Cardiac pace-maker (Demand-type)
- Carotid nerve stimulation
- Laryngeal stimulation which may occlude the air-way
- During pregnancy (Ottoson & Lundeberg 1988: 3-20; Gatterman 1990: 346)
- Fresh fractures - This is to prevent unwanted movement occurring
- Acute Haemorrhage
- Phlebitis (Kahn 1994: 76)
- Patients with thrombosis
- Used over affected areas of spreading cancer
- Epileptic sufferers
- Not to use opposite polarities on the temples (Relief Pulse Users Manual: 1)

2.2.2 SPINAL MANIPULATIVE THERAPY

Although this study is not testing the validity or efficacy of manual therapy, that being spinal manipulation, it is employed uniformly through out this study.

Manipulation has been shown to provide more immediate and more rapid response to pre-episodic status than any other forms of care, especially in patients suffering from chronic low back pain and those patients which are younger than forty years of age (Koes et al. 1993). In a very comprehensive study by Pope et al. (1994) in which they had a three week trial of spinal manipulation, TENS, massage and corsets, it was found that there were significant reduction of low back pain (measured by means of the visual analogue scales) in all treatment groups (manipulation, corset and massage) except for the TENS group. This research implied that TENS was of no benefit in treating sub-acute low back pain. Pope et al. (1994) conclude that in the past few years, various controlled studies of manipulation have been conducted. It has been reported that even with small sample sizes, those who received manipulation, experienced greater relief from low back pain than those who received sham manual treatment.
In this study the spinal manipulation was done equally to both groups, so no difference in results should be attributed to this form of care.

2.2.2.1 Contraindications to spinal manipulation therapy

- Benign bone tumours (especially the aggressive types) such as Aneurysmal bone cyst, Giant cell tumour, Osteoblastoma and Osteoid osteoma
- Spinal Cord Tumours
- Dislocations
- Acute fractures
- Acute inflammatory arthritis
- Infection such as osteomyelitis or septic diskitis
- Instability
- Haematoma of the spinal cord or intracanilicular
- Malignancy

- Meningeal tumour
- Myelopathy such as that caused by severe central herniation of nucleus pulposus
- Radiculopathy with atrophy or severe muscle weakness
- Abdominal aortic aneurysm especially the dissecting type
- Cauda equina syndrome. (Gatterman 1990: 67-68; Wyatt 1992: 199-201.)

2.3 SUMMARY

It appears that the efficacy of electrotherapy itself cannot be proved. Many findings suggest electrotherapy to be largely placebo (Deyo et al. 1990b; Marchand et al. 1993; Meyler et al. 1994). This author assumed that electrotherapy does indeed have an effect and set out to find a more beneficial waveform in the treatment of mechanical low back pain. However no study to date has proved that any one waveform produced by these devices is more beneficial than another. This research will hopefully add to this body of knowledge, which at present, is needed.

CHAPTER 3

METHODOLOGY

3.1 STUDY DESIGN AND PROTOCOL

The clinical trial was conducted over a one year period, between June 1995 and June 1996, at Technikon Natal Chiropractic Day Clinic in Durban, South Africa.

Subjects with chronic low back pain, of at least 6 weeks duration, were encouraged by advertisements in the Natal Mercury and on East Coast Radio to attend the Technikon Natal Chiropractic Day Clinic and participate in the research programme. All services were offered free of charge.

At the start of the screening process, a case history (Appendix A), physical examination (Appendix B) and regional examination (Appendix C) were conducted and if deemed necessary X-rays were taken.
Eligible subjects completed the Informed Consent Form by signing and dating it as required by the Helsinki convention. Oswestry Low Back Pain Disability Questionnaire (Appendix E)(Fairbank et al. 1980), Numerical Rating Scale 101 (Appendix F)(Jensen et al. 1986) and Short-Form McGill Pain Questionnaire (Appendix G)(Melzack 1987) were completed by the subject before consultations one, five and ten. The pain tolerance of the subject was assessed with the use of a pressure algometer before each treatment and was re-assessed after each treatment (Appendix H), as was the subject's low back range of motion assessed with the use of a goniometer before and after each treatment (Appendix I).
Thirty subjects took part in this study. The subjects were randomly divided into two equal groups. This was done by allowing a blinded subject to pick a letter out of a box.

The study involved treating each subject ten times over a one month period i.e. three times per week.

Subjects in one group received TENS treatment for ten minutes followed by a spinal adjustment. Subjects in the other group received Relief Pulse treatment for ten minutes followed by a spinal adjustment.
If the patient became asymptomatic they received ten minutes of electrotherapy from the respective device and did not have a spinal adjustment. (Till, Personal communication 1993).

3.2 SUBJECTS

Only subjects suffering from Posterior Facet Syndrome of the lumbar spine (Gatterman 1990: 115-117), Maigne's Syndrome (Gatterman 1990) and/or Sacro-iliac Syndrome (Gatterman 1990: 115-117), were included in this study.

If any of the subjects suffered from conditions which were contraindicated to electrotherapy and/or spinal manipulative therapy, they were excluded from the study. Subjects suffering from Nerve root entrapment, such as a lumbar disc herniation, central canal stenosis and/or lateral canal stenosis in the lumbar spine were not included in the study.

3.2.1 DIAGNOSTIC CRITERIA

Sacro-Iliac Syndrome:

- Pain is typically unilateral, dull in character, and is located over the buttocks.
- Pain may radiate posteriorly down the thigh or to the groin and anterior thigh.•Occasionally it may extend down the lateral or posterior calf to the ankle, foot, and toes.
- A positive FABERE test. To perform a FABERE test the subject lies in the supine position , flexes his leg and places the foot to the opposite knee. The researcher then stabilizes the opposite anterior superior iliac spine and presses down on the knee being tested. A positive test results in sacro-iliac pain. (Cipriano 1991: 91.)

• There is often associated joint dysfunction (fixation) on motion palpation. With the subject standing, to palpate a flexion fixation, the researcher places one thumb over the second sacral tubercle and the other over one posterior inferior iliac spine. The subject then flexes the ipsilateral thigh and knee to the chest. With normal motion, the thumb over the posterior inferior iliac spine moves downward one to two centimetres. To palpate an extension fixation, the researcher places one thumb on the sacral apex and the other over the ipsilateral ischial tuberosity. If movement is normal as subject flexes thigh the ischial tuberosity will move laterally one to two centimetres. Loss of this normal motion indicates joint dysfunction.(Gatterman 1990: 118-122.)

◦ Pelvic compression often causes sacro-iliac pain. This test is performed with the subject lying on his side, the researcher then exerts a strong downward pressure on the ilium. This test is repeated bilaterally. (Cipriano 1991: 79.)

◦ Yeoman's test may be positive causing pain in the sacro-iliac joint. This test is performed with the subject prone, the researcher flexes the patient's leg and extends the thigh (Cipriano 1991: 77)
(Gatterman 1990: 115-117.)

Posterior Facet Syndrome:

• Low back pain radiating into the groin, hip, buttock, and often the leg, in most cases above the knee.

◦ Axial compression (Kemp's test) will cause pain at the area of involvement. This test is preformed with the subject standing, the researcher actively bends the dorsolumbar spine obliquely and backward (extension). (Cipriano 1991: 67.)

• There is often joint dysfunction (fixation) at the involved level. This is assessed using motion palpation with the subject seated and facing away from the researcher, the palpating thumb is placed against the side of the spinous process, and for lumbar rotation, the subject is rotated to the extreme of range of motion toward the ipsilateral side, this procedure is then repeated bilaterally and at each segmental level. For lumbar lateral flexion, the same contact is used as above but the subject is laterally flexed ipsilaterally. To palpate for a flexion or

extension fixation. the subject is seated in front of and facing away from the researcher, a palpating thumb is placed between the spinous processes, when the subject is extended the spinous processes should approximate and when flexed the spinous processes should separate. Loss of this normal motion indicates joint dysfunction. (Schafer & Faye 1989: 217; Gatterman 1990: 142-147.)

Maigne's syndrome:

- Referred pain to iliac crest, lumbo-sacral, sacro-iliac, gluteal or trochanter areas. Frequently no local pain.
- Joint dysfunction T12-L1 on motion palpation. This is assessed using motion palpation with the subject seated and facing away from the researcher, the palpating thumb is placed against the side of the spinous process, and for lumbar rotation ,the subject is rotated to the extreme of range of motion toward the ipsilateral side, this procedure is then repeated bilaterally and at each segmental level. For lumbar lateral flexion , the same contact is used as above but the subject is laterally flexed ipsilaterally. To palpate for a flexion or extension fixation. the subject is seated in front of and facing away from the researcher, a palpating thumb is placed between the spinous processes, when the subject is extended the spinous processes should approximate and when flexed the spinous processes should separate. Loss of this normal motion indicates joint dysfunction (Gatterman 1990: 142-147.)
- Pain on skin rolling over area of cluneal nerves. (Maigne 1972.)

3.3 ETHICS

No patients with any contraindications to the electrotherapy and/or spinal manipulative therapy were allowed into the study. All patients completed and signed the relevant informed consent (Appendix D)form as required by the Helsinki convention. Radiation dosage was kept to a minimum by limiting lumbar x-rays to only one set per patient. X-rays were taken only if deemed necessary by the researcher.

3.4 INTERVENTION

Subjects in one group received TENS treatment for ten minutes followed by a spinal adjustment. Subjects in the other group received Relief Pulse treatment for ten minutes followed by a spinal adjustment. As it was found by Wang et al. (1992) that five to ten minutes of TENS caused the analgesic effect to reach a statistically significant level.

Four electrodes were used in both groups, with the electrode placement being the same for each patient. Channel 1 electrodes were placed with one electrode on the right hand side on the erector spinae muscle at the level between the spinous processes of T12 and L1, the other electrode was placed just below the right hand side Posterior Inferior Iliac Crest (PSIS). Channel 2 electrodes were placed with one electrode on the left hand side on the erector spinae muscle at the level between the spinous processes of T12 and L1, the other electrode was placed just below the left hand side PSIS. This is called the parallel pattern placement. (Kahn 1994: 111.)

Patients were warned to expect a mild tingling sensation. The chosen electrotherapy apparatus's intensity was then increased to the subjects tolerance, i.e. a firm tingling sensation.
The Relief Pulse group's therapy was delivered by a Relief Pulse (Mark I) Dual Channel Unit (P.O. Box 14661, Sinoville, South Africa). The electrodes were standard black carbon rubber electrodes with a self adhesive tape on one side. The Relief pulse frequency is not adjustable and is set at a frequency of 150 Hertz. (Relief Pulse User's manual: 3.)
The therapy in the TENS group delivered by an ITO Dual Channel TENS Model 120Z (Hi-Tech, 80 Moore road, Durban, South Africa). The electrodes used by the TENS unit were the same set of electrodes used by the Relief Pulse unit, as a study by Nolan in showed that commercially available electrodes varied in their conductive properties. A continuous frequency on the TENS was set at 150 Hertz. This is so that both groups would experience 150 Hertz thereby the only difference between the 2 groups would be the waveform that each device generated.

After ten minutes of electrotherapy the patient was then manipulated according to the diversified method at the vertebral level which was predetermined by the regional examination, using motion palpation procedures and relevant orthopaedic tests (Schafer & Faye 1989: 199, 283).

The spinal adjustment was preformed by placing the patient in the lateral recumbent position with the involved (problematic) area facing upward. The patient's uppermost knee is flexed. The patient's uppermost shoulder is then supported with the practitioner's stabilizing hand. The practitioner's contact hand is placed either on the mamilliary process of the involved lumber vertebrae or on the posterior inferior iliac spine in the case of upper sacro-iliac involvement, or on the ischial tuberosity in the case of lower sacro-iliac involvement. A high velocity impulse is delivered through the contact hand which is reinforced by means of a body drop. (Schafer & Faye 1989: 283.)

The predetermined levels were adjusted only once per treatment, irrespective of wether an audible cavitation was heard.

3.5 MEASUREMENT AND OTHER OBSERVATIONS

The subjective assessment was by means of three questionnaires which are widely accepted in the research community namely: (i) Oswestry Low Back Pain Disability Questionnaire (Appendix E)(Fairbank *et al.* 1980) which is used to indicate the extent to which a person's functional level is restricted by pain, (ii) Numerical Rating Scale 101 (Appendix F)(Jensen *et al.* 1986) which is used to rate the overall severity of pain and (iii) Short-Form McGill Pain Questionnaire (Appendix G)(Melzack 1987) which was designed to provide a quantitative profile of pain, namely: to evaluate pain therapies and as a diagnostic aid.

The objective assessment was measured by means of a pressure algometer (a pain threshold meter) manufactured by Wagner Instruments (P.O.Box 1217, Greenwich, CT 06836) and a low back range of motion goniometer (Brom II-Back range of motion instrument) manufactured by Performance

Attainment Associates (3600 Labore Road, Suite 6, St Paul. Mn, 55110-4144).

Measurement of lumbar range of motion is considered to be an affective objective method of assessing lumbar function (Breum et al. 1995). The Back range of motion instrument (Brom II) is a device for measuring lumbar mobility that uses the mechanisms based on the inclinometric technique, in fact the Brom II device is a modified inclinometer.

Measurements were taken in the neutral position and at the end of range of motion. To take the flexion and extension measurements, patients were asked to stand with their feet fifteen centimetres apart and heels aligned with a ruler, the extension arm of the flexion/extension unit was placed at T12-L1 and held their firmly by the researcher throughout the manoeuvre. The upper contact point of the base unit was strapped over the sacrum. The subjects were asked to maximally flex and extend while keeping their knees straight. Measurements were read and recorded off the protractor scale gauge on the base unit of Brom II. (Breum et al. 1995.)

To take the lateral flexion readings, each subject was asked to stand in the neutral position as above. The rotation/lateral flexion unit was placed over T12-L1 and held their firmly throughout the manoeuvre. Each subject was asked to bend towards the opposite side from the waist. When the subject reached full lateral flexion, The researcher read and noted the measurements from the protractor gauge. (Breum et al. 1995.)

To take rotation measurements, each subject was seated and the magnetic booster was positioned over the sacrum, the rotation/lateral flexion unit was placed over T12-L1 and held their firmly throughout the manoeuvre. The subject was then asked to rotate maximally to each side. Readings were recorded from the horizontally mounted compass device. (Breum et al. 1995.) This procedure was done twice, at the beginning and at the end of each treatment.

The normal range of motion from the neutral position for lumbar flexion is sixty degrees or greater, for lumbar extension it is twenty five degrees or greater, for lumbar lateral flexion it is twenty five degrees or greater (Cipriano 1991: 49-53), for lumbar rotation it is from three to eighteen degrees (Magee 1992: 255).

A study by Breum et al. in 1995 has shown that Brom II is as accurate as the double inclinometer method for measuring lumbar flexion, and lateral flexion, however they feel that it is not a reliable device for measuring extension nor rotation.

To take the pain threshold readings using an algometer, the patient was asked to lie prone and identify the maximum pain area with one finger. The researcher then palpated the painful area with his finger to identify the point of maximum sensitivity. A skin pencil was then used to mark this area. The gauge with it's rubber plunger placed on the marked painful area is placed at ninety degrees to the skin. The patient was asked to say " yes" when discomfort was felt. The pressure was increased at an even rate by counting "one and thousand, two and thousand" and so on. The pressure was stopped immediately as the patient said "yes", the gauge was removed and the pressure read off the gauge and recorded. This procedure was done before and after each treatment. (Fischer 1986.) It has been found that pain-free subjects had pain thresholds of 5.7 Kg/cm^2 (for woman), 8.0 Kg/cm^2 (for males) on the lumbar paraspinals and 6.0 Kg/cm^2 (for woman) and 6.4 Kg/cm^2 (for males) on gluteuls. (Fischer 1986.)

The subjective analysis was by means of the Oswestry Low Back Pain Disability Questionnaire (Appendix E), Numerical Rating Scale 101 (Appendix F) and Short-Form McGill Pain Questionnaire (Appendix G). All questionnaires were answered before treatments one, five and ten.

The Oswestry Low Back Pain disability questionnaire indicates the extent to which a person's functional level is restricted by pain. Subjects were asked to complete the questions truthfully. The questionnaire is divided into ten sections, each containing six items. The subject marks the statement in each section that most accurately describes the effect of their pain. If two items were marked then the more severe was scored. Each section scores fall on a 0 to 5 scale, with the higher values representing greater disability. The sum of the ten scores was expressed as a percentage of the maximum score.

If the patient failed to complete a section, the percentage score was adjusted accordingly. (Fairbank et al. 1980; McDowell & Newell 1987: 239-241.)

The numerical rating scale 101 questionnaire was used to rate the overall severity of pain. A visual analogue scale is a horizontal straight line, which is ten centimetres long and represents the continuum of the severity of the pain. Each end of the scale was marked with labels that indicated the range being considered. A zero indicated "no pain at all" and one hundred indicated "pain as bad as it could be". The subject was asked to place a mark on the line at a point representing the severity of pain when it was at its worst and again on the following scale when the pain was at its least. The marks were then measured on a ruler in millimetres. The sum of the two answers were then converted to a percentage value. (Jensen et al. 1986; McDowell & Newell 1987: 235-238.)

The Short-Form McGill pain questionnaire was used to provide a quantative profile of pain. Subjects were asked to rate each type of pain descriptor on the questionnaire. The display revealed the following descriptors of pain: throbbing, shooting, stabbing, sharp, cramping, gnawing, hot-burning, aching, heavy, tender, splitting, tiring-exhausting, sickening, fearful and punishing-cruel. Each pain descriptor was marked using the columns labelled none, mild, moderate and severe. The marks were then scored by using a pain rating intensity score which used scale values. The sum of the chosen scale values were then added and converted into a percentage value. (McDowell & Newell 1987: 243-249; Melzack 1987.)

3.6 STATISTICAL ANALYSIS

The data collected from Oswestry Low Back Pain Disability Questionnaire (Appendix E), Numerical Rating Scale 101 (Appendix F) and Short-Form McGill Pain Questionnaire (Appendix G) on treatments one, five and ten were converted to percentage values. The algometer and goniometer readings of treatments one, five, and ten only were recorded as values

(De Klerk, Personal communication 1995; Worku, Personal communication 1996). All of these values were statistically analyzed using the computer package called Statgraphics Plus Version 6 (by Manugistics Inc. 2115 East Jefferson Street, Rockville, Maryland, USA). Wilcoxon's Signed Rank Test (used for Intra group comparison) and Mann-Whitney's U-test (used for Inter Group Comparison) were used. The Wilcoxon Signed Rank test and the Mann-Whitney U test are both nonparametric tests, which allows them to be better suited to small sample groups such as those participating in this study. (Daniel 1978: 31, 82.)

The Median for the Numerical Rating Scale 101, Short-Form McGill Pain Questionnaire (treatment one, five and ten, before treatment only) and pressure algometer readings (treatment one, five and ten, before and after treatment) was used, and the information obtained was presented graphically in the form of bar charts. Median measurements were used as they are more accurate for small samples (Worku, Personal communication 1996).

These results are presented in the next chapter.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

In this chapter the data which was collected from the Relief Pulse and the TENS group during consultations one, five and ten was statistically analyzed. The TENS group received TENS for ten minutes followed by a spinal manipulation, whilst the Relief Pulse group received Relief Pulse for 10 minutes followed by a spinal manipulation. Objective data such as that obtained from the pressure algometer (Appendix H) and the back range of motion goniometer (Appendix I) as well as subjective data obtained from Oswestry Low Back Pain Disability Questionnaire (Appendix E), Numerical Rating Scale 101 (Appendix F) and Short-Form McGill Pain Questionnaire (Appendix G) was used for the statistical analysis.

The Wilcoxon Signed Rank Test was used for intra-group comparisons while Mann-Whitney's U-test was used for inter-group comparisons. The diagnostic and age distributions were tabulated as pie charts. Summary statistics of the medians of the Numerical Rating Scale 101, Short-Form McGill Pain Questionnaire (treatment one, five and ten, before treatment only) and pressure algometer readings (treatment one,five and ten, before and after treatment) were used to draw bar graphs.

Each questionnaire was discussed individually, and followed the following format: Wilcoxon Signed Rank Test for TENS, Wilcoxon Signed Rank Test for Relief Pulse and lastly by the Mann-Whitney U-test. This format was also used for the objective assessments. The level of significance was set at α is 0.05 (Daniel 1987: 31-37; Oyster et al. 1987: 149.)

Thus the confidence level is set at 95% ,meaning that 95% of subjects received an effect from the treatment (Oyster et al. 1987: 149).

4.2 CRITERIA FOR ADMISSIBILITY OF THE DATA

All questionnaires had to be completed by the respective subjects and all objective measurements were recorded by the researcher. All data obtained was then processed by the researcher.

4.3 NUMERICAL RATING SCALE 101 (APPENDIX F)

Table I

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.93987	0.00016
5 to 10	1.54919	0.06066
1 to 10	2.06559	0.01943

The null hypothesis for the treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table II

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.06559	0.01943
5 to 10	2.21880	0.00066
1 to 10	2.40535	0.00080

The null hypothesis for the treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table III

Mann-Whitney's U-Test for comparison between Relief Pulse and TENS Groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.81144	0.20855
5	1.74714	0.04030
10	0.42951	0.21475

The null hypothesis for treatment 1 is accepted therefore their is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is rejected therefore their is a difference between the subject's median pain between the two groups.

The null hypothesis for the treatment 10 is accepted therefore their is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.4 OSWESTRY LOW BACK PAIN DISABILITY QUESTIONNAIRE (APPENDIX E)

Table IV

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.76777	0.03854
5 to 10	1.80907	0.03522
1 to 10	1.80907	0.01761

The null hypothesis for the treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table V

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.44338	0.07445
5 to 10	2.21359	0.01342
1 to 10	3.3282	0.00043

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table VI

Mann-Whitney's U-Test for comparison between the Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.45871	0.32321
5	0.08376	0.46662
10	1.35866	0.08712

The null hypothesis for treatment 1 is accepted therefore their is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore their is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is accepted therefore their is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.5 SHORT-FORM McGILL PAIN QUESTIONNAIRE

Table VII

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	3.4744	0.00002
5 to 10	1.87083	0.03068
1 to 10	2.93987	0.01641

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table VIII

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.87083	0.00306
5 to 10	2.7735	0.00027
1 to 10	2.58199	0.00049

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table IX

Mann-Whitney's U-Test for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.72699	0.23361
5	0.41820	0.20910
10	0.31164	0.37765

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.6 PRESSURE ALGOMETER READINGS: BEFORE TREATMENT

Table X

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.1094	0.13362
5 to 10	1.44338	0.07445
1 to 10	1.44338	0.00744

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XI

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0.5547	0.28954
5 to 10	0.51639	0.30278
1 to 10	0.26726	0.39463

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XII

Mann-Whitney's U-Test for comparison between Relief Pulse and TENS group: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.08383	0.46659
5	1.20676	0.11376
10	1.56117	0.05924

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.7 PRESSURE ALGOMETER READINGS: AFTER TREATMENT

Table XIII

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0.28867	0.38641
5 to 10	2.40535	0.00080
1 to 10	2.93987	0.00016

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XIV

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.44338	0.07445
5 to 10	0.28867	0.38641
1 to 10	0	0.5

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XV

Mann-Whitney's U-Test for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.43766	0.33081
5	1.60137	0.05464
10	1.97372	0.02420

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is rejected therefore there is a difference between the subject's median pain between the two groups.

4.8 GONIOMETER (BROM) READINGS - FORWARD FLEXION: BEFORE TREATMENT

Table XVI

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.0323	0.15084
5 to 10	0.26726	0.39463
1 to 10	0.80178	0.21133

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XVII

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.40535	0.00080
5 to 10	1.33631	0.09072
1 to 10	1.6641	0.04804

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XVIII

Mann-Whitney's U-Test for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	1.16698	0.12160
5	0.58746	0.77844
10	0.45975	0.32284

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.9 GONIOMETER (BROM) READINGS - FORWARD FLEXION: AFTER TREATMENT

Table XIX

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.06559	0.01943
5 to 10	1.44338	0.07445
1 to 10	0.51639	0.30278

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XX

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.93987	0.00016
5 to 10	0.26726	0.39463
1 to 10	1.6641	0.04804

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XXI

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	1.75086	0.03998
5	0.49950	0.30870
10	0.31482	0.37644

The null hypothesis for treatment 1 is rejected therefore there is a difference between the subject's median pain between the two groups.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.10 GONIOMETER (BROM) READINGS - EXTENSION: BEFORE TREATMENT

Table XXII

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0.60302	0.27324
5 to 10	0.35355	0.36183
1 to 10	0.28867	0.38641

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXIII

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.1094	0.13762
5 to 10	1.6641	0.04804
1 to 10	0.60302	0.27324

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXIV

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.88361	0.18845
5	0.08548	0.46593
10	2.23556	0.01269

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is rejected therefore there is a difference between the subject's median pain between the two groups.

4.11 GONIOMETER (BROM) READINGS - EXTENSION: AFTER TREATMENT

Table XXV

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0.86602	0.19323
5 to 10	0.80178	0.21133
1 to 10	0.31622	0.37591

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXVI

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0.26726	0.39463
5 to 10	0.31622	0.37591
1 to 10	0	0.5

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXVII

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.19141	0.42409
5	1.97175	0.02431
10	1.31526	0.09421

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is rejected therefore there is a difference between the subject's median pain between the two groups.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.12 GONIOMETER (BROM) READINGS - RIGHT ROTATION: BEFORE TREATMENT

Table XXVIII

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0	0.5
5 to 10	0.35355	0.36183
1 to 10	0	0.5

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXIX

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.58199	0.00049
5 to 10	1.1094	0.13362
1 to 10	2.58199	0.04911

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XXX

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0	0.5
5	1.44455	0.07429
10	2.40378	0.00081

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is rejected therefore there is a difference between the subject's median pain between the two groups.

4.13 GONIOMETER (BROM) READINGS - RIGHT ROTATION: AFTER TREATMENT

Table XXXI

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.0328	0.15084
5 to 10	0.26726	0.39463
1 to 10	0	0.5

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXXII

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.40535	0.00080
5 to 10	0.60302	0.27324
1 to 10	2.58199	0.00049

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XXXIII

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.33565	0.36856
5	1.15002	0.12506
10	2.42195	0.00077

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is rejected therefore there is a difference between the subject's median pain between the two groups.

4.14 GONIOMETER (BROM) READINGS - LEFT ROTATION: BEFORE TREATMENT

Table XXXIV

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0.26726	0.39463
5 to 10	1.33333	0.09121
1 to 10	0.28867	0.38641

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXXV

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.54911	0.06066
5 to 10	0.66666	0.25249
1 to 10	1.0328	0.15084

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXXVI

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.98086	0.16332
5	1.46899	0.07091
10	2.77483	0.00027

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is rejected therefore there is a difference between the subject's median pain between the two groups.

4.15 GONIOMETER (BROW) READINGS - LEFT ROTATION: AFTER TREATMENT

Table XXXVII

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0	0.5
5 to 10	1.0194	0.13362
1 to 10	0.28867	0.38641

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXXVIII

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.33631	0.09072
5 to 10	0	0.5
1 to 10	1.54919	0.06066

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XXXIX

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.16775	0.43338
5	2.37056	0.00088
10	3.02572	0.00012

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is rejected therefore there is a difference between the subject's median pain between the two groups.

The null hypothesis for the treatment 10 is rejected therefore there is a difference between the subject's median pain between the two groups.

4.16 GONIOMETER (BROM) READINGS - LEFT LATERAL FLEXION: BEFORE TREATMENT

Table XL

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.44338	0.07445
5 to 10	2.26779	0.01167
1 to 10	2.84605	0.00022

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XLI

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.6641	0.04804
5 to 10	0.35355	0.36183
1 to 10	1.1094	0.13362

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XLII

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.54174	0.32572
5	1.79582	0.03626
10	0.38211	0.35118

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is rejected therefore there is a difference between the subject's median pain between the two groups.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.17 GONIOMETER (BROM) READINGS - LEFT LATERAL FLEXION: AFTER TREATMENT

Table XLIII

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.20605	0.11389
5 to 10	0	0.5
1 to 10	1.1094	0.13362

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is accepted therefore the subjects did not improve.

Table XLIV

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	2.2188	0.01325
5 to 10	1.1094	0.13362
1 to 10	1.87083	0.03068

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XLV

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.42236	0.33637
5	0.95977	0.16858
10	0.56050	0.28256

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.18 GONIOMETER (BROM) READINGS - RIGHT LATERAL FLEXION: BEFORE TREATMENT

Table XLVI

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.6641	0.04804
5 to 10	2.02073	0.02168
1 to 10	3.3282	0.00004

The null hypothesis for treatments 1 to 5 is rejected therefore the subjects improved.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XLVII

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.44338	0.07445
5 to 10	2.41209	0.00079
1 to 10	3.01511	0.01284

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is rejected therefore the subjects improved.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table XLVIII

Mann-Whitney's U-Test of for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.82169	0.20562
5	1.61527	0.05312
10	0.84865	0.19803

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.19 GONIOMETER (BROM) READINGS - RIGHT LATERAL FLEXION: AFTER TREATMENT

Table XLIX

Wilcoxon Signed Rank Test for the TENS group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	1.1094	0.13362
5 to 10	0.28867	0.38641
1 to 10	1.87083	0.03068

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table I

Wilcoxon Signed Rank Test for the Relief Pulse group: (n=15)

TREATMENTS	z-VALUE	p-VALUE
1 to 5	0.80178	0.21133
5 to 10	0.94868	0.17139
1 to 10	1.6641	0.04804

The null hypothesis for treatments 1 to 5 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 5 to 10 is accepted therefore the subjects did not improve.

The null hypothesis for the treatments 1 to 10 is rejected therefore the subjects improved.

Table II

Mann-Whitney's U-Test for comparison between Relief Pulse and TENS groups: (n=30)

TREATMENT	z-VALUE	p-VALUE
1	0.34467	0.36516
5	1.75431	0.03968
10	0	0.5

The null hypothesis for treatment 1 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

The null hypothesis for treatment 5 is rejected therefore there is a difference between the subject's median pain between the two groups.

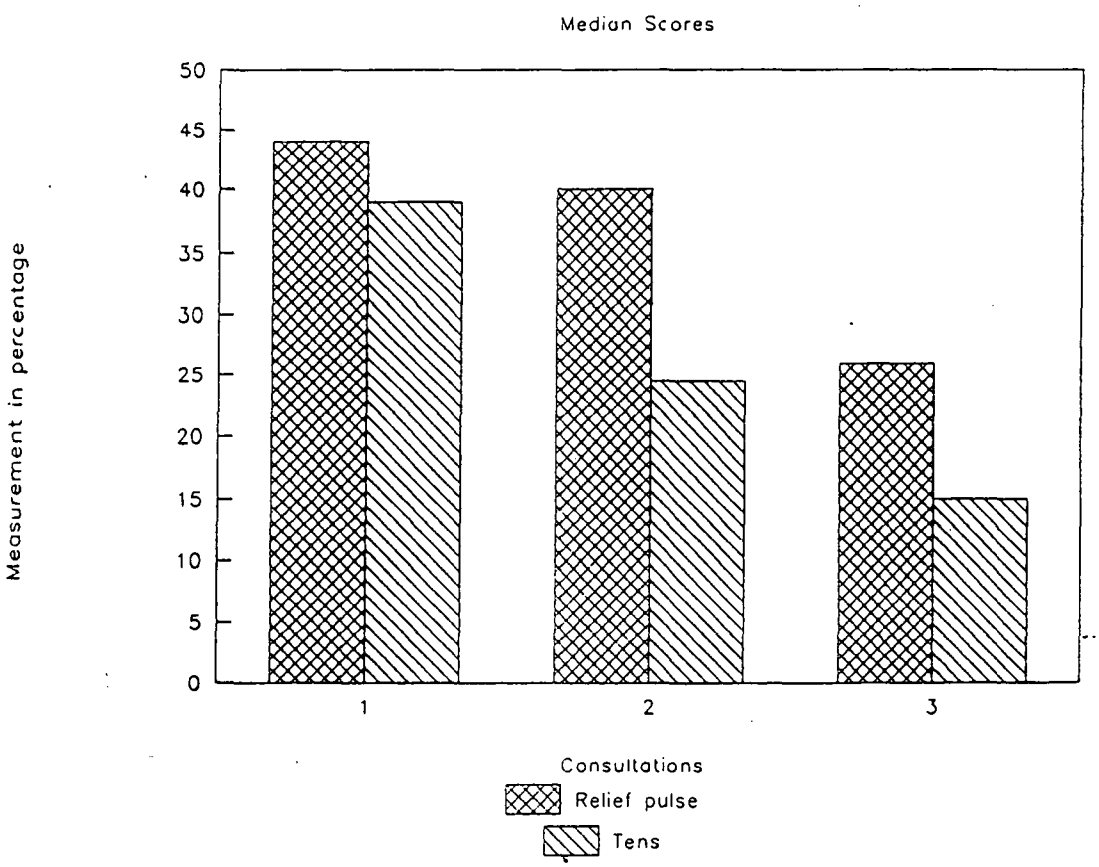
The null hypothesis for the treatment 10 is accepted therefore there is no significant difference between the subject's median pain in both groups. Hence the groups are comparable.

4.20 BAR CHARTS

Bar charts were drawn using the medians of the TENS and Relief Pulse groups. The median is the most sensitive measurement for this sample size (Worku, Personal communication 1996). Consultation 1 was the first treatment, consultation 2 was the fifth treatment and consultation 3 was the tenth treatment.

Graph I

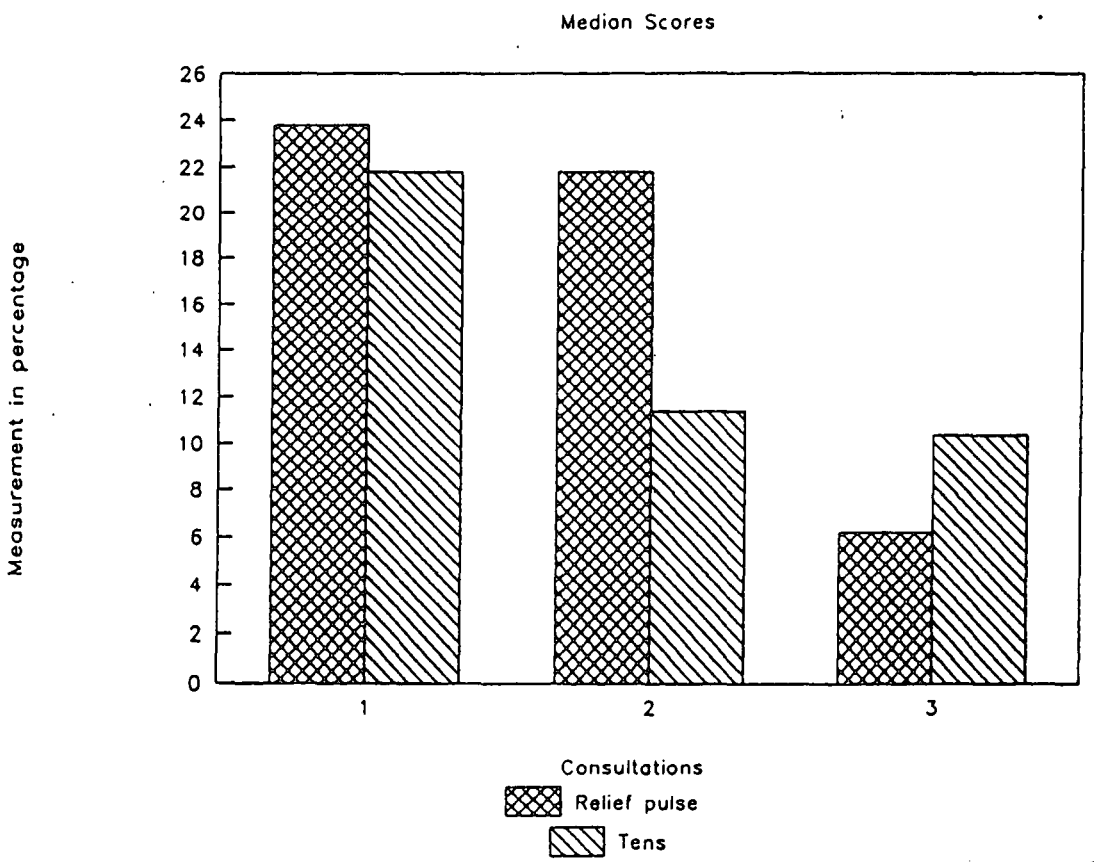
Comparison with respect to NRS 101 (Appendix F)



Both groups improved progressively, although the TENS group showed a more rapid rate of improvement.

Graph II

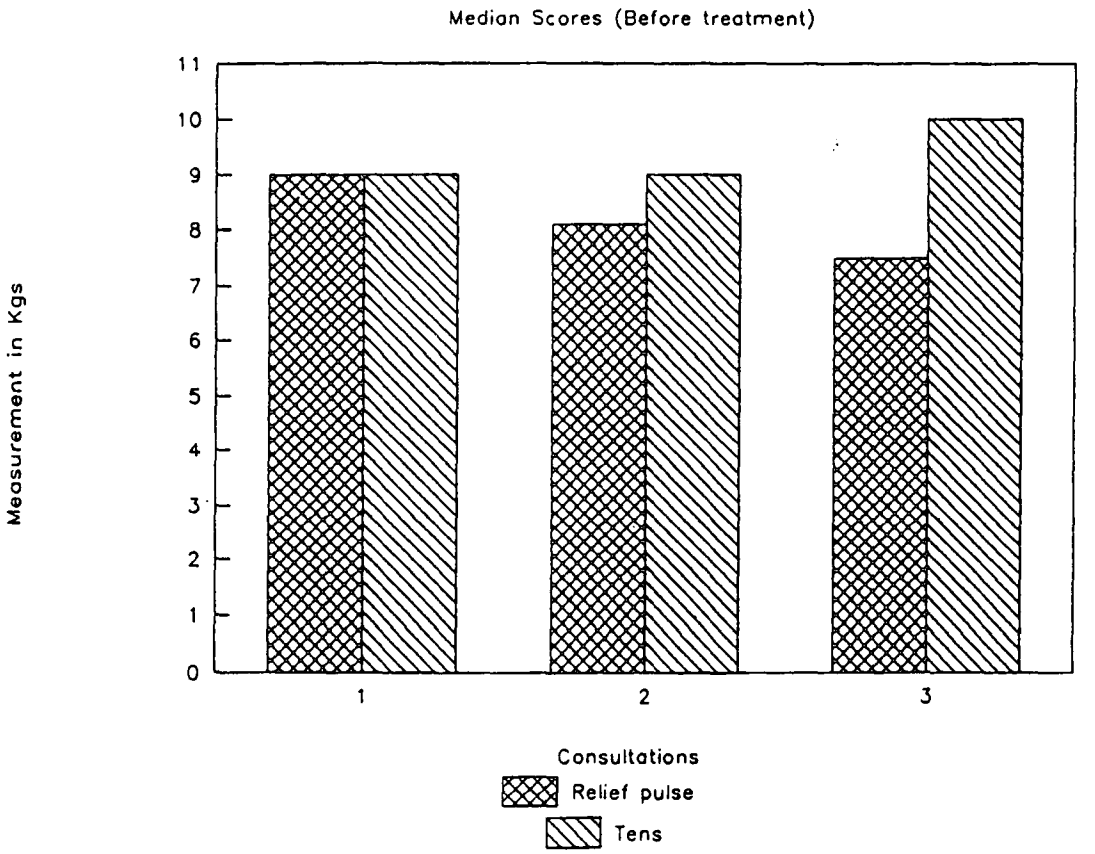
Comparison with respect to McGill questionnaire (Appendix G)



Both groups improved, although the TENS group showed more rapid rate of improvement between treatments 1 and 5, where as the Relief Pulse group showed more improvement at the end of the treatment (treatments 5 to 10).

Graph III

Comparison with respect to Algometer

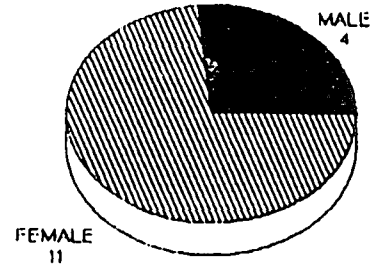


The readings for the Relief Pulse group decreased, but for the TENS group, a mild improvement could be seen.

4.21 PIE CHARTS

Graph IV

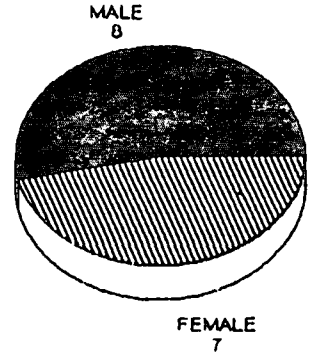
Gender distribution for the Relief Pulse group



This chart shows that the there were far more females than males in the Relief Pulse group.

Graph V

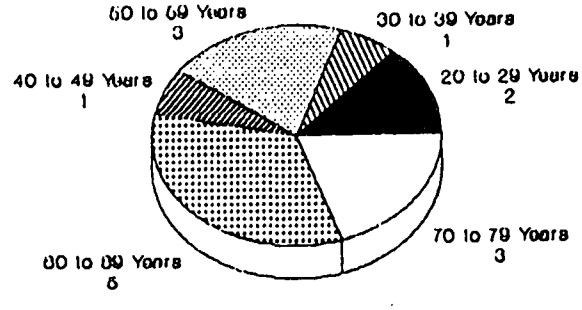
Gender distribution for the TENS group



This chart shows that there were relatively the same number of females and males in the TENS Group.

Graph VI

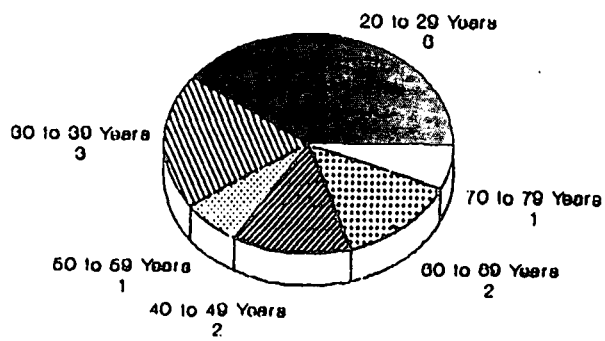
Age distribution for the Relief Pulse group



This chart shows that the there were relatively few subjects that were below the age of 40 years old.
A majority of subjects were between 60 to 69 years old in the Relief Pulse group.

Graph VII

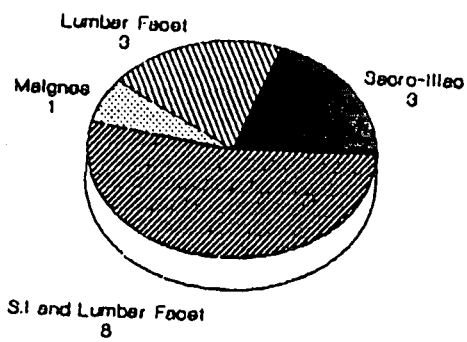
Age distribution for the TENS group



This chart shows that there were relatively few subjects over the age of 40 years old. A majority of subjects were between 20 and 29 years of age in the TENS group.

Graph VIII

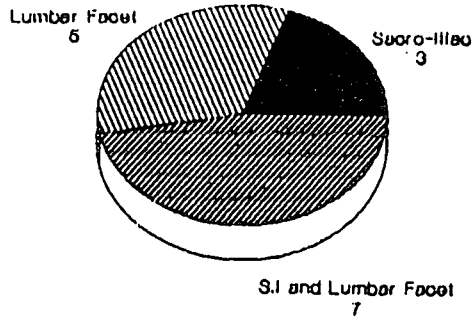
Diagnosis distribution for the Relief Pulse group



This chart shows that the most common diagnosis in the Relief Pulse group was Sacro-iliac syndrome with a concomitant Lumbar facet syndrome.

Graph IX

Diagnosis distribution for the TENS group



This chart shows that the most common diagnosis in the TENS group was also Sacro-iliac syndrome with a concomitant Lumbar facet syndrome.

4.22 CONCLUSION

This chapter has presented the results obtained from the collected data. The discussion, interpretation and implications of these results are discussed in chapter 5.

CHAPTER 5

DISCUSSION

5.1 INTERPRETATION

Each subject was assessed subjectively and objectively. The subjective assessment was by means of questionnaires. It was found with respect to the Numerical Rating Scale 101 questionnaire (Appendix F) which measured pain intensity that the TENS group's pain intensity decreased rapidly at the beginning of the study (between treatments one and five) but at the latter stages, no further improvement could be found. They did respond favourably (pain intensity decreased) overall (Table I).

In contrast it was found that the Relief Pulse group's pain intensity decreased statistically throughout the entire duration of the study (Table II).

In comparing the statistical results from both groups, it was found that both groups pain intensities were statistically similar at the beginning and at the end of the study (Table III). This suggests that both groups responded favourably to treatment (pain intensity decreased) but that the TENS group's favourable response was more rapid than that of the Relief Pulse group (Tables I-III). This trend was reinforced clinically by looking at the bar chart (Graph I) which also showed that both groups improved progressively although the TENS group showed a more rapid rate of improvement.

The Oswestry Low Back Pain Disability Questionnaire (Appendix E) which measured the subject's disability, showed that the TENS group's disability improved throughout the duration of the study (Table IV). The Relief Pulse group's disability did not improve at the beginning of the study, however it did improve during the latter stage of the study (between treatments five to ten) (Table V).

In comparing the two groups it was found that statistically both groups were similar during the duration of the study (Table VI). This suggests there is no statically significant difference between the two groups, and hence both treatments have the same effect with regards to disability.

The Short-form McGill Pain questionnaire (Appendix G) which measured the quantitive profile of pain revealed that the TENS group improved (quantative reduction in pain) during the entire duration of the study (between treatments one to ten) (Table VII). The Relief Pulse group also improved (quantitive reduction in pain) during the duration of the study (Table VIII). In comparing the two groups it was found that statistically both groups were similar during the duration of the study (Table IX). This suggests there is no statically significant difference between the two groups and hence both treatments have the same effect with regards to the quantative profile of pain. By looking at the bar chart (Graph II) it showed that clinically there was a more rapid rate of improvement by the TENS group but overall both groups responded favourably to treatment.

Analysing the subjects objectively was accomplished by means of a pressure algometer (Appendix H) which measured the subjects pain tolerance. It revealed that the readings which were taken before treatments (one, five and ten) that the TENS group (Table X) and the Relief Pulse group's readings (Table XI) did not improve statistically throughout the study. There was also no statistical difference found when comparing the two groups (Table XII). However when looking at the readings which were taken after treatments one, five and ten it was found that the TENS group's pain tolerance increased during the latter stages of the study (Table XIII) whereas the Relief Pulse groups readings did not improve (Table XIV). When comparing the two groups it was found that the TENS group improved (pain tolerance) more than the relief pulse group (Table XV). This was confirmed clinically by the bar chart (Graph III), which showed that the Relief Pulse groups readings decreased, and the TENS group had a mild improvement. This suggests that

This suggests that the TENS waveform was more effective in increasing the patients pain tolerance levels.

The other objective assessment was taken by means of a BROM goniometer which measured the subjects range of motion in degrees (Appendix I). The goniometer readings which were taken for forward flexion before treatments one, five and ten revealed that the TENS group's readings did not improve statistically (Table XVI) whereas the Relief Pulse group's readings improved throughout the entire study (Table XVII). When comparing the two groups it was found that there was no statistical difference between the two groups throughout the study (Table XVIII). When the readings which were taken after the relevant treatments was analyzed it was found that the TENS group's readings, and hence their degree of forward flexion, improved during the early stages of the study. The readings however did not improve statistically over the entire study, this suggests that the readings decreased between treatments five and ten (Table XIX). The Relief pulse group's readings improved between treatments one and five but these readings did not decrease over the latter stages of the study and hence there was improvement noted statistically between treatments one and ten (Table XX). When comparing the two groups it was found that there was only a statistical difference at the beginning (treatment one) of the study (Table XXI). This implies that Relief Pulse is more beneficial than TENS in increasing the degree of forward flexion.

The goniometer readings for extension range of motion which were taken before treatments one, five and ten show that the TENS group did not improve statistically during the study (Table XXII). The Relief Pulse group however showed improvement during the latter stage of the study (between treatment five and ten), but no improvement was noted for this group over the duration of the study (Table XXIII). When comparing the two groups it was noted that for the last consultation (treatment ten) there was a statistical difference found between the two groups (Table XXIV).

The measurements which were taken after those consultations showed that the TENS group's readings did not improve during the study (Table XXV). The Relief Pulse group also did not improve during the study (Table XXVI). When comparing the two groups it was noted that there was no statistical difference found at the beginning or the end of the study (Table XXVII).

The goniometer readings of right rotation which were taken before treatments one, five and ten revealed that the TENS groups right rotation did not improve during the study (Table XXVIII). The Relief Pulse group's right rotation improved at the beginning of the study i.e. between treatments one and five, as well as overall (Table XXIX). In comparing the two groups it was found that there was a statistical difference between the two groups at the end (treatment ten) of the study (Table XXX). These trends were also found in the extension readings which were taken after the treatments (Tables XXXI; XXXII and XXXIII). These readings suggest that the Relief Pulse waveform is more effective in increasing and improving right rotation in subjects.

The goniometer readings of left rotation which were taken before treatments one, five and ten revealed that the TENS group did not improve during the study (Table XXXIV). The Relief pulse group's readings did also not improve during the study (Table XXXV). In comparing the two groups however it was found that there was a statistical difference on the last treatment (Table XXXVI). These trends were also noted in the readings which were taken after the relevant treatments (Tables XXXVII and XXXVIII), however in comparing these two groups it was found that there were statistical differences found at treatments five and ten.

The goniometer readings of left lateral flexion which were taken before treatments one, five and ten revealed that the TENS group's readings improved over the latter portion of the study as well as overall (Table XL). The Relief Pulse group's readings improved at the beginning of the study but not overall (Table XLI), this suggests that although the

readings improved at the beginning of the study, they decreased during the latter stages of the study. There was however no statistical difference found between the groups at the beginning and at the end of the study (Table XLII). The readings which were taken after the relevant treatments showed the TENS group's readings did not improve during the study (Table XLIII). The Relief Pulse group showed improvement at the beginning of the study as well as overall (Table XLIV).
There was however no statistical difference found between the two groups throughout the study.

The readings which were taken of right lateral flexion which were taken before treatments one, five and ten showed that the TENS group's readings improved throughout the study (Table XLVI). The Relief Pulse group showed improvement at the latter stages of the study as well as overall (Table XLVII). There was no statistical difference found between the two groups throughout the study. The readings which were taken after the relevant treatments revealed that both the TENS and Relief Pulse groups improved overall during the study (Tables XLIX and L). By comparing the two groups the same trend was noticed, in that there was no statistical difference between the two groups. This suggests that both waveforms are effective in improving right lateral flexion in subjects, with no waveform being superior to the other (Table LI).

In looking at the gender distribution of the Relief Pulse (Graph IV) and TENS group (Graph V), one can see that the 73.3% of the Relief Pulse group consisted of females, whereas only 46.6% of the TENS group were female. With these percentage differences occurring between the groups it is likely that a discrepancies in the readings may be due this imbalance of gender distribution between the two groups, as it has been shown that males have higher pain and sensory threshold levels (Johnson et al. 1991b).

As far as the age distribution was concerned it was noted that 53.3% of the patients in the relief Pulse group were between the ages of 60 and 80 (Graph VI).

In the TENS group 40% of the subjects were between the ages of 20 and 29 (Graph VII). These age discrepancies between the two groups could influence the results, as anger and frustration are often present in patients which suffer from chronic pain. Elderly patients are more likely to underreport pain, as they perceive their pain as a normal part of ageing (Helme & Katz 1993). Johnson et al. (1991b) showed that a subjects age as well as their chronicity of pain did not alter the benefits which are derived from TENS treatment.

The diagnosis distribution between the two groups was relatively equal as the 53% of the Relief Pulse group suffered from a combination of sacro-iliac and lumbar facet syndrome. It was also noted that only the Relief Pulse group had a subject who suffered from Maigne's syndrome (Graph VIII). 46.6% of the TENS group suffered from sacro-iliac syndrome (Graph IX). This suggests that almost no discrepancies in the outcome of the two groups should be as a result of the different syndromes which were treated.

5.2 ARGUMENT

Many feel that electrotherapy is nothing more than placebo treatment (Deyo et al. 1990b; Marchand et al. 1993; Meyler et al. 1994). However variables which interfere with a clear comparison of TENS studies include: aetiology of pain, chronicity of pain, types of electrodes, electrode placements and frequency of treatment and evaluation methods (Sotosky & Lindsay 1991). As can be seen in this research, the author has attempted to eliminate all these variables. Unfortunately no information could be found of TENS effectiveness at 150 Hz, this was done to equate the frequency to that of Relief Pulse.

It is possible that the positive effects of the chiropractic adjustment although uniformly given to both groups, was sufficient to mask or minimize the effect of both forms of electrotherapy, as it has been shown that manipulation is a very effective form of treatment in treating low back which is mechanical in origin (Barr 1990; Frymoyer 1991: 1587).

Koes et al. (1993) showed that manual therapy in the form of manipulation was far superior to physiotherapy (electrotherapy) in reducing patients' perceived pain, and was especially evident in patients younger than 40 years of age.

It was noted in an experiment using rats that the analgesic effect reached a statistically significant level after five to ten minutes of TENS, however the maximum analgesic effect appeared thirty minutes after onset of the TENS unit (Wang et al. 1992). Johnson et al. (1991a) found that only 30% of patients received TENS analgesia immediately, whereas 75% of patients received TENS analgesia within half an hour, it is therefore possible that in this study (conducted at Technikon Natal), only 30% of the subjects tested attained TENS analgesia. Hence a negative result may have occurred as a result of the treatment duration (10 minutes in this study) being inadequate (Deyo et al. 1990b).

Although in this study there was a difference in the male-female distribution percentages in each group, it was noted by Johnson et al. (1991b) that males were found to have a significantly higher sensory threshold than females. And it was also noted that males utilized a significantly higher therapy level than females (Johnson et al. 1991b), this may be the reason that the TENS group (46.6% female) in this study had a higher pain tolerance threshold than that of the Relief Pulse group (73.3% female). However, it has been shown that men did not attain greater benefits from TENS than women, as measured using visual analogue scale (Johnson et al. 1991a). This may explain the reason for the difference in pain tolerance and no difference in pain intensities between the two groups during this study.

It is possible that both devices are largely placebo and therefore no difference could be found between the groups. Deyo et al. (1990b) reports that negative results may occur if patients were unlikely to respond to the treatment protocol. It is possible that the outcome measures were too unresponsive to detect clinically important differences (Deyo et al. 1990b).

The results show that hypothesis one and two were supported as both groups did improve statistically, however hypothesis three was not

supported as one group did not show a significant statistical difference over the other.

These results imply that if a practitioner wishes to use either Relief Pulse or Transcutaneous Electrical Nerve Stimulation in combination with a chiropractic lumbar roll adjustment that he or she will be have peace of mind that both electrical waveforms have identical benefit for the patient.

This study is the only study, to the author's knowledge, that could be found in which two therapeutic electrical waveforms delivered by two different units in combination with a chiropractic adjustment could be found.

5.3 SPECULATION

Although objective assessments were carried out on each treatment, only the information which correlated to the subjective assessment dates were utilized by the researcher i.e. subjective assessments on treatments one, five and ten. (Oyster et al. 1987: 127-133; Worku 1996, personal communication). If the researcher had unlimited funding and time, then a direct comparison of all makes and models of electrotherapy devices, with placebo units would have been tested with and without the intervention of a chiropractic adjustment.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

No other studies, to the author's knowledge, have evaluated the effect of the combination of chiropractic manipulation and two differing waveform devices.

This study concluded that neither waveform proved to be more effective than the other in treating patients with mechanical low back pain. When looking at the way each patient perceived his or her pain (subjective assessments) it became evident that both groups improved equally. This implies that both devices benefit the patient equally, this beneficial effect may be largely due to placebo (Deyo et al. 1990b). The objective assessments yielded some interesting results though, in so far as that TENS proved more beneficial in increasing the pain tolerance, yet this could be explained by the fact that males (greater number in TENS group) show higher sensory and pain threshold levels (Johnson et al. 1991b). Neither waveform proved more beneficial than the other in terms of increasing the subjects low back range of motion.

It is possible that such results that were obtained were obscured by the fact that spinal manipulation was preformed. Furthermore the spinal manipulation was performed by the researcher and at the start of the study was less proficient in performing this, yet at the end of the study had more than a year's internship experience, with this in mind patients who volunteered in 1995 did not receive as a proficient manipulation than those volunteering in 1996. Hence it could be said that there was no equal or standardized level of manipulation. For this reason it is recommended that a study be conducted utilizing these waveforms without the addition of spinal manipulation therapy. It is also recommended that the age distribution of the study be limited to a smaller sample size, the reason being that geriatric patients with

chronic pain usually underreport their pain (Helme & Katz 1993). Although both groups had relatively the same distribution of pain syndromes it is recommended that a future study be limited to only one type of syndrome. It also became increasing evident to the author that a much larger sample size should be used in future to adequately statistically analyze the differences that occurred. It is also recommended that the mean, median and mode be utilized in statistically analysing this data (Oyster et al. 1987: 141-144). This study was also not blinded as the researcher was aware of the devices, it is therefore recommended that a blinded trial be used in future (Deyo et al. 1990b). It is also recommended that a longer treatment duration of electrotherapy be utilised (Deyo et al. 1990b). As this study was (to the author's knowledge) the first time two electrotherapy waveforms have been compared, there is no data available to compare to other studies, and the results show no superior benefit of one waveform over the other, any effect may have been due to placebo, it is for this reason that the author recommends that this study be repeated but with additional placebo units.

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Appendix A

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient: _____ Date # _____

File #: _____

X-ray #: _____

Age: _____ Sex: _____ Occupation: _____

Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: Signature:

Case History:

Examination:

Previous: TN Current: TN

Other Other

X-ray Studies:

Previous: TN Current: TN

Other Other

Clinical path. lab.:

Previous: TN Current: TN

Other Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's case history

1. Source of history:

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

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

6. Current health status and life-style:
   - Allergies
   - Immunizations
   - Screening tests
   - Environmental hazards
     (home, school, work)
   - Safety measures
     (seat belts, condoms)
   - Exercise and leisure
   - Sleep patterns
   - Diet
   - Current medication
   - Tobacco
   - Alcohol
   - Social drugs

7. Family history:
   - Immediate family:
     - Age
     - Health
     - Cause of death
     - DM
     - Heart disease
     - TB
     - HBP
     - Stroke
     - Kidney disease
     - CA
     - Arthritis
     - Anaemia
     - Headaches
     - Thyroid disease
     - Epilepsy
     - Mental illness
     - Alcoholism
     - Drug addiction
     - Other

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

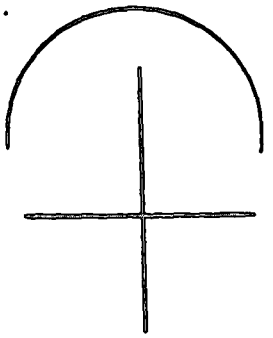
Psychiatric.

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION - LOW BACK

Standing:

Minor's sign
posture
skin
muscle tone
spinous percussion
Schober's test (6cm)
Treadmill
R.O.M.



Flexion 15cm from floor.

Extension 30°

R. Lat flex 35° Fingers to knees
L. Lat flex 35° " " "
R. rot. 30°
L. rot. 30°

/ painless limitation
// painful limitation

Gait:

rhythm
on toes (or while standing)
on heels (or while standing)
half-squat on one leg.

Motion Palpation:

sacro-iliacs (see below for findings)

Sitting:

Posture
Dermatomes:

T12
L1
L2
L3
L4
L5
S1
S2
S3

Reflexes:

patellar
Achilles
medial hamstring

Reflexes: myotomes: L. R.

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

tripod
Kemp's

MOTION PALPATION:

Jt.play		Left						Right					Jt.play	
P/A	Lat	Fle	Ext	LF	AR	PR		Fle	Ext	LF	AR	PR	P/A	Lat
							T10							
							T11							
							T12							
							L1							
							L2							
							L3							
							L4							
							L5							
					U	L	SI	U	L					

Supine:

skin, hair, nails
observe abdomen
fasciculations
abdominal reflexes
auscultate abdomen/groin
palpate abdomen/groin
pulses (abd/ext)
SLR
Braggard's
bowstring
sciatic notch
planter reflex
circumference (thigh, calf)

leg length:
- actual
- apparent

Patrick FABER
Gaenslen's
gluteus max 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
- glut.med

Prone:
gluteal skyline
skin rolling
iliac crest compression
facet joint challenge
S-I tenderness
Erichsen's test
Pheasant's test
myotomes:
- glut. max.

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

Non-organic signs:
pin-point pain
axial compression
trunk rotation
Burn's bench test
flip test
Hoover's test
ankle dorsiflexion test
pin-point pain.

Appendix C

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Underline abnormal findings in RED and elaborate on back of relevant page, if necessary.
Mark "NAD" if normal.

Patient:_____ File #_____

Last name First name

Clinician:_____ Signature:_____

Intern:_____ Signature:_____

Date:_____

Height:_____ Weight:_____ Temp:_____

Rates: Heart:_____ Pulse:_____ Respiration:_____

Blood pressure: Arms: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

Minor's sign
Skin changes
Posture
erect
Adam's
Ranges of motion:

T/L spine:	Flexion: 90	Fingers to floor
	Extension: 50	
	R.lat.flex.: 30	Fingers down leg
	L.lat.flex.: 30	Fingers down leg
	Rot.to R.: 35	
	Rot.to L.: 35	

Flex.

L.Rot. R.Rot.

L.lat flex. R.lat. flex.

Ext.

/ = pain-free limitation; // = painful limitation.

Romberg's sign.
Pronator drift.
Trendelenburg's sign.
Gait.
rhythm
balance
pendulousness
on toes
on heels
tandem
Half squat.
Scapular winging.
Muscle tone.
Spasticity/Rigidity.

Shoulder:
- skin
- symmetry
- ROM - glenohumeral
  - scapulo-thoracic
  - acromioclavicular
  - elbow
  - wrist

Chest measurement
- inspiration
- expiration

Visual acuity

Breast examination:
- Inspection:
  - skin
  - size
  - contour
  - nipples
  - arms overhead
  - hands against hips
  - leaning forward.
- Palpation:
  - axillary lymph nodes.

SEATED EXAMINATION.

- Spinal posture
- Head
  - scalp
  - skull
  - face
  - skin
- Eyes
  - conjunctiva
  - sclera
  - eyebrows
  - eyelids
  - lacrimal gland
  - nasolacrimal duct
  - alignment
  - corneal reflex
  - ocular movement

	L			R		
	III	IV	VI	III	IV	VI

  - visual fields
  - accomodation
  - iris
  - pupils
  - red reflex
  - optic disc

vessels
general background
macula
vitreous
lens

Ears:
auricle
ear canal
drum
auditory acuity
Weber test
Rinne test

Nose:
external
internal
septum
turbinates
olfaction

Sinuses (frontal & maxillary):
tenderness
transillumination

Mouth and pharynx:
lips
buccal mucosa
gums and teeth
roof
tongue
inspection
movement
taste
palpation
pharynx
inspection
CN X

Neck:
posture
size
swelling
scars
discoloration
hair line

ROM:

Flexion:	45	chin to larynx chin to sternum
Extension:	55	forehead parallel to floor
L.lat.flex:	40	
R.lat.flex:	40	
L.rot.:	70	
R.rot.:	70	

Flex.

L.Rot. R.Rot.

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

Ext.

lymph nodes
trachea
thyroid
carotid arteries (thrills, bruit)
CN V
CN VII
CN VIII (nystagmus)
CN IX
CN XI
TMJ
Inspection
ROM
deviation
Palpation
crepitus
tenderness

- Neurological:
  - Dermatomes
    - C5
    - C6
    - C7
    - C8
    - T1
  - Tendon reflexes
    - biceps
    - triceps
    - brachioradialis
  - Muscle strength
    - C5
    - C6
    - C7
    - C8
    - T1
  - Coordination:
    - point-to-point
    - dysdiadochokinesia
- Thorax:
  - Chest:
    - Inspection:
      - skin
      - shape
      - respiratory distress
      - rhythm (respiratory)
      - depth "
      - effort "
      - intercostal/supraclavicular retraction
    - Palpation:
      - tenderness
      - masses
      - respiratory expansion
      - tactile fremitus
    - Percussion:
      - lungs (posterior)
      - diaphragmatic excursion
      - kidney punch
    - Auscultation:
      - breath sounds
        - vesicular
        - bronchial
      - adventitious sounds
        - crackles (rales)
        - wheezes (rhonchi)
      - voice sounds
        - broncophony
        - whispered pectoriloquy
        - egophony

Cardiovascular:
auscultation (aortic murmurs)
Allen's test

SUPINE EXAMINATION

JVP
PMI
auscultation heart (L.lat.recumbent)
respiratory excursion
percussion chest (anterior)
breast palpation
The abdomen:
Inspection:
skin
umbilicus
contour
peristalsis
pulsations
hernias (umbilical/incisional)
Auscultation:
bowel sounds
bruit
Percussion:
general
liver
spleen
Palpation:
superficial reflexes
cough
light
rebound tenderness
deep
liver
spleen
kidneys
aorta
intra-/retro-abdominal wall mass
shifting dullness
fluid wave
Acute abdomen:
where pain began and now
cough
tenderness
guarding/rigidity
rebound tenderness
Rovsing's sign
psoas sign
obturator sign
cutaneous hyperaesthaesia
rectal exam
Murphy's sign.

Male genitals and hernias.
  Inspection:
   skin
   prepuce
   glans
   meatus
   nits/lice
   scrotum
   inguinal/femoral bulges
 Palpation:
   penis (tenderness/induration)
   testes
   epididymis
   inguinal canal
   femoral canal
   cremasteric reflex
 Auscultation:
   scrotal mass.
Peripheral vasculature:
 Inspection:
   skin
   nail beds
   pigmentation
   hair loss
 Palpation:
   pulses - radial, brachial, femoral, popliteal, post.tibial,
            dorsalis pedis
   lymph nodes - epitrochlear, femoral (horizontal & vertical)
   temperature (feet & legs)
  Manual compression test
  Retrograde filling (Trendelenburg) test
  Arterial insufficiency test

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

Neurological:
- dermatomes
  - L1
  - L2
  - L3
  - L4
  - L5
  - S1
- muscle strength
  - hip flexion
  - knee extension
  - ankle dorsiflexion
  - plantar flexion
- tendon reflexes
  - patellar
  - Achilles
- plantar reflex

Rectal examination:
- Inspection
  - sacrococcygeal & perianal areas
- Palpation
  - sphincter tone
  - tenderness
  - induration
  - nodules
  - prostate
  - seminal vesicles

Mental status
- Appearance and behaviour:
  - level of consciousness
  - posture and motor behaviour
  - dress, grooming, personal hygiene
  - facial expression
  - affect
- Speech and language:
  - quantity
  - rate
  - volume
  - fluency
  - aphasia (prn)
- Mood
- Thought processes (logical, relevant, organized)
- Memory and attention:
  - orientation (time, place, person)
  - remote memory
  - recent memory
  - new learning ability
- Higher cognitive functions:
  - information and vocabulary (general & specialised knowledge)
  - abstract thinking.

Appendix D:
LETTER OF INFORMED CONSENT

Dear Patient

I am currently doing a study on mechanical low back pain. The nature of my study involves electrotherapy devices and chiropractic manipulation. You will be randomly assigned to a group which will receive treatment from one of the two devices. You will be asked to fill in questionnaires about your low back pain and to conform to certain orthopaedic tests on a regular basis for the duration of the study. The study will last 10 (ten) treatments (a maximum of 7 weeks).

I.....understand that I will be receiving the best treatment for my ailment. I will undertake to answer the questionnaires and questions asked to me both honestly and to the best of my ability. I will undertake to keep all my appointments with the intern and to continue with the treatment until the end of the research. If I cannot make the appointment then I will telephonically cancel and reschedule.

I understand that, if deemed necessary, that I will have a set of X-rays taken and that I will therefore be exposed to small doses of radiation. I further understand due to the nature of the treatment that allergic skin reaction occurs in 10 % of patients, a further side effect has been observed in a few patients who have undergone mastectomy and radiation treatment, that is an increase tendency to oedema.

I understand and will comply with all of the above.

....
signature date

Appendix E

OSWESTRY LOW BACK PAIN DISABILITY QUESTIONNAIRE

This questionnaire has been designed to give the intern information as to how your back pain has affected your ability to manage in everyday life. Please answer every section, and mark in each section only the ONE BOX which applies to you. We realise you may consider that two of the statements in any one section relate to you, but please just MARK THE BOX WHICH MOST CLOSELY DESCRIBES YOUR PROBLEM.

ction 1 — Pain Intensity

I can tolerate the pain I have without having to use pain killers.
The pain is bad but I manage without taking pain killers.
Pain killers give complete relief from pain.
Pain killers give moderate relief from pain.
Pain killers give very little relief from pain.
Pain killers have no effect on the pain and I do not use them.

ction 2 — Personal Care (Washing, Dressing, etc)

I can look after myself normally without causing extra pain.
I can look after myself normally but it causes extra pain.
It is painful to look after myself and I am slow and careful.
I need some help but manage most of my personal care.
I need help every day in most aspects of self care.
I do not get dressed, wash with difficulty and stay in bed.

:tion 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, but I can manage if they are conveniently positioned, eg 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 lift only very light weights.
I cannot lift or carry anything at all.

tion 4 — Walking

Pain does not prevent me walking any distance.
Pain prevents me walking more than 1 mile.
Pain prevents me walking more than ½ mile.
Pain prevents me walking more than ¼ mile.
I can only walk using a stick or crutches.
I am in bed most of the time and have to crawl to the toilet.

on 5 — Sitting

I can sit in any chair as long as I like.
I can only sit in my favourite chair as long as I like.
Pain prevents me sitting more than 1 hour.
Pain prevents me from sitting more than ½ hour.
Pain prevents me from sitting more than 10 mins.
Pain prevents me from sitting at all.

Section 6 — Standing

- ☐ I can stand as long as I want without extra pain.
- ☐ I can stand as long as I want but it gives me extra pain.
- ☐ Pain prevents me from standing for more than 1 hour.
- ☐ Pain prevents me from standing for more than 30 mins.
- ☐ Pain prevents me from standing for more than 10 mins.
- ☐ Pain prevents me from standing at all.

Section 7 — Sleeping

- ☐ Pain does not prevent me from sleeping well.
- ☐ I can sleep well only by using tablets.
- ☐ Even when I take tablets I have less than six hours sleep.
- ☐ Even when I take tablets I have less than four hours sleep.
- ☐ Even when I take tablets I have less than two hours sleep.
- ☐ Pain prevents me from sleeping at all.

Section 8 — Sex Life

- ☐ My sex life is normal and causes no extra pain.
- ☐ My sex life is normal but causes some extra pain.
- ☐ My sex life is nearly normal but is very painful.
- ☐ My sex life is severely restricted by pain.
- ☐ My sex life is nearly absent because of pain.
- ☐ Pain prevents any sex life at all.

Section 9 — Social Life

- ☐ My social life is normal and gives me no extra 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, eg dancing, etc.
- ☐ Pain has restricted my social life and I do not go out as often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have no social life because of pain.

Section 10 — Travelling

- ☐ I can travel anywhere without extra pain.
- ☐ I can travel anywhere but it gives me extra pain.
- ☐ Pain is bad but I manage journeys over two hours.
- ☐ Pain restricts me to journeys of less than one hour.
- ☐ Pain restricts me to short necessary journeys under 30 minutes.
- ☐ Pain prevents me from travelling except to the doctor or hospital.

NUMERICAL RATING SCALE 101

No..... tx.....

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

0 100

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

0 100

Appendix G

SHORT-FORM McGILL PAIN QUESTIONNAIRE

Please answer every section, and mark in each section only the ONE BOX which applies to you.

Tx. . . . . .

	NONE	MILD	MODERATE	SEVERE
THROBBING	0) _____	1) _____	2) _____	3) _____
SHOOTING	0) _____	1) _____	2) _____	3) _____
STABBING	0) _____	1) _____	2) _____	3) _____
SHARP	0) _____	1) _____	2) _____	3) _____
CRAMPING	0) _____	1) _____	2) _____	3) _____
GNAWING	0) _____	1) _____	2) _____	3) _____
HOT-BURNING	0) _____	1) _____	2) _____	3) _____
ACHING	0) _____	1) _____	2) _____	3) _____
HEAVY	0) _____	1) _____	2) _____	3) _____
TENDER	0) _____	1) _____	2) _____	3) _____
SPLITTING	0) _____	1) _____	2) _____	3) _____
TIRING-EXHAUSTING	0) _____	1) _____	2) _____	3) _____
SICKENING	0) _____	1) _____	2) _____	3) _____
FEARFUL	0) _____	1) _____	2) _____	3) _____
PUNISHING-CRUEL	0) _____	1) _____	2) _____	3) _____

Appendix H

ALGOMETER MEASUREMENTS:

Patient No. .....

TREATMENTS:	RESULTS:Before	RESULTS:After
Treatment 1		
Treatment 2		
Treatment 3		
Treatment 4		
Treatment 5		
Treatment 6		
Treatment 7		
Treatment 8		
Treatment 9		
Treatment 10		

AVERAGE:		

Appendix I: GONIOMETER MEASUREMENTS

Patient no.....

	Flex.	Ext.	R.Rot.	L.Rot.	L.Lat.	R.Lat
Treatment 1: BEFORE						
AFTER						
Treatment 2: BEFORE						
AFTER						
Treatment 3: BEFORE						
AFTER						
Treatment 4: BEFORE						
AFTER						
Treatment 5: BEFORE						
AFTER						
Treatment 6: BEFORE						
AFTER						
Treatment 7: BEFORE						
AFTER						
Treatment 8: BEFORE						
AFTER						
Treatment 9: BEFORE						
AFTER						
Treatment 10:BEFORE						
AFTER						