

THE EFFICACY OF DETUNED ULTRASOUND COMPARED TO  
PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION OF THE  
GLUTEAL MUSCULATURE BOTH USED IN CONJUNCTION WITH  
MANIPULATION IN THE TREATMENT OF SACROILIAC  
SYNDROME.

BY

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## DEDICATION

To my dear husband, Geoff, for you unwavering love and support

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## ABSTRACT

The purpose of this study was to determine the relative efficacy of chiropractic manipulation used in conjunction with detuned ultrasound over the gluteal muscles compared to manipulation used in conjunction with proprioceptive neuromuscular facilitation stretching of the gluteal muscle group in the treatment of sacroiliac syndrome. It was hypothesised that both treatment groups would be effective in the treatment of sacroiliac syndrome but that manipulation used in conjunction with proprioceptive neuromuscular facilitation of the gluteal musculature would be more effective than manipulation used in conjunction with detuned ultrasound, in terms of subjective and objective clinical findings.

This comparative, randomised, controlled clinical trial consisted of sixty patients, all suffering from low back pain attributable to sacroiliac syndrome. Patients were obtained by consecutive sampling and each patient was assessed for the presence of sacroiliac syndrome. Patients were randomly assigned either to the group receiving manipulation used in conjunction with detuned ultrasound or the group receiving manipulation used in conjunction with proprioceptive neuromuscular facilitation of the gluteal musculature.

Each patient received four treatments over a two week period. Subjective data was obtained using the Numerical Pain Rating Scale 101 and the Oswestry Low Back Pain Disability Questionnaire. Objective data was obtained from the results of the orthopedic

sacroiliac pain provocation tests and pressure algometer readings. The subjective and objective data were collected at the beginning of the initial and after the second and final consultation.

The data was then transferred to spreadsheets and underwent statistical analysis. Intra-group analysis was performed using the ANOVA test and Wilcoxon Signed Rank test to determine any significant change within each group at the first, second and final consultations. Inter-group analysis was performed using unpaired t-tests and Mann Whitney U-tests to determine any significant change between the two groups at the first, second and final consultations.

Intra-group analysis of the results indicated that both treatment groups improved significantly ( $p \leq 0.025$ ) between the first and final consultation, for all measures.

Inter-group analysis of the data did not show any difference between Group 1 and Group 2 by the end of the final consultation. Therefore there was no statistically significant difference between the two groups in terms of objective and subjective findings.

It was therefore concluded that both treatment groups responded equally well to the treatment.

It is recommended that further studies have a larger sample size and homogeneity in order to improve outcome measures.

## TABLE OF CONTENTS

DEDICATION	I
ACKNOWLEDGEMENTS	ii
ABSTRACT	iii
TABLE OF CONTENTS	v
LIST OF TABLES	xii
LIST OF FIGURES	xiii
DEFINITIONS	xiv
 CHAPTER ONE	
1.1. INTRODUCTION	2
1.2. OBJECTIVES OF THE STUDY	5
 CHAPTER TWO	
2.1. INTRODUCTION	7
2.2. INCIDENCE AND PREVALENCE OF SACROILIAC SYNDROME	7

2.3. ANATOMY OF THE SACROILIAC JOINT	10
2.4. BIOMECHANICS OF THE SACROILIAC JOINT	13
2.5. NERVE SUPPLY OF THE SACROILIAC JOINT	15
2.6. THE SACROILIAC SYNDROME	16
2.7. THE GLUTEAL MUSCLES	21
2.8. ETIOLOGY OF LOW BACK PAIN	23
2.9. MANIPULATION	25
2.10. CONTRA-INDICATIONS TO MANIPULATION	28
2.11. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION	29
2.12. SUMMARY OF THE LITERATURE REVIEW	32
 CHAPTER THREE	
3.1. INTRODUCTION	35
3.2. THE DATA	35
3.2.1. THE PRIMARY DATA	36
3.2.2. THE SECONDARY DATA	36
3.3. THE SUBJECTS	37
3.4. EXCLUSION AND INCLUSION CRITERIA	38

3.5. DELIMITATIONS	39
3.6. ETHICS	40
3.7. THE SAMPLE GROUP	41
3.8. MEASUREMENTS	42
3.8.1. THE SUBJECTIVE MEASUREMENTS	42
3.8.2. THE OBJECTIVE MEASUREMENTS	44
3.9. INTERVENTIONS	47
3.9.1. SPINAL MANIPULATIVE THERAPY	48
3.9.1.1. MOTION PALPATION	48
3.9.1.2. MANIPULATION	49
3.9.2. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION	50
3.9.3. PLACEBO	51
3.10. TREATMENT OF THE SUBPROBLEMS	52
3.10.1. THE FIRST SUBPROBLEM	52
3.10.2. THE SECOND SUBPROBLEM	52
3.11. STATISTICAL ANALYSIS	53
3.11.1 TREATMENT OF THE DATA	53



3.11.1.1. SUBJECTIVE DATA	53
3.11.1.2. OBJECTIVE DATA	53
3.11.2. STATISTICAL ANALYSIS OF THE DATA	54
3.11.2.1. NON-PARAMETRIC TESTING	54
3.11.2.2. PARAMETRIC TESTING	56
3.11.2.3. HYPOTHESIS TESTING	57
3.11.2.4. SUMMARY STATISTICS	58
CHAPTER FOUR	
4.1. INTRODUCTION	60
4.2. DEOMOGRAPHIC DATA	61
4.2.1. AGE DISTRIBUTION	61
4.2.2. GENDER DISTRIBUTION	62
4.2.3. TRIGGER POINT DISTRIBUTION	63
4.2.4. PRESENCE OF EXTREMITY PAIN	64
4.2.5. NUMBER OF SMOKERS IN EACH GROUP	65
4.2.6. PREVIOUS HISTORY OF LOW BACK PAIN	66
4.2.7. PREVIOUS CHIROPRACTIC TREATMENT OF LOW	

BACK PAIN	66
4.2.8. COMPARISON OF PAIN DISTRIBUTION	67
4.3. STATISTICAL ANALYSIS OF THE DATA	68
4.3.1. SAMPLE SIZE	68
4.3.2. ABBREVIATIONS	68
4.4. PARAMETRIC AND NON-PARAMETRIC PAIRED HYPOTHESIS TESTS	69
4.5. PARAMETRIC AND NON-PARAMETRIC UNPAIRED TESTS	78
CHAPTER FIVE	
5.1. INTRODUCTION	87
5.2. INTRA-GROUP ANALYSIS	88
5.2.1. OBJECTIVE DATA	88
5.2.1.1. ALGOMETER	88
5.2.1.2. ORTHOPEDIC ASSESSMENT	89
5.2.2. SUBJECTIVE DATA	89
5.2.2.1. NUMERICAL PAIN RATING SCALE 101	89

5.2.2.2. OSWESTRY DISABILITY INDEX	90
5.3. INTER-GROUP ANALYSIS	91
5.3.1. OBJECTIVE MEASURES	91
5.3.1.1. ALGOMETER	91
5.3.1.2. ORTHOPEDIC TESTS	92
5.3.2. SUBJECTIVE MEASURES	92
5.3.2.1. NUMERICAL PAIN RATING SCALE 101	92
5.3.2.2. OSWESTRY DISABILITY INDEX	93
5.4. SOLVING THE HYPOTHESIS	93
5.5. DISCUSSION OF THE DEMOGRAPHIC DATA	94
5.6. STUDY LIMITATIONS	95
5.7. COMPARISON WITH OTHER STUDIES	97
CHAPTER SIX	
6.1. RECOMMENDATIONS	101
6.2. CONCLUSION	103

REFERENCES

APPENDIX	A
APPENDIX	B
APPENDIX	C
APPENDIX	D
APPENDIX	E
APPENDIX	F
APPENDIX	G
APPENDIX	H

## LIST OF TABLES

4.1. AGE DISTRIBUTION	61
4.2. GENDER DISTRIBUTION	62
4.3. TRIGGER POINT DISTRIBUTION	66
4.4. PRESENCE OF EXTREMITY PAIN	64
4.5. NUMBER OF SMOKERS IN EACH GROUP	65
4.6. PREVIOUS HISTORY OF LOW BACK PAIN	66
4.7. PREVIOUS CHIROPRACTIC TREATMENT	66
4.8. COMPARISON OF PAIN DISTRIBUTION	67
4.9. COMPARISON OF FIRST AND SECOND CONSULTATION IN GROUP 1	70
4.10. COMPARISON OF SECOND AND FINAL CONSULTATION IN GROUP 1	71
4.11. COMPARISON OF FIRST AND FINAL CONSULTATION IN GROUP 1	73
4.12. COMPARISON OF FIRST AND SECOND CONSULTATION IN GROUP 2	74
4.13. COMPARISON OF SECOND AND FINAL CONSULTATION IN GROUP 2	75
4.14. COMPARISON OF FIRST AND FINAL CONSULTATION IN GROUP 2	77
4.15. COMPARISON OF GROUP 1 AND GROUP 2 AT THE INITIAL CONSULTATION	79
4.16. COMPARISON OF GROUP 1 AND GROUP 2 AT THE SECOND CONSULTATION	80
4.17. COMPARISON OF GROUP1 AND GROUP 2 AT THE FINAL CONSULTATION	81

## LIST OF FIGURES

4.1. COMPARISON OF INITIAL, SECOND AND FINAL CONSULTATIONS FOR ALGOMETER OVER THE JOINT	83
4.2. COMPARISON OF THE INITIAL, SECOND AND FINAL CONSULTATION FOR ALGOMETER OVER THE MUSCLE	83
4.3. COMPARISON OF THE INITIAL, SECOND AND FINAL CONSULTATION FOR NUMERICAL PAIN RATING SCALE 101	84
4.4. COMPARISON OF THE INITIAL, SECOND AND FINAL CONSULTATION FOR ORTHOPEDIC ASSESSMENT	84
4.5. COMPARISON OF THE INITIAL, SECOND AND FINAL CONSULTATION FOR THE OSWESTRY	85

## DEFINITIONS

### 1. Spinal adjustment

A passive, manual maneuver during which an articular element is suddenly carried beyond the usual, physiological limit of movement without, however, exceeding the boundaries of anatomical integrity. This is characterized by the thrust which is a brief, sudden and carefully dosed implosion delivered at the end of the normal passive range of motion and is usually accompanied by a cracking sound (Sandoz, 1976).

### 2. Motion palpation

The indirect palpation of vertebral, cranial and iliac processes or facets during or at the termination of segmental spinal motions (Alley, 1983).

### 3. Fixation

A state whereby a vertebra or pelvic bone has become temporarily immobilised in a position which it may normally occupy during any phase of physiological spinal movement (Bryner, 1987).

#### 4. Proprioceptive Neuromuscular Facilitation (PNF)

PNF refers to any of several post-isometric relaxation stretching techniques in which a muscle group is passively stretched, then contracts isometrically against resistance while in the stretched position, and then is passively stretched again through the resulting increased range of motion (Internet 1).



# CHAPTER

# ONE

## INTRODUCTION

Although not a life threatening disease, back pain is a very common and disabling condition resulting in considerable suffering and cost to the patient. According to Cassidy and Burton (1992), the lifetime prevalence of low back pain is from 60% to 90% and the 1-year prevalence is from 15% to 20% (Borenstein, 1995). Cox (1990) estimates that 6.8% of the adult population in the U.S.A. is found to have back pain at any given time.

Cassidy and Mierau (1992) believe that dysfunction of the sacroiliac joint is a condition which commonly causes low back pain. This view is supported by Bernard and Kirkaldy-Willis (1987) who in a study of 1293 patients found that the sacroiliac joint was the source of back pain in 22.5% of the patients. The same authors also concluded that the radiographic findings in 30% of subjects with L5-S1 isthmic spondylolisthesis were coincidental and that the sacroiliac joint was the source of the pain (1987).

The mechanism of injury of the sacroiliac joint is not fully understood. In late to middle age, movement is reduced by articular cartilage degeneration, by fibrosis, and rarely by bony ankylosis. It may be possibly that minor dysfunction in the sacroiliac joint leads to pain. It seems reasonable to suppose that pain results from sustained contraction of muscle overlying the joint (Kirkaldy-Willis, 1992). The major muscle groups situated in the region of the sacroiliac joint include gluteus maximus, gluteus medius, multifidus and piriformis and it is hypothesised that hypertonicity of one or more of these muscles may

aggravate the sacroiliac syndrome. Gitelman (1980) reinforced this observation by noting that the gluteus maximus often shows hypertonicity during sacroiliac fixation. This produces an asymmetrical tension and strong leverage on the sacrum which will tend to maintain the sacral displacement until the gluteal tension is released (Travell and Simons, 1992). Travell and Simons (1992) point out that the gluteus maximus is one of the muscles attaching to the sacrum that commonly develops myofascial trigger points after sacroiliac displacement.

The sacroiliac joint is accepted as a significant source of low back pain (Kirkaldy-Willis, 1992 : Bernard and Cassidy, 1991). According to Haldeman (1992), the role that the sacroiliac joint plays in the pathogenesis of mechanical low back pain is unclear. However, he points out that manipulation of the painful sacroiliac joint is successful in the majority of cases. Manipulation is further advocated as an acceptable and popular form of treatment by Kirkaldy-Willis (1992) and Cassidy and Mierau (1992).

McAtee (1993) believes that PNF (proprioceptive neuromuscular facilitation) is perhaps the most valuable tool for restoring normal movement patterns, strength, endurance, and, ultimately full function of the affected area. He points out that in terms of back rehabilitation, the segmental and multisegmental techniques that are needed for treatment are found in the PNF repertoire.

Several studies have demonstrated the efficacy of PNF stretching as compared to conventional static stretching (McAtee, 1993). Moore and Hutton (1980) used electromyography to investigate the difference between static stretching and two PNF techniques. Their results showed that PNF is more effective than static stretching for improving flexibility. Prentice (1983) compared static stretching and PNF for increasing flexibility at the hip joint and found that, although both methods were effective, PNF was significantly better than static stretching. The PNF stretching should always be done within the pain free range of the individual so as not to damage the muscle in any way, which could further aggravate the patient's condition.

A comprehensive rehabilitation program must be initiated immediately following an injury so that return to play can occur rapidly and safely (Johnson, 1997). Stretching exercise is used to relax muscles, thereby reducing unnecessary muscle tone, increasing joint mobility, and restoring optimal neurological patterning (Haldeman, 1992).

This study serves to explore combination manual therapy for sacroiliac syndrome by adding gluteal muscle proprioceptive neuromuscular facilitation stretching to an established effective intervention thus attempting to eliminate hypertonicity of the gluteal musculature which may be partly responsible for causing the syndrome.

### 1.1 OBJECTIVES OF THE STUDY

The purpose of this study is to investigate the efficacy of manipulation in conjunction with detuned ultrasound over the gluteal muscles compared to manipulation used in conjunction with proprioceptive neuromuscular facilitation stretching of the gluteal muscle group in terms of subjective and objective clinical findings in the treatment of sacroiliac syndrome.

The first objective is to determine the efficacy of manipulation used in conjunction with detuned ultrasound over the gluteal muscles compared to manipulation used in conjunction with proprioceptive neuromuscular facilitation stretching of the gluteal muscles in terms of subjective clinical findings.

The second objective is to determine the efficacy of manipulation used in conjunction with detuned ultrasound over the gluteal muscles compared to manipulation used in conjunction with proprioceptive neuromuscular facilitation stretching of the gluteal muscles in terms of objective clinical findings.

# CHAPTER

# TWO



## **REVIEW OF THE RELATED LITERATURE**

### **2.1. INTRODUCTION**

Cassidy and Mierau (1992) describe sacroiliac syndrome as a painful and debilitating condition, which may result in considerable discomfort to the patient. Cox (1990) states that low back pain is the diagnosis in 10% of all chronic health problems and that back impairments are the major cause for activity limitation in those under 64 years of age.

According to Bernard and Cassidy (1991), the sacroiliac joint is a common but frequently overlooked source of low back pain. These authors state further that sacroiliac joint dysfunction may lead to localised pain over the sacroiliac joint as well as referred pain into the extremity, thus making it difficult to distinguish from many other causes of low back pain.

### **2.2. INCIDENCE AND PREVALENCE OF SACROILIAC SYNDROME**

According to Burton and Cassidy (1992), the lifetime prevalence of low back pain is from 60-90%. The problem imposed by low back pain is further emphasised by Borenstein (1995) who states that the 1-year prevalence rate of low back pain is from

15% to 20%. Further evidence is apparent in the total cost of worker's compensation in the United States, which in 1990 was estimated at \$50 billion of which back care alone represented about \$30 billion (Burton and Cassidy, 1992).

The extent of the problem of low back pain is emphasised by Cox (1990) who states that the most frequent cause of activity limitation in persons under 64 years of age are impairments of the back.

In a survey done by van der Meulen (1997) on a rural population group in South Africa, it was found that low back pain occurred commonly amongst the population group and that it adversely affected the lives of many of those with the condition.

Many authors agree that the sacroiliac joint is an important, but often overlooked source of low back pain (Cassidy, 1992 ; Plougher, 1993). Kirkaldy-Willis (1992) believes that the sacroiliac joint is implicated in more than one-fifth of all cases of low back pain.

Daum (1995) agrees that pathology of the sacroiliac joint is an underestimated cause of back or sciatic-type pain. He demonstrates this by stating that approximately 40% of patients who presented with back complaints in a care centre had concomitant sacroiliac joint disease. Daum (1995) states further that, although the sacroiliac joint may be affected by infectious, metabolic, inflammatory, neoplastic , or degenerative disease,



the most common source of low back pain caused by sacroiliac dysfunction is mechanical instability of the joint resulting in either a fixed subluxation or hypermobility of the joint.

A study done on school children by Mierau et al. (1984) suggested that there was a statistically significant correlation between a prolonged history of low back pain and sacroiliac joint dysfunction.

This was in direct contrast to other studies such as that done by Gemmel and Jacobson (1990) on fit college students demonstrated that 26.5 % of the participants had a history of low back pain and that 19.3% demonstrated unilateral or bilateral sacroiliac joint dysfunction. They also found that females had a higher incidence of low back pain than males and that Caucasians had a higher incidence than black participants. 27.3% of those with low back pain who were considered to be either of high or average fitness were found to have sacroiliac joint dysfunction. It was found, however, that of those diagnosed with sacroiliac joint dysfunction only 37.5% reported having low back pain. The authors concluded that they were unable to make a correlation between low back pain and sacroiliac joint dysfunction.

Laslett (1997) believes too that the sacroiliac syndrome does not make up a high proportion of low back pain. He suggests that the prevalence of sacroiliac syndrome may be as low as 3.5-6.5%.

According to Bernard and Cassidy (1991), radiographic evaluation of the sacroiliac joint does not provide any precise diagnostic information regarding the sacroiliac joint. This, together with a lack of other clear objective findings associated with the syndrome, may partially explain the opposing views held by many authors as to the exact incidence of sacroiliac syndrome.

### **2.3. ANATOMY OF THE SACROILIAC JOINT**

The bony pelvis constitutes the base of the trunk, forming a link between the vertebral column and the lower extremities. The pelvis is made up of three bones, the paired ilia and intervening sacrum. These bones are united by three joints, the two sacroiliac joints and the symphysis pubis (Alderink, 1991).

Hendler et al. (1995) describes the sacroiliac joint as comprising of the synovial articulation between the surfaces of the sacrum and the ilium.

Bellamy et al. (1983) states that the adult sacroiliac joint is vertically orientated and that each joint is divided into a vertical, synovial or auricular portion and a dorsal, syndesmotic or postauricular portion.

The auricular cartilage on the sacrum is more than twice as thick as that on the ilium. The former is hyaline cartilage whilst the latter is fibrocartilage (Kirkaldy-Willis, 1992).

According to Grieve (1976), the integrity of the sacroiliac joint depends on the strength and efficiency of the principle ligaments surrounding the joint.

The joint has a thick capsule anteriorly which is lined by a synovial membrane which produces synovial fluid used for lubricating the joint cavity (Plougher, 1993). There is no joint capsule posteriorly and the joint space is continuous with the large, strong, interosseous sacroiliac ligament (Kirkaldy-Willis, 1992). This ligament bridges the bones of the sacrum and ilium and is further strengthened by the sacrotuberous and sacrospinous ligaments (Bellamy, 1983).

Bellamy et al. (1983) points out that it is the ligamentous skeleton of the joint which prevents the sacrum rotating around the horizontal axis due to the gravitational force of the lumbar spine on the sacral promontory.

The articular surface of the sacroiliac joint varies greatly among individuals in terms of size, shape and roughness, being smooth in childhood and consisting of irregular depressions and elevations that fit into one another in adulthood (Magee, 1992).

According to Alderink (1991), these irregularities of the joint surface allow for only slight sacral motion.

Walker (1992) believes that it is the variability and complexity in the orientation of the joint surfaces which adds to the unique stability of the sacroiliac joint. Walker goes on to say that although no muscles actually cross the sacroiliac joint, the adjacent muscles consisting of the quadratus lumborum, erector spinae, gluteus maximus, gluteus minimus, piriformis and iliacus muscles have fibrous extensions which contribute to the strength of the joint by blending with the anterior and posterior sacroiliac joint ligaments thereby increasing the joints stability. Cassidy (1992) states that although many large and powerful muscles do surround the joint, none are known to directly influence its movement.

According to Kirkaldy-Willis (1992) the iliac cartilage of the sacroiliac joint begins to degenerate early in life, becoming obvious in males by the third decade of life and in females by the fifth decade.

Cassidy (1992) states that the degenerative changes that occur include surface defibrillation, proteoglycan depletion and chondrocyte cloning. He states further that large crevice formation and surface erosions also tend to occur most frequently in middle-aged men. Changes such as these do not occur on the sacral cartilage until later in life.

The patency of the joint remains throughout life. However, in some cases fusion of the joint may occur due to a fibrous ankylosis. Bony ankylosis is rare (Kirkaldy-Willis. 1992,

Cassidy, 1992). Cassidy (1992) is uncertain whether these changes are clinically significant and believes that more research is needed in order to fully understand the role of the sacroiliac joint in mechanical low back pain.

#### **2.4. BIOMECHANICS OF THE SACROILIAC JOINT**

Bernard and Cassidy (1991) describe the functioning of the sacroiliac joint as being the transmission or dissipation of the loading of the upper trunk to the lower extremities.

Haldeman (1992) states that the sacroiliac joint is very stable and capable of only minimal movement due to factors such as the dense strong ligamentous complex, the irregular interlocking joint surfaces and the large forces needed to disrupt the joint.

Many of the studies done to determine sacroiliac joint motion have shown varying degrees of joint mobility. Panzer and Gatterman (1995) describe sacroiliac joint motion as being very slight at 3° to 5° having demonstrated so in both specimens as well as live subjects. This limited motion, they point out, is due to factors such as age, gender as well as the complementary ridges and depressions making up the joint surfaces.

In a study done by Jacob and Kissling (1995) to determine the mobility of the sacroiliac joint in healthy volunteers between 20 and 50 years of age, they found an average total rotational motion of approximately 2° in the sacroiliac joint between standing erect on

both feet and one-legged stance. These authors however did not find any significant difference in motion in respect of age, sex or parturition.

Bernard and Cassidy (1991) have found the predominant motion of the sacroiliac joint to be X-axis rotation with a small degree of Z-axis rotation.

According to Bernard and Cassidy (1991) the sacroiliac joint can withstand six times as much medially directed force and seven times as much lateral bending force as compared to the lumbar spine. However, the lumbar motion segments can withstand twenty times as much axial compression and twice as much axial torsion as the sacroiliac joint. This, according to the authors suggests that the sacroiliac joint is susceptible to axial compression and torsion forces created by forward bending, lifting and twisting as these would tend to stress the weaker anterior capsule and ligaments.

Many other authors , however, believe that there is a greater range of motion in the sacroiliac joints of women and that this is increased in pregnancy (Haldeman 1992 ; Bernard and Cassidy 1991).

Gemmel and Jacobson (1990) in a study done on 83 fit college students also found a predominance in females as opposed to males suffering from sacroiliac syndrome.

Cassidy and Mierau (1992) believe that the development of ligament laxity during and after pregnancy, and prior to menstruation, makes the sacroiliac joint susceptible to mechanical strain.

Kirkaldy-Willis et al. (1992) draws attention to the possibility that minor dysfunction's of the joint may lead to pain. They believe that it is reasonable to assume that the resulting pain is from sustained contraction of muscle overlying the joint. Travell and Simons (1992) state that sacroiliac joint dysfunction is often associated with trigger point tenderness in the gluteal muscles as well as other major muscles in the sacroiliac region.

## **2.5. NERVE SUPPLY OF THE SACROILIAC JOINT**

The sacroiliac joint is a pain sensitive structure and has extensive sensory innervation (Daum, 1995). According to Hilton's Law, a joint may receive innervation from any nerve that crosses it. Therefore, the sacroiliac joint may be innervated from as cephalad as L2 to as caudad as L3 or L4 (Bernard and Cassidy, 1991 : Daum, 1995).

According to Bernard and Cassidy (1991), the synovial capsule of the sacroiliac joint and overlying ligaments have unmyelinated free nerve endings that transmit pain, thermal sensation, pressure and position sense information. Posteriorly the ligaments and joint capsule are supplied by the lateral branches of the posterior primary rami from L4 to S3.

Anteriorly the innervation is from L2 to S2. These authors state further that S1 pain may be well localised or referred into an extremity. This referred pain is usually deep, dull and often ill-defined and radiates in a sclerotomal distribution.

Daum (1995), agrees that the innervation of the sacroiliac joint explains the multiple manifestations of sacroiliac pain.

## **2.6. THE SACROILIAC SYNDROME**

Bernard and Cassidy (1991) believe that sacroiliac syndrome is one of the most common conditions affecting the sacroiliac joint but is frequently overlooked as a source of low back pain.

Osterbauer et al. (1993) state that most manual medicine practitioners believe that the underlying biomechanical lesion associated with sacroiliac joint dysfunction is fixation of the sacroiliac joint.

According to Hendler (1995), sacroiliac dysfunction, or subluxation, occurs when the ilium slips on the sacrum resulting in one articular surface becoming wedged upon the prominence of an opposed articular surface. This causes tautening of the surrounding



ligaments as well as muscle spasm resulting in continuous, intense pain. Bernard and Cassidy (1991) state that due to the fact that the sacroiliac joint is synovial, it can logically cause pain as it is subjected to the same inflammatory, infectious and dysfunctional conditions affecting other synovial joints.

Many authors agree as to the difficulty of a clear and objective diagnosis of sacroiliac syndrome (Osterbauer 1993 ; Haldeman 1992 and Cassidy 1992). According to Xiadong and Yonggang (1994), the symptoms of sacroiliac syndrome are easily confused with those of lumbar sprain, disc protrusion, superior cluneal nerve traumas and lumbosacral joint sprain causing an improper diagnosis which leads to inappropriate treatment which may lead to a chronic inflammation in the long term. According to Haldeman (1992), objective measurement tools such as myelography, computerised tomography, and magnetic resonance imaging are not reliable for the detection and diagnosis of sacroiliac syndrome. Kirkaldy-Willis et al. (1992) states that there may, however, be a slightly increased uptake of isotope over the sacroiliac joint using a bone scan in the case of sacroiliac syndrome.

According to Bernard and Cassidy (1991) the diagnosis of sacroiliac syndrome is based on a thorough case history and is confirmed using specific provocative sacroiliac joint stress tests. Osterbauer et al. (1995) includes the absence of other factors such as lesions of the disc, sciatica, radiating pain and neurological deficits as being an important factor in the diagnosis of the sacroiliac syndrome.

Patients with sacroiliac syndrome give a clinical history of sharp, aching or dull pain over the affected sacroiliac joint which may be referred into the buttock, groin, posterior thigh or less frequently below the knee. These symptoms are most commonly unilateral and occur on the right side. Aggravating factors include bending, sitting or driving whilst relieving factors include standing or walking.. Sacroiliac syndrome is not associated with neurological symptoms such as weakness, paraesthesias, or dysesthesias (Bernard and Cassidy, 1992). Cassidy and Mierau (1992) state that this syndrome is often accompanied by unilateral muscle spasm and gluteal trigger points. According to Travell and Simons (1992), trigger point tenderness in the erector spinae, quadratus lumborum, piriformis and 3 glutei muscles is commonly found in patients with sacroiliac joint dysfunction.

Physical examination of the patient reveals tenderness over the posterior superior iliac spine (PSIS) in the region of the sacroiliac joint or buttock. This is associated with restricted movement of the sacroiliac joint (Kirkaldy-Willis et al. 1992). According to Bernard and Cassidy (1991) lumbosacral movement may elicit pain on flexion and extension. They state further that motor, reflex, or sensory neurological deficits as well as nerve root tension signs are not present with sacroiliac syndrome.

In a study done by Gemmel and Jacobson (1990) on the incidence of sacroiliac syndrome and low back pain in fit college students, it was found that 26.5% of the subjects had a history of low back pain. Kirkaldy-Willis et al. (1992) are of the opinion that early diagnosis and adequate treatment of the sacroiliac syndrome leads to resolution within 2 to 3 months. However, these authors state further that resolution may in some cases take

longer than this. Therefore it seems that some people may suffer from a more chronic case of sacroiliac syndrome.

According to Kirkaldy-Willis et al. (1992), when the signs and symptoms are consistent with sacroiliac syndrome, the diagnosis of sacroiliac syndrome is confirmed by stressing the sacroiliac joint. The three most commonly used by this author are Patrick Faber's, Gaenslens' and Yeomans' test. Laslett and Williams (1994) state that pain provocation tests stress the joint thereby reproducing the patient's symptoms. In a study done by these authors to assess the inter-reliability of seven pain provocation tests for pain of sacroiliac origin, Gaenslens' test was found to have substantial inter-therapist reliability (88.2% with a  $p < 0.001$  level of significance). They also found that the posterior shear test showed the greatest inter-examiner reliability of the tests assessed (94.1% with a  $p < 0.001$  level of significance).

This is in contrast to a study done by Kirkaldy-Willis et al. (1992) who state that Yeomans test (Extension test) is the most specific and reliable test for the diagnosis of sacroiliac syndrome.

In a study done by Broadhurst and Bond (1998), two pain provocation tests namely Faber (Flexion ABduction and External Rotation) and POSH (POsterior SHear) were found to have a high degree of sensitivity and specificity in confirming the diagnosis of sacroiliac dysfunction (at a 0.005 level of significance). This double-blinded, placebo controlled

trial used the criterion that the patients pain was diminished by 75% following an injection of the joint with 1% lidocaine. It concluded that these two tests could adequately diagnose sacroiliac joint pain. As a result, the posterior shear test was combined with the three tests commonly used by Kirkaldy-Willis (1992) and an orthopaedic assessment scale was determined for this present trial.

In a study conducted by Dreyfuss et al. (1994), it was found that 20% of asymptomatic individuals had a positive result using one or more pain provocation tests. Van Deursen et al. (1990) in a study done to determine the value of some clinical tests of the sacroiliac joint found poor inter-tester reliability of six frequently used sacroiliac tests. This included Patrick Faber's test, which is used in this study. These authors did however feel that these tests were still useful especially when combined with other findings in the diagnostic procedure. The previous results are in keeping with those of Potter and Rothstein (1985) who examined the inter-tester reliability of thirteen tests for sacroiliac joint dysfunction. Reliability was found to be poor with 11 of the 13 tests resulting in less than 70 % agreement. The results of the above three studies suggest that one should not rely solely on these tests to diagnose sacroiliac syndrome.

## **2.7. THE GLUTEAL MUSCLES**

The gluteal musculature consists of the gluteus maximus, gluteus medius and gluteus minimus muscles.

### **1. The Gluteus Maximus**

Proximally this muscle attaches to the posterior iliac crest, the posterolateral surface of the sacrum and the side of the coccyx. Distally, the fibres are secured to the iliotibial band of the fascia lata and to the femur. This muscle is supplied by spinal roots L5, S1 and S2 which are derived from the inferior gluteal nerve. Pain arising from this muscle is most commonly referred into the buttock region with trigger point 1 referring pain up as far as the sacroiliac joint. The major function of this muscle is extension of the thigh at the hip (Travell and Simons, 1992).

### **2. The Gluteus Medius**

Proximally this muscle attaches along the anterior three fourths of the iliac crest and inserts on the greater trochanter. This muscle is supplied by spinal roots L4, L5 and S1 via the superior gluteal nerve. Pain referred from this muscle is commonly identified as low back pain. Pain and tenderness is referred along the posterior crest of the ilium, to the sacrum and to the posterior and lateral buttock region. This muscle functions mainly as an abductor of the thigh (Travell and Simons, 1992).

### 3. The Gluteus Minimus

This muscle attaches in a similar but less extensive area than the gluteus medius. Pain is referred from anterior trigger points into the lateral aspect of the lower limb and to the ankle whilst posterior trigger points refer over the lower medial buttock and down the back of the thigh and calf. The major function of this muscle is abduction of the thigh (Travell and Simons, 1992).

According to Travell and Simons (1992), sacroiliac joint dysfunction is commonly associated with trigger point tenderness of the three glutei muscles as well as the other major muscles in the sacroiliac region. Cassidy and Mierau (1992) agree that sacroiliac syndrome is often accompanied by muscle spasm and gluteal trigger points.

Bernard and Cassidy (1991) are of the opinion that myofascial syndromes, commonly of the gluteus maximus and quadratus lumborum, often cause pain to be referred to the sacroiliac joint.

According to Walker (1992), the sacroiliac joint is not crossed by any muscle. However, fibrous extensions from the adjacent muscles including the gluteus maximus and minimus blend with the sacroiliac ligaments thereby increasing the joints stability. Increased muscle contraction may place increased tension on the tissues of the sacroiliac joint increasing any symptoms caused by sacroiliac joint pathology.

Kirkaldy-Willis (1992) hypothesises that the pain of sacroiliac syndrome may partially be due to the sustained contraction of muscles overlying the joint. He states further that this muscle hypertonicity may be accompanied by dysfunction in the sacroiliac joint

Kirkaldy-Willis (1992) states too that dysfunction of the Gluteus maximus is often associated with sacroiliac syndrome. He goes on to say that manipulation of the sacroiliac joint relieves the pain of sacroiliac syndrome probably by reducing hypertonicity in the posterior muscles that maintain the joint in a state of fixation.

## **2.8. ETIOLOGY OF LOW BACK PAIN**

According to Liebenson (1996), patients with low back pain rarely have structural pathological conditions that can be clearly determined as a cause for their symptoms. For this reason, most such cases are classified with the label “non-specific back pain”.

Nearly all the tissues and structures of the lower spine are innervated, and to a greater or lesser extent each is susceptible to some form of injury or disease that would enable it to become a source of back pain. Formal epidemiological studies on the pathological cause of back pain are lacking and it is therefore impossible to provide a legitimate epidemiological background to the list of possible sources and causes of low back pain (Jayson, 1992).

Linn (1994) states that back pain may arise from many structures such as muscles, nerve roots, ligaments, synovia and periosteal. However, the author states further that the definite source is rarely identified.

Bogduk and Twomey (1991) identify a wide variety of pathological conditions that can affect the low back. These may be congenital malformations, fractures, infectious and neoplastic disease, inflammatory, metabolic and various other miscellaneous disorders. These authors point out that altered biomechanics of the spine which result in minor aberrations of structure or in injury are referred to as mechanical low back pain and occur frequently.

According to Cox (1990) common causes of back pain include

1. Lumbosacral sprains and strains associated with fatigue, obesity, inadequate muscle tone or pregnancy.
2. Herniated disc, axial skeletal joint dysfunction and injuries of the bone, joint or ligament.
3. Myofascial syndromes.
4. Degenerative disease of the spine (Osteoarthritis).

Burton and Cassidy (1992) have certain individual risk factors associated with the development of low back pain. These include :



1. Increasing age.
2. Lack of fitness.
3. Poor health.
4. Psychosocial problems.
5. Smoking.
6. Drug abuse.
7. Major scoliosis.
8. Headaches.

However, the reliability with which diagnosticians agree on these classifications has not been empirically demonstrated.

## **2.9. MANIPULATION**

A spinal adjustment can be defined as a passive, manual manoeuvre during which an articular element is suddenly carried beyond the usual, physiological limit of movement without exceeding the boundaries of anatomical integrity. This is usually characterized by a brief, sudden thrust which is applied at the limit of normal passive range of motion and which is accompanied by a cracking noise (Sandoz, 1976).

The exact mechanism by which chiropractic manipulation produces its effects is unknown but a variety of different theories have been postulated.

Bernard and Cassidy (1991) postulate that manipulation causes stretching of hypertonic muscles against their muscle spindles leading to increased afferent input to the central nervous system. They hypothesise that this leads to reflex inhibition of gamma and alpha neurons which may lead to a readjustment of muscle tone and relaxation. They further postulate that manipulation may cause stimulation of type I and type II articular mechanoreceptors and in type III ligamentous mechanoreceptors which send impulses along nerve fibres and may thereby inhibit pain impulses travelling through smaller fibres.

Cassidy et al. (1992) state that chronicity can lead to shortening of periarticular connective tissue and that intra-articular adhesions may form. Manipulation may in some cases break these adhesions. Sandoz (1976) states that both passive and active range of motion is temporarily increased following an adjustment. Increased movement causes an increase in proprioceptive input which in turn causes reflex inhibition on pain transmission (Cassidy et al. 1992).

Kirkaldy-Willis (1992) believes that manipulation has much to offer the patient with low back pain. A retrospective study done by Bernard and Kirkaldy-Willis (1985) reviewed 1293 cases of low back pain. Of these, 205 patients were suffering from sacroiliac syndrome alone. In 95% of the cases, manipulation yielded excellent or good results.

In a review done by Cassidy et al. (1992) on manipulation for the treatment of low back pain, they found that in the 25 trials reviewed, manipulation was found to be more effective than the respective conservatively treated control group. This is in keeping with the findings of Manga et al. (1993) who, in a review on alternatives for treatment and management of low back pain, found spinal manipulation applied by chiropractors to be more effective than many other alternative forms of low back pain treatment methods.

Outstanding results were achieved by Xiaodong and Yonggang (1994) who used a series of manipulations to reduce the subluxated sacroiliac joint and received a cure rate of 100%.

In a study done by Osterbauer et al. (1990) they evaluated treatment outcomes of manipulative care in patients with sacroiliac syndrome. Results showed that pain decreased significantly from a mean baseline value of 25 to 12 ( $p < 0.05$ ). Average disability scores also diminished from 28 to 13% ( $p < 0.05$ ) and a reduction in the number of pain provocation tests was noted.

Shekelle et al. (1992) concluded that spinal manipulation accelerates healing in acute uncomplicated back pain but that its role in preventing the development of chronic or recurring low back pain is unknown.



Kirkaldy-Willis (1992) states that 3 to 4 days of daily manipulation may restore joint movement and relieve pain. However, up to 10 days of daily manipulation may sometimes be required. Kirkaldy-Willis (1992) states further that manipulation may relieve pain by reducing posterior muscle hypertonicity which maintain joint fixation as well as increasing range of motion of the ilium on the sacrum.

In a review by Deyo (1983) on 59 trials on conservative therapy for low back pain, it was found that spinal manipulation had short-term benefits but no long-term benefits. This is in contrast to a study done by Meade et al. (1990) in which chiropractic manipulation was found to have benefits which were recorded as long as two years following the initial treatment.

Cassidy and Mierau (1992) advocate the side posture adjustment as the treatment of choice in sacroiliac syndrome.

## **2.10. CONTRA-INDICATIONS TO MANIPULATION**

According to Cassidy et al. (1992), there are two main categories of contra- indications namely relative and absolute.

Relative contra-indications include osteopaenia, spondyloarthropathies, patients on anticoagulant medication, bleeding disorders and psychological overlay.

Absolute contra-indications include :

1. Destructive lesions of the spine, ribs and pelvis
2. Healing fracture or dislocation
3. Gross instability
4. Cauda equina syndrome
5. Large abdominal aneurysm
6. Visceral referred pain

### **2.11. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION (PNF)**

According to Internet 3, PNF was initially used by physical therapists for the treatment of various neuromuscular disorders and for paralysis. (Internet 1) states that PNF refers to any of several post-isometric relaxation stretching techniques in which passive stretching of a muscle group occurs followed by isometric contraction against resistance whilst in the stretched position. This is followed by another passive stretch thereby resulting in an increased range of motion.

According to McAtee (1993), PNF is a valuable tool for restoring normal movement patterns, strength, endurance, and ultimately, full function. He states further that

segmental and multisegmental stabilisation techniques, which are required for rehabilitation of the back, are found in the PNF repertoire.

The physiological basis of PNF is based on the stretch reflex which results in the stimulation of golgi tendon and muscle spindles. The resulting impulses to the brain lead to contraction and relaxation of muscle. Injury leads to a delay in muscle spindle and golgi tendon stimulation with resulting muscle weakness. PNF is responsible for re-educating the motor units which are lost due to injury (Internet 2).

(Internet 1) believes that the intense muscle contraction caused by PNF fatigues many of the fast twitch fibers making it more difficult for the fatigued fibers to contract in resistance to subsequent stretch. (Internet 1) states further that the tension caused by muscle contraction activates the golgi tendon organs, which inhibits muscle contraction via the lengthening reaction. Tension on the muscle is caused by voluntary contraction during stretch, activating the golgi tendons more than stretch alone. Therefore, when voluntary contraction is stopped, even more inhibition of contraction against a subsequent stretch occurs. PNF uses the time immediately following the isometric contraction to train stretch receptors to get used to the greater range of muscle length.

McAtee (1993) in a review of 14 studies done on PNF, found that in 8 of these studies that PNF was significantly more effective than static, ballistic or passive stretching for increasing range of motion and flexibility. Wilkinson et al. (1992) concluded that the

majority of studies show PNF techniques to result in greater gains than static stretching or ballistic stretching.

In a study done by Prentice (1983) to compare static stretching and PNF stretching for improving hip joint flexibility, it was found that PNF produced a significantly greater improvement in hip joint flexion over a 10-week session than the static stretch.

This is in keeping with a study done by Moore and Hutton (1980), where the differences between static stretching and two PNF techniques namely Contract Relax (C.R.) and Contract-Relax-Antagonist-Contract (CRAC) were investigated using electromyography. The results showed that the CRAC technique (which will be used in this study) was more effective than static stretching for improving flexibility.

According to Anderson and Burke (1991), if a muscle is very tight then the stretching technique should concentrate on relaxation whilst doing the stretch rather than on flexibility. In this instance, the PNF would initially reduce muscle tension before flexibility gains are experienced. In order to avoid injury or discomfort in an acute episode, Internet 3 states that no more than 90% of muscular effort should be exerted in the isometric phase of the stretch.

According to Anderson and Burke (1991), those patients with high blood pressure, heart disease and those who are unaware of the valsalva maneuver occurring during PNF should exercise caution when doing PNF.

## **2.12. SUMMARY OF THE LITERATURE REVIEW**

The role that the sacroiliac joint plays in the etiology of low back pain is subject to considerable controversy but many authors do agree that the sacroiliac joint is a frequent but usually overlooked source of low back pain.

Hendler et al. (1995) states that the symptoms caused by low back pain are significantly relieved with the use of manipulation. In a review by Manga et al. (1993), spinal manipulation applied by chiropractors was shown to be more effective than many alternative treatments for low back pain.

Hendler et al. (1995) states that manipulation successfully treats sacroiliac joint dysfunction by reducing sacroiliac pain. Haldeman (1992) also advocates manipulation for a painful sacroiliac joint stating that this treatment method is successful in the majority of cases of sacroiliac syndrome. Daum (1995) uses manipulation in order to reduce and stabilize the subluxated or unstable sacroiliac joint. The side posture adjustment as described by Schafer and Faye (1990) seems to be the treatment of choice for sacroiliac syndrome.

A review done by McAtee (1993) found PNF stretching to be significantly more effective for increasing range of motion and flexibility when compared to static, ballistic or passive



stretching. A study done by Moore and Hutton (1980), found the CRAC technique to be more effective than static stretching in terms of improving flexibility. McAtee (1993) uses PNF to stretch and strengthen muscles. PNF is also used by this author to restore normal movement, strength, endurance and full function which are all useful in the rehabilitation of a back injury.

Travell and Simons (1992) state that sacroiliac joint dysfunction is commonly associated with trigger point tenderness of the gluteal muscles. Bernard and Cassidy (1991) believe that myofasciitis of the gluteus maximus may refer pain into the sacroiliac joint.

Kirkaldy-Willis (1992) agrees that gluteus maximus dysfunction is often associated with sacroiliac syndrome. He states further that manipulation of the sacroiliac joint relieves the pain of sacroiliac syndrome probably by reducing posterior muscle hypertonicity.

No research was found by this researcher evaluating the effectiveness of stretching the gluteal musculature in conjunction with manipulation of the sacroiliac joint in the treatment of sacroiliac syndrome.

There is an obvious lack of research on the effectiveness of the CRAC PNF technique and a scarcity of reliable research into the efficiency of the side posture adjustment as well as an absence of any clinical trials combining the two techniques. This lack of clinical evidence creates a need for further research into these techniques in order to establish the most effective treatment method for sacroiliac syndrome. This will not only result in a reduction on pain and suffering to the patient but will also have beneficial effects on society as a whole in terms of economic productivity and cost saving.

# CHAPTER

# THREE

## MATERIALS AND METHODS

### 3.1 INTRODUCTION

This chapter is concerned with the design, primary and secondary data, the subjects and the interventions utilized within each study group. A brief overview of each questionnaire used, the methods of statistical analysis as well as the evaluation methods used will be discussed.

The study design chosen was a randomised, comparative clinical trial. This involved two treatment groups, both receiving chiropractic manipulation and each group receiving either PNF stretching of the gluteal musculature or detuned ultrasound respectively.

### 3.2 THE DATA

Two types of data were used in this study : primary and secondary data.

### 3.2.1. THE PRIMARY DATA

The primary data consists of

- The case history (Appendix A), physical examination (Appendix B) and low back regional (Appendix C)
- The patients' perception of their pain level (Numerical Pain Rating Scale 101 – Appendix D)
- The patients' perception of their disability (Oswestry Low Back Disability Index – Appendix E)
- The patients' pressure threshold in terms of pain (Wagner Algometer)
- Orthopaedic assessment score as determined by the results of four sacroiliac provocation tests (Appendix F)

### 3.2.2. THE SECONDARY DATA

Data pertaining to the study was obtained using a variety of sources such as journal articles, books, Medline and the Internet. This data was obtained through the Technikon Natal library.

### **3.3 THE SUBJECTS**

Recruitment of patients into the study was done by means of advertisements placed on noticeboards of tertiary institutions in Durban, local sports clubs, pharmacies, health shops, as well as in local newspapers. Sixty participants were consecutively selected from the respondents providing they complied with the inclusion and exclusion criteria for the study. Respondents were not excluded from the study on the grounds of race, gender, occupation or severity of the condition. As the aim of this study was to pilot a treatment intervention on a specific condition, the convenience sampling method was considered sufficient.

Each research patient who presented to the Technikon Natal Chiropractic Clinic complaining of low back pain was assessed to determine if they would be a suitable candidate for the study. This was done by means of a case history (Appendix A), physical examination (Appendix B) and regional low back examination (Appendix C).

### **3.4. EXCLUSION AND INCLUSION CRITERIA**

Patients were excluded from the study for the following reasons :

- Low back pain attributable to neoplastic lesions of the spine, ribs or pelvis
- Low back pain attributable to inflammatory, infectious, metabolic or vascular causes
- A healing fracture or dislocation
- Gross instability and spinal anomalies
- Cauda equina syndrome
- Visceral referred pain
- Pregnancy
- Medication (a washout period depending on the half life of the medication was required if on medication)
- Spinal manipulation less than 1 month prior to the study
- Haematological disorders

Candidates were included into the study if :

- They were from the ages of 18-50 years of age (in order to limit degeneration)
- They agreed not to partake in any other treatment regime for the remainder of the study
- They agreed not to alter their lifestyle for the duration of the study

### **3.5. DELIMITATIONS**

This study was concerned with low back pain attributable to sacroiliac syndrome. The diagnosis of sacroiliac syndrome was made according to the clinical picture of the condition as described in 2.5 above. The definite diagnosis of sacroiliac syndrome was made using the orthopaedic assessment scale. This consisted of four orthopaedic tests used to specifically diagnose sacroiliac syndrome. These included the Gaenslen's test, Patrick Faber's test, Yeoman's test and Posterior shear or "thigh thrust" test.

Each of the above tests was allocated with a score on production of a positive result. According to Laslett and Williams (1994) the posterior shear test is the most sensitive test for determining the presence of a sacroiliac syndrome. The reliability of this test was determined in a study to assess the inter-rater reliability of seven pain provocation tests for pain of sacroiliac origin. A positive result with this test was given a score of 4. A positive Gaenslen's, Patrick Faber or Yeoman's test was given a score of 2 for each positive test. These tests have, according to Bernard and Cassidy (1991), a high degree of interexaminer reliability and are easily mastered. However they have not been shown to be as sensitive as the posterior shear test and have thus been allocated with a lower value for each positive result. From these scores, an orthopaedic assessment rating out of 10 was determined. Only patients with a rating of 6 out of 10 or higher were considered diagnostically acceptable and were accepted into the study. The consulting clinician gave each patient a rating independent to that of the researcher and the mean rating was determined. This was done on the first visit, second visit and final consultation. A change

in score gave an indication as to whether there was an improvement in the patients' sacroiliac syndrome or not.

Radiological examination of the patient was not deemed necessary due to the fact that only cases of functional low back pain were accepted into the study. It was accepted that there would be a high incidence of degenerative joint disease amongst these patients anyway and thus it would not be beneficial to evidence this on radiograph as it would not preclude the patient from the study. If a radiograph was required to confirm a clinical diagnosis, the patient was excluded from the study.

### **3.6. ETHICS**

Each patient was given a letter of information (Appendix G) giving a precise description of the nature and intent of the study. Each patient was informed that they had a 50% chance of receiving a placebo or a real treatment in combination with the spinal manipulation. Following this, the patient was given the opportunity to ask questions pertaining to the study which were answered as clearly as possible.

The patient was informed that they could withdraw from the study at any time and without having to give a reason for doing so. All patient information was treated confidentially. Each patient was then required to complete an informed consent form



(Appendix H) stating that they understood the implications of the study and were willing to participate in the study.

### **3.7. THE SAMPLE GROUP**

A sample group consisting of sixty patients was obtained using convenience sampling and these subjects were divided into two equal sized groups of 30 patients each by means of random allocation. Patients were randomly allocated as follows : Thirty letters were inscribed with the letter P [representing the manipulation with PNF group] and thirty letters were inscribed with the letter M [representing the manipulation with detuned ultrasound group]. The identical labels were then folded and placed in a container, which was agitated to mix the labels. As each patient was incorporated into the study, a label was drawn out of the container in order to determine into which treatment group the patient was to be assigned.

Group 1 was the experimental group and received manipulation combined with PNF of the gluteal musculature.

Group 2 was the control group and received manipulation combined with detuned ultrasound over the gluteal musculature.

### **3.8. MEASUREMENTS**

Objective and subjective data was collected before the 1<sup>st</sup> treatment and after the 3<sup>rd</sup> and final treatment sessions. At each of these visits, patients were required to complete a Numerical Pain Rating Scale 101 (Jenson et al. 1986), and an Oswestry Low Back Pain Disability Index (adapted from Fairbank et al. 1980). An algometer (Wagner FDK20 model) was used to record pressure readings in kilograms per centimeter squared. The results of the four sacroiliac tests were recorded and an orthopaedic assessment rating was determined.

#### **3.8.1 SUBJECTIVE MEASUREMENTS**

Subjective measurements were recorded from two questionnaires completed by the patient in writing. These questionnaires included the Numerical Pain Rating Scale 101 (Jensen et al. 1986) and the Oswestry Low Back Disability Index (Fairbank et al. 1980). These questionnaires were completed before the 1<sup>st</sup> treatment and after the 2<sup>nd</sup> and final treatment sessions.

The Numerical Pain Rating Scale 101 (NRS-101) is used to numerically measure the patients pain intensity. The questionnaire instructs the patient to rate their pain when at its worst by indicating on a scale of zero to one hundred, where zero indicates “no pain at all” and 100 indicates “pain as bad as it could be”. The mean value was then calculated

by adding the value of the patients worst pain to the value of their least pain and dividing this value by two (Jensen et al. 1986). This mean value was recorded at the relevant visits and was used for statistical analysis.

Jensen et al.(1986) in a comparative study found the NRS 101 to be a practical method for the measurement of clinical pain intensity due to the fact that it is easy to administer and score, could be administered in either written or verbal form and the fact that the difficulty of the scale did not seem to be associated with age.

The Oswestry Low Back Pain Disability Index is used to indicate the degree of disability that the patient is experiencing in their every day life. This questionnaire consists of ten sections each containing six questions. The scoring of each question ranges from a minimum of zero to a maximum of five. Upon the completion of the questionnaire, the scores were tallied to give a maximum possible score of fifty. The final score was then multiplied by two to give a percentage. According to Fairbank et al. (1980) this questionnaire is a reliable and valid method of measuring the percentage disability suffered by patients with low back pain.

In a study done by Triano et al. (1993), the Oswestry Low Back Pain Disability questionnaire was one of only three out of seven questionnaires which demonstrated sufficient reliability and responsiveness to clinical changes over time to be considered useful in a randomised, clinical trial for musculoskeletal disorders.

### 3.8.2 OBJECTIVE MEASUREMENTS

Objective measurements were recorded from the results of algometer readings and the orthopaedic assessment scale which consisted of four orthopaedic tests. These measurements were collected before the 1<sup>st</sup> and after the 2<sup>nd</sup> and final treatment sessions.

The algometer recorded pressure threshold readings in order to give an indication of the pressure sensitivity of the patient. The algometer used was the Wagner FDK20 Force Dial (Wagner Instruments, P.O. Box 1217, Greenwich, CT, 06836 USA, tel. 2038699861). Pressure was measured over the most sensitive area of the sacroiliac joint area and over the most sensitive area of the gluteal muscles. The patient was instructed to say “yes” when the pressure exerted by the algometer became a feeling of pain. Upon removal of the algometer, a reading was taken in kg per square centimeter. If the reading on the algometer was higher than on previous visits then this indicated that the tenderness over that area was decreasing.

Fischer (1986) states that one of the most important features of the algometer is that it demonstrated abnormal tenderness and also the improvement of that specific area to treatment. In a study by Fischer (1987), an algometer was used to obtain pressure threshold measurements in order to diagnose trigger points (including those in the gluteal muscles) and to evaluate the treatment thereof. This author concluded that changes in

threshold obtained under standard clinical conditions could be regarded as reliable objective data.

An orthopaedic assessment rating scale was developed, using the results of four orthopaedic tests. These tests were specifically chosen to confirm the diagnosis of sacroiliac syndrome. They included Gaenslens' test, Patrick Fabers' test, Yeomans' test and the Posterior shear or "thigh thrust" test. The assessment rating had two functions :

1. Standardization in terms of the maximization of homogeneity.
2. Inferential statistics with concurrent correlation with the Oswestry, NRS 101 and algometer.

To be accepted into the study the patients' orthopaedic assessment rating, as determined by the results of these tests, had to be a minimum of six out of ten.

1. POSH (POsterior SHear or "thigh thrust" test) : According to Broadhurst and Bond (1998), this test is done by flexing the hip to 90°, adducting the femur to the midline and then applying an axial pressure along the length of the femur. Laslett and Williams(1994) state that excessive adduction of the hip should be avoided in order to minimise pain and discomfort . A positive test is indicated by pain over the sacroiliac joint. (supine)

2. Patrick Faber (Flexion ABduction and Eternal Rotation) : Broadhurst and Bond (1998) perform this test by stabilising the pelvis with one hand whilst the distal end of the opposite femur is used as a lever to move the ilium anteriorly. This is done by placing the right ankle over the left thigh above the knee whilst the examiners left hand pushes downwards on the medial aspect of the right knee. A positive test is indicated if this position produces pain over the right sacroiliac joint. (supine)
  
3. Gaenslen's test (Pelvic torsion) : Laslett and Williams(1994) produce posterior rotation of the right ilium on the sacrum by flexing the right hip and knee and simultaneous left hip extension. Overpressure is applied to force the sacroiliac joint to its end range. A positive test is indicated if this position produces pain over the right sacroiliac joint. (supine)
  
4. Yeoman's test : This test is done with the patient lying prone. The examiner flexes the patients knee to 90°and extends the hip. Pain localised over the sacroiliac joint indicates pathology in the anterior sacroiliac ligaments (Magee, 1997).

Each test, if positive, gave a score of two except for the posterior shear test which gave a score of four. A negative test was recorded as zero. Tests which produced pain in the lumbar spine, hip, groin, leg or other inapplicable site, and not in the sacroiliac joint, were recorded as zero. The scores were then added to give a total out of ten.

Although the reliability of orthopaedic testing has been demonstrated with some certainty in chapter 3, authors such as Broadhurst and Bond (1998) believe that the orthopaedic tests need to be used in combination in order to show a high predictive value for pain arising from the sacroiliac joint. Van Deursen et al. (1990) in their study on the value of some clinical tests for sacroiliac syndrome, found the diagnostic value of some orthopaedic test surprisingly low. They did however state that these tests are of value especially when combined with other findings in the diagnostic procedure. Thus, the combination of the orthopaedic scale used in this study with the Oswestry, NRS 101 and algometer findings make this study much more reliable than if the orthopaedic scale were used alone.

### **3.9. INTERVENTIONS**

Each patient who was accepted into the study was required to attend four treatment sessions over a two week period. According to Gatterman (1990), a sacroiliac syndrome can resolve with one adjustment, but may require further treatments (up to six) over a two week period. If a patient became asymptomatic before this time then treatment was discontinued. However, the patient was still monitored for the duration of the study.

### 3.9.1. SPINAL MANIPULATIVE THERAPY

Once a final diagnosis of sacroiliac syndrome was confirmed using the orthopaedic assessment rating, patients from both Groups 1 and 2 were treated with manipulative therapy of the sacroiliac joint. The site of the lesion was detected using motion palpation.

#### 3.9.1.1. MOTION PALPATION

The motion palpation procedure used in this study was a modification of the method prescribed by Bergmann (1993).

1. The patient was asked to stand whilst holding a support for balance.
2. The researcher stood behind the patient and placed a thumb contact on the patients posterior superior iliac spine (PSIS) and first or second sacral tubercle.
3. The patient was then asked to raise the ipsilateral leg to approximately 90° thereby flexing the hip and sacroiliac joint.
4. With normal movement the researchers thumbs approximated as the PSIS moved posteriorly and inferiorly relative to the stationary sacral tubercle.
5. A flexion restriction was suspected when the thumbs did not approximate.



In a study done by Hertzog et al. (1989), it was found that this type of motion palpation procedure produced significant intraexaminer reliability for all three scores tested.

Intraexaminer agreement was 68%, 79% and 72% for a positive finding, a negative finding and identification of a positive finding on the correct side, respectively.

However, they advised that interexaminer scores should not be used in clinical investigations as these were not always reliable.

In a review by Troyanovich and Harrison (1998), they found motion palpation to be an unreliable and invalid diagnostic procedure.

#### 3.9.1.2. MANIPULATION

The chiropractic technique used in this procedure was manipulation according to the Diversified technique as described by Schafer and Faye (1989). For this procedure, the patient lies in the lateral recumbent position with the applicable side uppermost. A thenar or hypothenar contact is then made and a thrust is applied to the fixated sacroiliac joint. A record was made of the motion palpation findings as well as the appropriate adjustment which was given at each visit.

### 3.9.2. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION

Patients falling into group 1 of the study received PNF of the gluteal musculature following the manipulation of the appropriate sacroiliac joint. The PNF procedure was given at all treatment sessions. The PNF technique used was the Contract-Relax-Antagonist-Contract (CRAC) technique.

It was administered to the patient as follows :

1. The patient lay supine and pulled the knee cephalad towards the opposite shoulder thereby flexing the hip and grasping the distal thigh. This position avoided excessive flexion pressure at the knee joint. The other leg remained straight.
2. The researcher then placed both hands on the patient's lateral knee to offer resistance to the isometric contraction.
3. The patient then pushed his knee diagonally towards the researcher, isometrically contracting the gluteal muscles for 6 seconds.
4. The patient then relaxed, breathed deeply, and stretched his leg even further towards the opposite shoulder thereby increasing the stretch on the gluteal muscles.

5. This was repeated three times and then the opposite leg was done.

Group 2 received manipulation of the sacroiliac joint in the same manner as Group 1 but in addition, also received detuned ultrasound over the gluteal musculature.

Although the effectiveness of PNF is determined by an increase in flexibility, it was not deemed necessary for the purposes of this study to determine increased flexibility but rather to determine a decrease in the pain of the sacroiliac syndrome attributable to the PNF stretch. This was done by means of the orthopaedic assessment scale, Oswestry, NRS 101 and algometer findings.

### 3.9.3. PLACEBO

Patients falling into group 2 of the study received placebo treatment in the form of detuned ultrasound over the gluteal musculature. Each patient was prepared and positioned as if receiving legitimate ultrasound. The patients were at no time given any indication that the treatment they were getting was placebo. The detuned ultrasound was done at all treatment sessions.

### **3.10. TREATMENT OF THE SUBPROBLEMS**

The purpose of this study was to investigate the relative effectiveness of manipulation used in conjunction with proprioceptive neuromuscular facilitation of the gluteal musculature versus manipulation used in conjunction with detuned ultrasound in terms of objective and subjective clinical findings in the treatment of sacroiliac syndrome.

#### **3.10.1. THE FIRST SUBPROBLEM**

The first subproblem was to evaluate the efficacy of manipulation used in conjunction with proprioceptive neuromuscular facilitation of the gluteal musculature and manipulation used in conjunction with detuned ultrasound in terms of subjective clinical findings.

#### **3.10.2. THE SECOND SUBPROBLEM**

The second subproblem was to evaluate the efficacy of manipulation used in conjunction with proprioceptive neuromuscular facilitation of the gluteal musculature and manipulation used in conjunction with detuned ultrasound in terms of objective clinical findings.

### 3.11. STATISTICAL ANALYSIS

#### 3.11.1. TREATMENT OF THE DATA

##### 3.11.1.1. SUBJECTIVE DATA

The subjective data was treated as follows :

- Questionnaires completed by patients were screened to ensure that they had been completed correctly.
- Raw data was extracted from the questionnaires and converted into percentages. This was recorded separately for each group.
- The data was statistically analysed using a 95% confidence level.

##### 3.11.1.2. OBJECTIVE DATA

The objective data was treated as follows :

- The algometer readings were recorded separately for each group.
- The orthopaedic assessment rating was recorded separately for each group.
- The data was statistically analysed using a 95% confidence level.

### 3.11.2. STATISTICAL ANALYSIS OF THE DATA

The Technikon Natal statistician was consulted in regards to the manner in which data from the research study was to be analysed. Both non-parametric and parametric tests were used to statistically analyse the data (sample size  $n_1=30$  and  $n_2=30$ ). Data was transferred to a spread sheet and statistical analysis was conducted at a 95% confidence level.

#### 3.11.2.1. NON-PARAMETRIC TESTING

Categorical variables were analysed using non-parametric testing regardless of the sample size.

The categorical variables include the :

1. Oswestry Low Back Pain Disability Index
2. Orthopaedic Assessment Rating Scale consisting of the four orthopedic tests (Patrick Faber's, Gaenslen's, Yeomann's and Thigh thrust test).

Frequencies and percentages were collected for analysis.

**A) MANN-WHITNEY UNPAIRED TEST**

The Mann-Whitney unpaired test is used to determine inter-group comparison between Group1 and Group 2, in terms of objective and subjective data using the results of the Oswestry Low Back Pain Disability Index and the Orthopedic assessment scale. The purpose of this was to analyse whether there was a significant difference between the two groups at the initial, second and fourth visits.

Confidence levels with regards to all measurements were conducted at the 95% confidence interval ( $\alpha = 0.05$ ).

**B) WILCOXON SIGNED RANK TEST**

The Wilcoxon signed rank test is used to determine intra-group comparison within Groups 1 and 2, in terms of objective and subjective data using the results of both categorical variables. The purpose of this was to analyse whether there was a significant difference within each group at the initial, second and fourth visits.

Confidence levels with regards to all measurements were conducted at the 95% confidence interval ( $\alpha = 0,05$ ).

### 3.11.2.2. PARAMETRIC TESTING

Continuous variables were analysed using parametric testing methods.

The continuous variables include the :

1. Algometer measurements
2. Numerical Pain Rating Scale 101

Means, ranges and standard deviations were used for analysis.

#### **A) TWO SAMPLE UNPAIRED T-TEST**

The Two Sample Unpaired t-test is used to determine inter-group comparison, in terms of objective and subjective data using the results of the continuous variables. The purpose of this was to analyse whether there was a significant difference between the two groups at the initial, second and fourth visits.

Confidence levels with regards to all measurements were conducted at the 95% confidence interval ( $\alpha = 0,05$ ).



## **B) ANOVA TEST**

The ANOVA is used for intra-group comparison, in terms of objective and subjective data using the continuous variables. The purpose of this was to analyse whether there is a significant difference within the groups at the initial, second and fourth visits. If there is a difference between two or more of the visits the ANOVA test will be used to determine where the difference lies.

Confidence levels with regards to all measurements were conducted at the 95% confidence interval ( $\alpha = 0,05$ ).

### **3.11.2.3. HYPOTHESIS TESTING**

#### **a) SUBPROBLEM ONE**

Null hypothesis ( $H_0$ ) : there is no statistically significant improvement in the patients condition within each group in terms of subjective clinical findings.

Alternative hypothesis ( $H_1$ ) : there is a statistically significant improvement in the patients condition within each group in terms of subjective clinical findings.

b) SUBPROBLEM TWO

Null hypothesis ( $H_0$ ) : there is no statistically significant improvement in the patients' condition within the two groups in terms of objective clinical findings.

Alternative hypothesis ( $H_1$ ) : there is a statistically significant improvement in the patients' condition within the two groups in terms of objective clinical findings.

### **3.12. SUMMARY STATISTICS**

If a significant difference between the two groups was found in terms of objective and subjective clinical findings using the parametric and non-parametric testing methods, then the mean was used to identify the superior group.

# CHAPTER

# FOUR

## THE RESULTS

### 4.1. INTRODUCTION

This chapter is concerned with the demographic data of all the patients accepted into the trial as well as with the statistically analysed results of the subjective and objective data obtained from the subjects over the duration of the treatment period.

Subjective data was obtained from the Numerical Pain Rating Scale 101 and the Oswestry Low Back Pain Disability Index. Objective data was obtained from the orthopaedic assessment rating scale and from the algometer readings.

Statistical analysis of this data was done in order to solve the subproblems. The ANOVA and the Wilcoxon Signed Rank test were used for intra-group analysis and the unpaired t-test and Mann-Whitney U-test were used for inter-group analysis.

## **4.2. DEMOGRAPHIC DATA**

### **4.2.1. AGE DISTRIBUTION**

**TABLE 4.1**

<b>AGE DISTRIBUTION</b>	<b>GROUP 1</b>	<b>GROUP 2</b>	<b>TOTAL</b>
18-25 YEARS	6	6	6
26-35 YEARS	13	6	19
36-50 YEARS	11	18	29
18-50 YEARS	30	30	60

The mean age of Group 1 was 33.33.

The median age of Group 1 was 35.

The mean age of Group 2 was 37.5.

The median age of Group 2 was 39.

The mean age of Group 1 and Group 2 was 35.42.

These age ranges are in keeping with Burton and Cassidy (1992), who state that back pain reaches a maximal frequency during middle age.

4.2.2. GENDER DISTRIBUTION

TABLE 4.2.

GENDER DISTRIBUTION	GROUP 1	GROUP 2	TOTAL
FEMALES	15	15	30
MALES	15	15	30
TOTAL	30	30	60

The number of females and males found in each group were exactly equal.

These results are in contrast to the study done by Gemmel and Jacobson (1990) in which they found a definite predominance in females reporting a history of low back pain.

4.2.3. TRIGGER POINT DISTRIBUTION

TABLE 4.3.

MUSCLE	GROUP 1	GROUP 2	TOTAL
GLUTEUS MAXIMUS	10	15	25
GLUTEUS MEDIUS	20	20	40
GLUTEUS MINIMUS	4	6	10
TOTAL	34	41	75

The distribution of trigger points was weighted in the gluteus medius followed by the gluteus maximus and the gluteus minimus.

In contrast to this is Walker (1992) and Kirkaldy-Willis (1992) who believe sacroiliac syndrome to be most commonly associated with myofasciitis of the gluteus maximus.

#### 4.2.4. PRESENCE OF EXTREMITY PAIN

TABLE 4.4.

EXTREMITY PAIN	GROUP 1	GROUP 2
GROIN	3	5
POSTERIOR THIGH	5	15
BELOW KNEE	1	7
HIP	1	0
BUTTOCK	1	1
TOTAL	11	28

The presence of pain referred into the extremity is in keeping with the pattern described by Bernard and Cassidy (1991).



#### 4.2.5. NUMBER OF SMOKERS IN EACH GROUP

**TABLE 4.5.**

	GROUP 1	GROUP 2	TOTAL
SMOKERS	8 (27 %)	14 (47%)	22 (37%)

Burton and Kirkaldy-Willis (1992) have identified smoking as a risk factor for the development of low back pain.

There was a much higher proportion of smokers in Group 1 than in Group 2. At the initial consultation it was noted that Group 2 had a higher and statistically significant difference in Oswestry readings than Group 1. This indicated that Group 2 was more severe in terms of disability caused by low back pain than Group 1. This could possibly be due the higher incidence of smoking in Group 2.

#### 4.2.6. PREVIOUS HISTORY OF LOW BACK PAIN

**TABLE 4.6.**

	GROUP 1	GROUP 2	TOTAL
HISTORY OF LOW BACK PAIN	13 (43%)	16 (53%)	29 (48 %)

These findings showed a greater percentage than that found by Gemmel and Jacobson (1990) who found a history of low back pain in 26.5% of their study group.

#### 4.2.7. PREVIOUS CHIROPRACTIC TREATMENT OF LOW BACK PAIN

**TABLE 4.7.**

	GROUP 1	GROUP 2	TOTAL
PREVIOUS CHIROPRACTIC TREATMENT	11 (36.7%)	7 (23%)	18 (30%)

4.2.8. COMPARISON OF PAIN DISTRIBUTION AND SIDE OF SACROILIAC  
JOINT DYSFUNCTION

TABLE 4.8.

LOCATION	PAIN DISTRIBUTION	SID
BILATERAL	32	19
RIGHT	14	14
LEFT	14	27
TOTAL	60	60

This is in contrast to Bernard and Cassidy (1991) who state that symptoms of sacroiliac joint syndrome usually have a right- sided predominance.

### **4.3. STATISTICAL ANALYSIS OF THE DATA**

#### **4.3.1. SAMPLE SIZE**

Group 1 (Manipulation with proprioceptive neuromuscular facilitation) : 30 subjects

Group 2 (Manipulation with detuned ultrasound) : 30 subjects

#### **4.3.2. ABBREVIATIONS**

S.D. : Standard deviation

S.E. : Standard error

p-value : observed level of significance

Ho : Null hypothesis

H1 : Alternate hypothesis

$\alpha$  : level of significance

NRS 101 : Numerical Pain Rating Scale 101

Oswestry : Oswestry Low Back Pain Disability Index

Orthopaedic assessment : Results of four sacroiliac pain provocation tests.

Level of significance : 5%  $\alpha = 0,05$

Reject  $H_0$  if  $P \leq \alpha / 2$  for a 2-tailed test or  $P \leq \alpha$  for a 1-tailed test.

Accept  $H_0$  if  $P > \alpha / 2$  for a 2-tailed test or  $P > \alpha$  for a 1-tailed test.

As  $\alpha / 2 = 0,025$ , the p-value must be equal to or less than 0,025 in order to reject  $H_0$  (there is a significant difference).

#### **4.4. PARAMETRIC AND NON-PARAMETRIC PAIRED HYPOTHESIS TESTS**

Objective and subjective data was obtained from Group 1 and Group 2 and the measurements were tabulated to compare the results of the initial and second consultation, second and final consultation, and the initial and final consultation. P-values were calculated at a 95% level of significance, using the ANOVA test for the continuous variables (algometer and NRS 101), and the Wilcoxon Signed Rank test for the categorical variables (Oswestry and orthopaedic tests).



**STATISTICAL RESULTS OF THE SUBJECTIVE AND OBJECTIVE DATA  
COMPARING THE FIRST AND SECOND CONSULTATION IN GROUP 1.**

**TABLE 4.9.**

GROUP 1					
	FIRST			SECOND	
	MEAN	S.D.	P-VALUE	MEAN	S.D.
ALGOMETER JOINT	4.515	37.3	1.0	4.53	1.53
ALGOMETER MUSCLE	4.6	1.67	1.0	4.8	4.53
NRS 101	46.7	15.4	0.565	40.5	14.7
ORTHOPEDIC	8.2	1.58	0.000	6.03	2.8
OSWESTRY	24.73	10.05	0.409	24.10	11.83

**The ANOVA test : Algometer and NRS 101**

**Wilcoxon Signed Rank test : Orthopaedic rating and Oswestry**

Table 4.9 gives an indication of the results of Group 1 following the initial treatment.  
These are compared to the results of Group 1 following the second treatment.

There is a significant improvement noted for the orthopaedic rating between the initial and second visit for Group 1. Therefore the Null hypothesis is rejected for this result. However, there is no significant difference noted for the algometer (joint and muscle), NRS 101 and Oswestry results when comparing the first and second visit for Group 1. Therefore the Null hypothesis is accepted for these results.

**STATISTICAL RESULTS OF THE SUBJECTIVE AND OBJECTIVE DATA  
COMPARING THE SECOND AND FINAL CONSULTATION IN GROUP 1**

**TABLE 4. 10.**

GROUP 1					
	SECOND			FINAL	
	MEAN	S.D.	P-VALUE	MEAN	S.D.
ALGOMETER JOINT	4.53	1.53	0.512	5.04	1.55
ALGOMETER MUSCLE	4.79	1.53	0.213	5.60	1.91
NRS 101	40.5	14.77	0.021	27.56	22.97
ORTHOPEDIC	6.03	2.8	0.016	4.27	3.5
OSWESTRY	24.1	11.83	0.013	17.53	9.13

**The ANOVA test : Algometer and NRS 101****Wilcoxon Signed Rank test : Orthopaedic rating and Oswestry**

Table 4.10 gives an indication of any further improvement in the patients' condition from the second to the final consultation in Group 1. There was no significant improvement in measurement outcomes for the algometer readings taken over the joint. Therefore the Null hypothesis was accepted for this reading. All other measurement outcomes showed a significant improvement in outcome measures. The Null hypothesis was therefore rejected for these results.



STATISTICAL RESULTS OF THE SUBJECTIVE AND OBJECTIVE DATA  
COMPARING THE FIRST AND FINAL CONSULTATON IN GROUP 1

TABLE 4.11.

GROUP 1					
	FIRST			FINAL	
	MEAN	S.D.	P-VALUE	MEAN	S.D.
ALGOMETER JOINT	4.515	37.34	0.417	5.04	1.55
ALGOMETER MUSCLE	4.61	1.671	0.082	5.60	1.91
NRS 101	46.7	15.42	0.000	27.57	22.97
ORTHOPEDIC	8.2	1.58	0.000	4.27	3.5
OSWESTRY	24.73	10.05	0.002	17.53	9.13

The ANOVA test : Algometer and NRS 101

Wilcoxon Signed Rank test : Orthopaedic rating and Oswestry

Table 4.11 gives an indication of the overall response of the treatment between the first and the final consultation in Group 1. There is no significant improvement in algometer

readings over the joint. Therefore the Null hypothesis is accepted for these results. There is a significant improvement in all other outcome measures. Therefore the Null hypothesis is rejected for these measures.

**STATISTICAL RESULTS OF THE SUBJECTIVE AND OBJECTIVE DATA COMPARING THE FIRST AND SECOND CONSULTATOIN IN GROUP 2.**

**TABLE 4.12.**

GROUP 2					
	FIRST			SECOND	
	MEAN	S.D.	P-VALUE	MEAN	S.D.
ALGOMETER JOINT	3.86	1.7	1.0	4.03	1.48
ALGOMETER MUSCLE	3.99	1.56	1.000	4.35	1.41
NRS 101	48.43	13.69	0.231	42.47	16.90
ORTHOPEDIC	8.37	1.47	0.000	5.7	2.96
OSWESTRY	33.83	17.21	0.003	26.57	11.04

**The ANOVA test : Algometer and NRS 101**

**Wilcoxon Signed Rank test : Orthopaedic rating and Oswestry**

Table 4.12 gives an indication of the initial improvement of the patient following the first treatment. There is no significant difference in algometer (joint and muscle) and NRS 101 readings from the first to the second consultation in Group 2. The Null hypothesis is thus accepted for these outcome measures. There is a significant difference in outcome for the orthopaedic rating and the Oswestry. The Null hypothesis is thus rejected for these outcome measures.

**STATISTICAL RESULTS OF THE SUBJECTIVE AND OBJECTIVE DATA  
COMPARING THE SECOND AND FINAL CONSULTATION IN GROUP 2.**

**TABLE 4.13.**

GROUP 2					
	SECOND			FINAL	
	MEAN	SD	P-VALUE	MEAN	SD
ALGOMETER JOINT	4.03	1.48	0.379	4.68	1.75
ALGOMETER MUSCLE	4.35	1.41	0.314	5.04	1.88
NRS 101	42.47	16.90	0.660	37.05	19.81
ORTHOPEDIC	8.37	1.47	0.000	5.7	2.96
OSWESTRY	26.57	11.04	0.003	19	12.27

**The ANOVA test : Algometer and NRS 101****Wilcoxon Signed Rank test : Orthopaedic rating and Oswestry**

Table 4.13 gives an indication as to the improvement between the second and the final consultation in Group 2. There is no significant difference in algometer (joint and muscle) and NRS 101 readings. Therefore the Null hypothesis is accepted for these outcome measures. There is a significant difference in orthopaedic and Oswestry readings. The Null hypothesis is thus rejected for these outcome measures.

**STATISTICAL RESULTS OF THE SUBJECTIVE AND OBJECTIVE DATA  
COMPARING THE FIRST AND FINAL CONSULTATION IN GROUP 2.**

**TABLE 4.14.**

GROUP 2					
	FIRST			FINAL	
	MEAN	SD	P-VALUE	MEAN	SD
ALGOMETER JOINT	3.86	1.70	0.169	4.68	1.75
ALGOMETER MUSCLE	3.99	1.56	0.044	5.04	1.88
NRS 101	48.43	13.69	0.033	37.05	19.812
ORTHOPEDIC	8.37	1.47	0.000	3.07	3.18
OSWESTRY	33.83	17.21	0.000	19	12.27

**The ANOVA test : Algometer and NRS 101**

**Wilcoxon Signed Rank test : Orthopaedic rating and Oswestry**

Table 4.14 gives an indication of the final outcome of Group 2 following the final treatment. There was no significant improvement in algometer readings over the joint.

The Null hypothesis is thus accepted for these measures. There is a significant difference between the remaining outcome measures. The Null hypothesis is therefore rejected for these outcome measures.

#### **4.5. PARAMETRIC AND NON-PARAMETRIC UNPAIRED TESTS**

Objective and subjective data was obtained at the initial, second and final consultations in order to compare measurements between Group1 and Group 2. Data was analysed at a 95% level of confidence, using the Two Sample Unpaired t-test to obtain a p-value for continuous variables, and the Mann-Whitney Unpaired test to obtain a p-value for categorical variables.

**STATISTICAL RESULTS OF SUBJECTIVE AND OBJECTIVE DATA  
COMPARING GROUP 1 AND GROUP 2 AT THE INITIAL CONSULTATION.**

**TABLE 4.15.**

INITIAL CONSULTATION					
	GROUP 1			GROUP 2	
	MEAN	S.D.	P-VALUE	MEAN	S.D.
ALGOMETER JOINT	4.515	3.34	0.275	3.86	1.7
ALGOMETER MUSCLE	4.61	1.67	0.148	3.99	1.56
NRS 101	46.7	15.42	0.647	48.4	13.69
ORTHOPEDIC	8.2	1.58	0.683	8.37	1.47
OSWESTRY	24.73	10.05	0.021	33.83	17.21

**Two Sample Unpaired t-test : Algometer and NRS 101**

**Mann Whitney U test : Orthopaedic rating and Oswestry**

Table 4.15 compares the objective and subjective data taken from Group 1 and Group 2 at the initial consultation. The Oswestry readings show a significant difference between

Group 1 and Group 2. The Null hypothesis is therefore rejected for these readings. There is no statistically significant difference between the remaining outcome measures. The Null hypothesis is therefore accepted for these outcome measures.

**STATISTICAL RESULTS OF SUBJECTIVE AND OBJECTIVE DATA  
COMPARING GROUP 1 AND GROUP 2 AT THE SECOND CONSULTATION.**

**TABLE 4.16.**

SECOND CONSULTATION					
	GROUP 1			GROUP 2	
	MEAN	S.D.	P-VALUE	MEAN	S.D.
ALGOMETER JOINT	4.532	1.525	0.198	4.027	1.478
ALGOMETER MUSCLE	4.790	1.532	0.252	4.350	1.414
NRS 101	40.5	14.771	0.633	42.467	16.897
ORTHOPEDIC	6.03	2.8	0.647	5.7	2.96
OSWESTRY	24.10	11.83	0.253	26.57	11.04

**Two Sample Unpaired t-test : Algometer and NRS 101**

**Mann Whitney U test : Orthopaedic rating and Oswestry**



Table 4.16 compares the objective and subjective data between Group1 and Group 2 at the second consultation. There is no statistically significant difference between the results taken from the two groups. The Null hypothesis was therefore accepted for all readings. Thus there was no difference in outcomes of the two groups following the second consultation.

**STATISTICAL RESULTS OF SUBJECTIVE AND OBJECTIVE DATA  
COMPARING GROUP 1 AND GROUP 2 AT THE FOURTH CONSULTATION.**

TABLE 4.17.

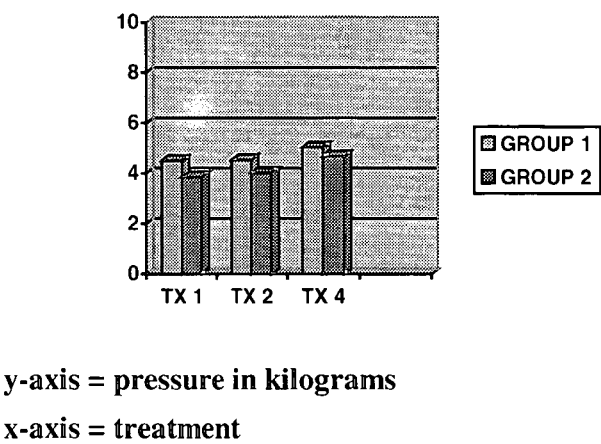
FOURTH CONSULTATION					
	GROUP 1			GROUP 2	
	MEAN	S.D.	P-VALUE	MEAN	S.D.
ALGOMETER JOINT	5.040	1.547	0.406	4.683	1.750
ALGOMETER MUSCLE	5.597	1.905	0.259	5.040	1.880
NRS 101	27.567	22.965	0.092	37.050	19.812
ORTHOPEDIC	4.27	3.50	0.186	3.07	3.18
OSWESTRY	17.53	9.13	0.847	19	12.27

**Two Sample Unpaired t-test : Algometer and NRS 101****Mann Whitney U test : Orthopaedic rating and Oswestry**

Table 4.17 shows the subjective and objective results taken from Group 1 and Group 2 following the final consultation. There is no statistically significant difference between the two groups. The Null hypothesis is therefore accepted for all outcome measures. It can be seen that there is no evidence to suggest that manipulation combined with PNF is more effective than manipulation with detuned ultrasound, in terms of subjective and objective findings, for the treatment of sacroiliac syndrome. There is evidence, however, of an overall improvement in each group for the treatment of sacroiliac syndrome.

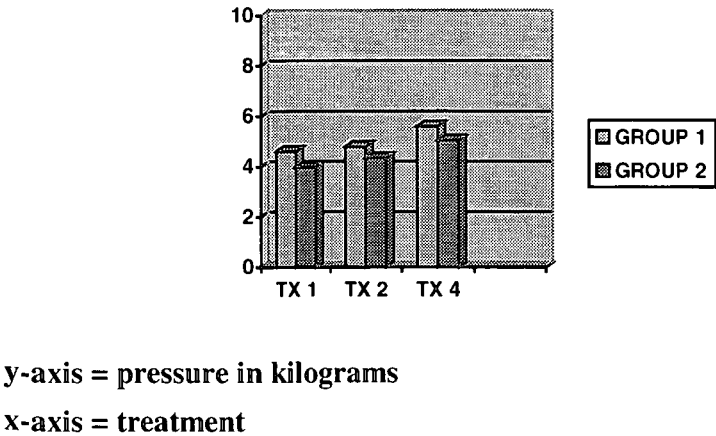
THE RESULTS OF BOTH GROUPS, COMPARING THE INITIAL, SECOND AND FINAL CONSULTATIONS WITH RESPECT TO ALGOMETER READINGS OVER THE JOINT(MEAN).

FIGURE 4.1.



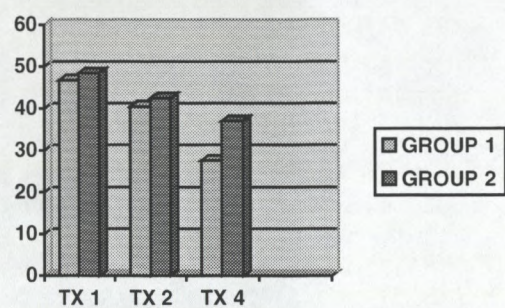
THE RESULTS OF BOTH GROUPS, COMPARING THE INITIAL, SECOND AND FINAL CONSULTATION WITH RESPECT TO ALGOMETER READINGS OVER THE MUSCLE (MEAN).

FIGURE 4.2.



THE RESULTS OF BOTH GROUPS, COMPARING THE INITIAL, SECOND AND FINAL CONSULTATION WITH RESPECT TO NRS 101 READINGS (MEAN).

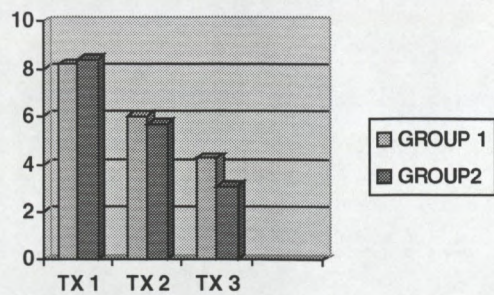
FIGURE 4.3.



y-axis = percentage of pain experienced  
x-axis = treatment

THE RESULTS OF BOTH GROUPS, COMPARING THE INITIAL, SECOND AND FINAL CONSULTATION WITH RESPECT TO ORTOPAEDIC RATING (MEAN).

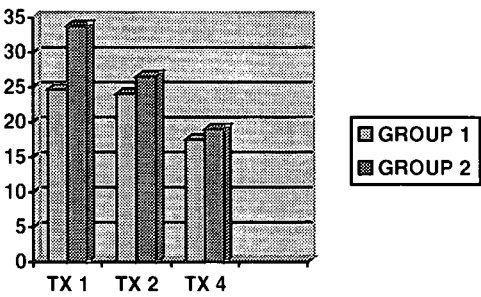
FIGURE 4.4.



y-axis = test score out of 10  
x-axis = treatment

THE RESULTS OF BOTH GROUPS, COMPARING THE INITIAL, SECOND AND FINAL CONSULTATION WITH RESPECT TO OSWESTRY READINGS (MEAN).

FIGURE 4.5.



y-axis = percentage disability  
x-axis = treatment

# CHAPTER

# FIVE

## DISCUSSION

### 5.1. INTRODUCTION

This chapter is a discussion of the subjective and objective findings as reported on in Chapter 4. Subjective data was obtained using the Numerical Pain Rating Scale 101 and the Oswestry Low Back Pain Disability Index. Objective data was obtained using the Algometer and the Orthopaedic Assessment Rating Scale. Intra-group analysis using both the subjective and objective data was done using the Wilcoxon Signed Rank test. Inter-group analysis for both the objective and subjective data was done using the Mann-Whitney U-test.

Data was obtained at the beginning of the initial and after the second and final consultations. Statistical analysis was performed on this data in order to compare the first and second consultation, the second and final consultation, and lastly, the first and final consultation in order to determine the efficacy of the treatments given for the treatment of sacroiliac syndrome.

## **5.2. INTRA-GROUP ANALYSIS**

Intra-group comparison of subjective and objective data showed that both Group 1 and Group 2 experienced improvement in their subjective pain levels, objective orthopaedic testing, pain threshold levels and disability caused by the low back pain.

### **5.2.1. OBJECTIVE DATA**

#### **5.2.1.1. ALGOMETER**

Algometer readings were analysed in tables 4.9 to 4.17. A significant improvement in pain threshold level was noted between the initial and final consultation in Group 2 in algometer readings over the muscle (Table 4.14). This could indicate that four treatment sessions provided more benefit when treating sacroiliac syndrome with manipulation combined with PNF than fewer treatment sessions would have done. Although no statistically significant improvement could be noted with the remaining algometer data, including readings over both the muscle and the joint, there was a slight increase in pressure threshold levels between successive visits in both groups when the means were directly compared.



### 5.2.1.2. ORTHOPAEDIC ASSESSMENT

Orthopaedic assessment rating data were analysed in tables 4.9 to 4.17. A significant improvement was noted between the initial and second consultation in test scores for Group 1 (Table 4.9). A similar improvement was demonstrated in Group 2 (Table 4.12). Further improvement was also demonstrated by the final consultation in both Group 1 and Group 2 (Table 4.11 and 4.14). The statistical significance of all these values indicates that that patients benefited more from four treatments than from fewer treatment sessions.

### 5.2.2. SUBJECTIVE DATA

#### 5.2.2.1. NUMERICAL PAIN RATING SCALE 101

The Numerical Pain Rating Scale data was analysed in tables 4.9 to 4.17. Both Group 1 and Group 2 showed an improvement in subjective pain levels from the first to the second consultation (Tables 4.9 and 4.12). However, this improvement was not statistically significant. A slight further improvement was noted in Group 1 from the second to the final consultation (Table 4.10). A significant improvement was noted in Group 2 from the second to the final consultations (Table 4.13).

Both Group 1 and Group 2 demonstrated a significant improvement in pain levels from the initial to the final consultation (Tables 4.11 and 4.14). These findings serve to further

support the results of the objective finding which indicate that four treatment sessions for this condition is better than fewer treatment sessions.

#### 5.2.2.2.OSWESTRY LOW BACK PAIN DISABILITY QUESTIONNAIRE

The Oswestry data was analysed in tables 4.9 to 4.17. Group 1 showed only a slight improvement in disability due to back pain from the first to the second consultation (Table 4.9). However, this was not statistically significant. A statistically significant improvement in disability due to low back pain was found from the first to the second consultation in Group 2 (Table 4.12). Further statistically significant improvement was noted from the second to the fourth consultation and from the first to the final consultation in both Groups 1 and 2 (Tables 4.10 ; 4.11 ; 4,13 and 4.14 ). This data supports the before mentioned data which indicates that four treatment sessions for this condition is better than fewer treatment sessions.

### **5.3. INTER-GROUP ANALYSIS**

Inter-group analysis for the objective data can be found in tables 4.15 to 4.17.

There was no evidence found to support that manipulation combined with PNF is more effective than manipulation combined with detuned ultrasound , in terms of subjective and objective clinical findings, for the treatment of sacroiliac syndrome.

There was no clinically significant difference between the two groups at the initial consultation except for the Oswestry readings which were found to be significantly higher in Group 2. Data taken after the 2<sup>nd</sup> and final consultation did not show a significant difference between the two groups for any of the outcome measures.

In conclusion, at a 95% level of confidence, any additional benefit provided by the PNF could not be demonstrated for the treatment of sacroiliac syndrome.

#### **5.3.1. OBJECTIVE MEASURES**

##### **5.3.1.1. ALGOMETER**

Algometer data for inter-group comparison is found in tables 4.15 to 4.17. Algometer readings taken over both the muscle and the joint showed similar pain tolerance level in

Group 1 and Group 2 at the initial consultation (Table 4.15). There was an increase in pain tolerance levels in subsequent visits when comparing the mean for Group 1 and Group 2 but this was not statistically significant (Tables 4.16 and 4.17).

#### 5.3.1.2. ORTHOPAEDIC TESTS

Orthopaedic test data for inter-group comparison is found in tables 4.15 to 4.17. There is no statistically significant difference between the two groups at the first, second or final consultation in terms of positive orthopaedic testing.

#### 5.3.2. SUBJECTIVE MEASURES

##### 5.3.2.1 NUMERICAL PAIN RATING SCALE 101

NRS 101 data for inter-group comparison was found in tables 4.15 to 4.17. Initial consultation showed no statistically significant pain levels between Group 1 and Group 2 (Table 4.15).

Both the second and the final consultation showed a decrease in pain levels when comparing Group 1 and Group 2 but this was not statistically significant (Tables 4.16 and 4.17).

#### 5.3.2.2.OSWESTRY LOW BACK PAIN DISABILITY INDEX

Oswestry data for inter-group comparison was found in tables 4.15 to 4.17. There was a statistically significant difference in Oswestry data at the initial consultation (Table 4.15). However, at the second and final consultation, there was no statistically significant difference between the two groups in terms of subjective disability due to low back pain(Tables 4.16 and 4.17).

#### 5.4. SOLVING THE HYPOTHESES

Statistical analysis of the data reveals that both Group 1 and Group 2 showed significant improvement in their condition from the initial to the final consultation. Improvement was noted at the second and final consultations. Improvement was seen on analysis of both the objective and subjective data.

Therefore, the Alternative hypothesis (H1) was accepted as there was a significant improvement in the patients' condition in terms of subjective findings in both groups.

All subjective data showed an improvement in pain levels and disability throughout the treatment program. Improvement was noted after the second and final consultations and a

significant improvement in subjective data was noted in Group 1 and Group 2 between the initial and the final consultation. Thus the Null hypothesis ( $H_0$ ) was rejected.

The Alternate hypothesis ( $H_1$ ) was accepted as there was a significant improvement in the patients' condition in terms of objective clinical findings.

The algometer readings from Group 1 did showed improvement when comparing the mean but this was not significant. All other objective data showed a statistically significant improvement leading to a rejection of the Null hypothesis ( $H_0$ ).

## **5.5. DISCUSSION OF THE DEMOGRAPHIC DATA**

The age distribution (Table 4.1.) showed equal numbers of patients in the 18 to 25 year age group. However, Group 1 had nearly double the number of patients in the 26 to 35 year age group than Group 2, whereas Group 2 had a higher proportion of patients in the 36-50 year age group. This may account in part for the fact that Group 2 had statistically significant higher Oswestry results than Group 1 at the initial consultation as according to Burton and Cassidy (1992), back pain reaches a maximal frequency during middle age.

The gender distribution (Table 4.2.) showed an equal distribution of males and females in each group.

The distribution of trigger points (Table 4.3.) showed a predominance of trigger points in the Gluteus Medius muscle in both Group 1 and Group 2. This was followed by the Gluteus Maximus and the Gluteus Minimus in decreasing order of frequency for both groups. Gluteus Medius showed approximately four times the frequency for both groups compared to the Gluteus Minimus and twice the frequency of the Gluteus Maximus.

## **5.6. STUDY LIMITATIONS**

The overall results of the study indicate that both groups improved in terms of objective and subjective clinical findings with no statistically significant difference in outcome measures between the two groups.

One of the most important shortfalls of the study is the small sample size (30 per group). A large sample size is always preferential as it reduces the chances of incorrectly accepting or rejecting the Null hypothesis and thus serves to improve the validity of the study.

Another shortfall of the study is a lack of homogeneity amongst the study participants. Due to the study design and time constraints, it was not possible to distribute the patients equally in terms of age, sex, race, occupation etc. Although the sex distribution amongst both groups was equal, the age distribution was different.

Although each patient was instructed not to partake in any other treatment regime or new lifestyle activities for the duration of the treatment period, it was impossible for the researcher to monitor the compliance of the patient with these instructions. It is unknown if this may have altered the outcome of the study or not.

Although the subjective questionnaires are an accepted and popular form of recording subjective data, the extent to which the patient can fully understand and truthfully complete them is not certain. It is possible that patients may have completed the questionnaire simply in order to satisfy the researcher.

There was no blinding in the trial, leading to the possibility of practitioner bias and the influencing of results.



### **5.7. COMPARISON WITH OTHER STUDIES.**

The results obtained in this study have been compared to some other studies in order to determine any similarities which could serve to further validate this study.

A study by Pope et al. (1994) was done in order to determine the relative efficacy of chiropractic treatment to massage, corset and transcutaneous muscle stimulation (TMS) in patients with subacute low back pain.

Similarities to this present trial include a minimum recruitment age of 18 and lack of neurological deficit, tumor or infection. Both this study and the study done by Pope et al. (1994) treated patients over four visits. However, this study was done over two weeks whereas the latter study was completed over three weeks.

Both the trials demonstrated a great improvement in pain levels in those patients treated by manipulation by the fourth consultation.

A second study done by Meade et al. (1990) compared chiropractic treatment to hospital outpatient treatment. Similarities to the present study included a minimum recruitment age of 18, no contraindications to manipulation and no treatment within the past month. As with this study, Meade et al. (1990) also measured changes in the Oswestry pain questionnaire to determine outcome. In contrast to this study, the questionnaires were

sent out at weekly intervals for six weeks, at six months and at one and two years after entry.

Both trials used manipulation applied by chiropractors in the manipulation groups. The main difference between the two trial was that the Meade et al. (1990) administered treatment over a maximum of ten treatment sessions which were spread mainly over the first three months but which could extend for as long as a year. The current trial is also concerned with low back pain attributable to sacroiliac syndrome whereas the former study is concerned with mechanical subacute low back pain.

The final study to be compared is that done by Broughton and Kretzmann (2000) in which spinal manipulation was compared to spinal manipulation combined with low back strapping for the treatment of low back pain. Both studies consisted of sixty patients and statistical analysis was done in a similar fashion. One of the differences was that there were six treatment sessions in the Broughton and Kretzmann (2000) trial whereas this study consisted of only four treatment sessions. In the study by Broughton and Kretzmann (2000) there was no statistically significant difference noted between the two groups by the final consultation.

The current trial also did not have any significant difference between the two groups by the final consultation.

It seems that treatment modalities such as PNF and low back strapping do not seem to provide any added benefit when combined with manipulation for the treatment of low back pain.

# CHAPTER

# SIX

## RECOMMENDATIONS AND CONCLUSIONS

### **6.1. RECOMMENDATIONS**

A longer time period and financial freedom would allow the researcher to create a more effective and reliable study on the efficacy of manipulation with or without proprioceptive neuromuscular facilitation (PNF) for the treatment of sacroiliac syndrome.

A number of recommendations can be made by the researcher. Firstly, as mentioned before, a larger sample size is always preferred in a study such as this. The sample size of sixty patients allowed for both parametric and non-parametric statistical analysis to be done. Although these have both been done, power analysis could have been included in order to further strengthen the results. When testing the Null hypothesis, there is always the possibility of a type II error in which the Null hypothesis is accepted when it should be rejected. As the sample size increase, the chances of making this error decrease.

The study would have been greatly enhanced by making each group more homogeneous in terms of age, sex, race, history and severity of complaint etc. This can, however lead to selection bias.

The lack of blinded outcome assessment leads to the possibility of observer bias.

However, although it was not possible for the researcher to be blinded due to the nature

of the treatment, observer bias could have been eliminated by allowing a third person to collect and collate the objective data without knowing which group the patient belonged to.

A second clinician gave each patient an orthopaedic assessment rating score independent to that of the researcher. However, different clinicians were asked to give this rating depending on who was available at the time thus allowing for more variables into the study. The use of only one clinician only is advisable.

A similar study consisting of more than four consultations would be useful in order to determine whether further relief could be obtained over a longer treatment period.

A study comparing the natural history of the condition would also be useful in order to determine the actual efficacy of the treatment program.

The inclusion of a follow-up treatment is advisable in order to determine the long term efficacy of the treatment regime.

## **6.2. CONCLUSION**

The purpose of this study was to determine the efficacy of manipulation combined with detuned ultrasound over the gluteal muscles to manipulation combined with proprioceptive neuromuscular facilitation (PNF) in terms of subjective and objective findings for the treatment of sacroiliac syndrome.

At a 5% level of confidence, it was found that both treatment programs improved the sacroiliac syndrome. However, neither group was found to be overall more effective than the other, in terms of objective and subjective clinical findings, for the treatment of sacroiliac syndrome.

It was the impression of the researcher that the patients receiving the PNF treatment were initially worse after the first treatment as compared to the patients receiving manipulation alone. This may be due to delayed muscle soreness caused by the PNF in patients unaccustomed to this type of physical activity.

It is postulated that PNF should be avoided in very acute cases of sacroiliac syndrome as patients such as these did not seem to improve significantly in this study. The researcher is uncertain as to why this occurred.

The chiropractic adjustment is known to be a safe and effective form of therapy for the treatment of spinal disorders of mechanical origin. Further research is needed in order to determine the efficacy of PNF for the treatment of sacroiliac syndrome. Until then, it is up to the discretion of the clinician as to whether or not to use this treatment modality.

In conclusion, this study has demonstrated that manipulation used in conjunction with PNF is as effective as manipulation used in conjunction with detuned ultrasound for the treatment of sacroiliac syndrome.



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**TECHNIKON NATAL CHIROPRACTIC DAY CLINIC**  
**CASE HISTORY**

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

**FOR CLINICIAN'S USE ONLY**

Initial visit clinician: \_\_\_\_\_ Signature: \_\_\_\_\_

**Case History:**

**Examination:**

Previous: \_\_\_\_\_

Current: \_\_\_\_\_

**X-Ray Studies:**

Previous: \_\_\_\_\_

Current: \_\_\_\_\_

**Clinical Path. lab:**

Previous: \_\_\_\_\_

Current: \_\_\_\_\_

**Case Status:**

PTT: \_\_\_\_\_ Conditional: \_\_\_\_\_ Signed Off: \_\_\_\_\_ Final Sign out: \_\_\_\_\_

**Recommendations:**

**Intern's Case History**

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

**3. Present Illness:**

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

**4. Other Complaints:**

**5. Past Medical History:**

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

6. Current health status and life-style:

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

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

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

**TECHNIKON NATAL CHIROPRACTIC DAY CLINIC**

**PHYSICAL EXAMINATION**

Patient: \_\_\_\_\_ File#: \_\_\_\_\_ Date: \_\_\_\_\_  
 Clinician: \_\_\_\_\_ Signature: \_\_\_\_\_  
 Intern: \_\_\_\_\_ Signature: \_\_\_\_\_

**1. VITALS**

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

**2. GENERAL EXAMINATION**

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

Urinalysis: \_\_\_\_\_

**3. CARDIOVASCULAR EXAMINATION**

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

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

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



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

**Percussion:** - borders of heart

**Auscultation:**

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

#### 4. RESPIRATORY EXAMINATION

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

**Inspection**

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

**Palpation**

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

**Percussion**

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

**Auscultation**

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

#### 5. ABDOMINAL EXAMINATION

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

**Inspection**

- Shape:
- Scars:
- Hernias:

**Palpation**

- Superficial:
- Deep = Organomegally:

- Percussion** - Rebound tenderness:  
- Ascites:  
- Masses:

- Arteries (aortic, renal, iliac, femoral, hepatic)

## 6. G.U.T EXAMINATION

Discharges:

**Gait and Posture**

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

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

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

- Pupillary light reflexes      = Direct:
- = Consensual:
- Fundoscopy findings:
- III    Ocular Muscles:
- Eye opening strength:
- IV    Inferior and Medial movement of eye:
- V     a.      Sensory      - Ophthalmic:
- Maxillary:
- Mandibular:
- b.      Motor        - Masseter:
- Jaw lateral movement:
- c.      Reflexes     - Corneal reflex
- Jaw jerk
- VI    Lateral movement of eyes
- VII   a.      Motor - Raise eyebrows:
- Frown:
- Close eyes against resistance:
- Show teeth:
- Blow out cheeks:
- b.      Taste - Anterior two-thirds of tongue:
- VIII   General Hearing:
- Rinnes = L:            R:
- Webers lateralisation:
- Vestibular function - Nystagmus:
- Rombergs:
- Wallenbergs:
- Otoscope examination:
- IX &   Gag reflex:
- X      Uvula deviation:
- Speech quality:
- XI     Shoulder lift:
- S.C.M. strength:
- XII    Inspection of tongue (deviation):

### **Motor System:**

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

- Forearm = Supination & Pronation:
  - Fingers = Extension (Interphalangeals & M.C.P's):
  - Thumb = Opposition:
  - Hip = Flexion & Extension:
  - = Adduction & Abduction:
  - Knee = Flexion & Extension:
  - Foot = Dorsiflexion & Plantar flexion:
  - = Inversion & Eversion:
  - = Toe (Plantarflexion & Dorsiflexion):
- b. Tone
- Shoulder:
  - Elbow:
  - Wrist:
  - Lower limb - Int. & Ext. rotation:
  - Knee clonus:
  - ankle clonus:
- c. Reflexes
- Biceps:
  - Triceps:
  - Supinator:
  - Knee:
  - Ankle:
  - Abdominal:
  - Plantar:

### Sensory System:

- a. Dermatomes
- Light touch:
  - Crude touch:
  - Pain:
  - Temperature:
  - Two point discrimination:
- b. Joint position sense
- Finger:
  - Toe:
- c. Vibration:
- Big toe:
  - Tibial tuberosity:
  - ASIS:
  - Interphalangeal Joint:
  - Sternum:

### Cerebellar function:

Obvious signs of cerebellar dysfunction:

- = Intention Tremor:
- = Nystagmus:
- = Truncal Ataxia:

Finger-nose test (Dysmetria):

Rapid alternating movements (Dysdiadochokinesia):

Heel-shin test:

Heel-toe gait:

Reflexes:

Signs of Parkinsons:

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

Obvious Abnormalities:

Spinous Percussion:

R.O.M:

Other:

**9. BREAST EXAMINATION:**

Summon female chaperon.

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

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

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

PATIENT: \_\_\_\_\_

FILE #: \_\_\_\_\_ DATE: \_\_\_\_\_

INTERN/RESIDENT: \_\_\_\_\_

SUPERVISING CLINICIAN: \_\_\_\_\_

STANDING:

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

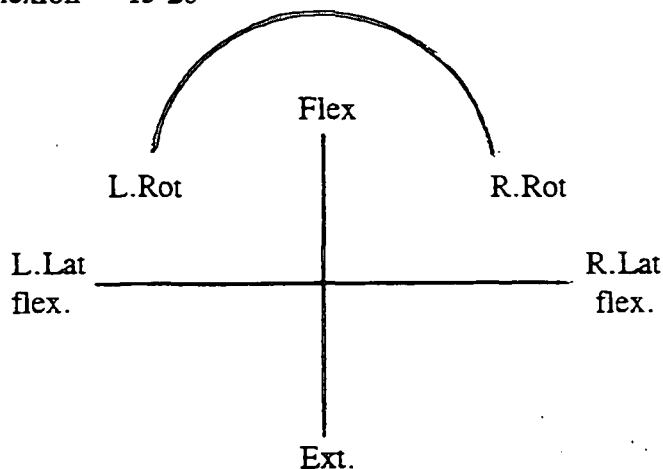
RANGE OF MOTION

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

Extension = 20-35°

L/R Rotation = 3-18°

L/R Lateral Flexion = 15-20°



SUPINE:

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

Pulses (extremities)

SLR

Bowstring

Plantar Reflex

Circumference (thigh, calf)

Leg Length:

actual

apparent

Sciatic Notch

Patrick FABERE

Gaenslen's Test

Gluteus Maximus Stretch

Hip Medial rotation

Psoas Test

Thomas' Test:

hip joint

Rectus Femoris

### LATERAL RECUMBENT

S-I Compression

Ober's Test

Femoral Nerve stretch

Myotomes:

QL

Gluteus Medius

### NON ORGANIC SIGNS

Pin Point Pain

Axial Compression

Trunk Rotation

Burn's Bench Test

Flip Test

Hoover's Test

Ankle Dorsiflexion Test.

### GAIT

Rhythm

On toes (standing)

On Heels (standing)

Half squat on one leg

### PRONE

Gluteal skyline

Skin rolling

Iliac crest compression

Facet joint challenge

S-I tenderness

Erichson's Test

Pheasant's Test

Myotome:

Glut. Max

Active MF Trigger Pts:

QL

Glut. Med

Glut. Min

Glut. Max

Piriformis

Hamstrings

TFL

## NEUROLOGICAL EXAMINATION

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

Tripod

Kemp's Test

### MOTION PALPATION and JOINT PLAY:

LEFT:      Upper Thoracics:  
              Lumbar Spine:  
              Sacroiliac Joint:

RIGHT:     Upper Thoracics:  
              Lumbar Spine:  
              Sacroiliac Joint:

#### **Basic Exam: Hip**

Case History:

ROM: Active:

Passive:

RIM:

Orthopaedic/Neuro/

Vascular:

Observ/Palpation:

#### **Basic Exam: Thoracic Spine**

Case History:

ROM: Motion Palp:

Active:

Passive:

Orthopaedic/Neuro/

Vascular:

Observ/Palpation:



## Numerical Rating Scale - 101 Questionnaire

Date: \_\_\_\_\_ File no: \_\_\_\_\_ Visit no: \_\_\_\_\_

Patient name: \_\_\_\_\_

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

Please write only **one** number.

\_\_\_\_\_

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

Please write only **one** number.

\_\_\_\_\_

# OSWESTRY BACK DISABILITY INDEX

## APPENDIX E

Patient Name: \_\_\_\_\_ File no: \_\_\_\_\_ Date \_\_\_\_\_

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

<p><b>Section 1 - Pain Intensity</b></p> <p><input type="checkbox"/> I have no pain at the moment.  <input type="checkbox"/> The pain is very mild at the moment.  <input type="checkbox"/> The pain is moderate at the moment.  <input type="checkbox"/> The pain is severe at the moment.  <input type="checkbox"/> The pain is the worst imaginable at the moment.</p>	<p><b>Section 6 - Standing</b></p> <p><input type="checkbox"/> I can stand as long as I want without extra pain.  <input type="checkbox"/> I can stand as long as I want, but it gives extra pain.  <input type="checkbox"/> Pain prevents me from standing for more than 1 hour.  <input type="checkbox"/> Pain prevents me from standing for more than ½ hour.  <input type="checkbox"/> Pain prevents me from standing for more than 10 minutes.  <input type="checkbox"/> Pain prevents me from standing at all.</p>
<p><b>Section 2 - Personal Care (Washing, Dressing ...)</b></p> <p><input type="checkbox"/> I can look after myself normally without causing extra pain.  <input type="checkbox"/> I can look after myself normally but it causes extra pain.  <input type="checkbox"/> It is painful to look after myself and I am slow and careful.  <input type="checkbox"/> I need some help but manage most of my personal care.  <input type="checkbox"/> I do not get dressed, I wash with difficulty and stay in bed.</p>	<p><b>Section 7 - Sex life</b></p> <p><input type="checkbox"/> My sex life is normal and causes no extra pain.  <input type="checkbox"/> My sex life is normal but causes extra pain.  <input type="checkbox"/> My sex life is nearly normal but it is very painful.  <input type="checkbox"/> My sex life is severely restricted.  <input type="checkbox"/> My sex life is absent because of pain.  <input type="checkbox"/> Pain prevents any sex life at all.</p>
<p><b>Section 3 - Lifting</b></p> <p><input type="checkbox"/> I can lift heavy weights without extra pain.  <input type="checkbox"/> I can lift heavy weights but it gives extra pain.  <input type="checkbox"/> Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.  <input type="checkbox"/> Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.  <input type="checkbox"/> I can lift only very light weights.  <input type="checkbox"/> I cannot lift or carry anything at all.</p>	<p><b>Section 8 - Social life</b></p> <p><input type="checkbox"/> My social life is normal and gives no extra pain.  <input type="checkbox"/> My social life is normal but increases the degree of pain.  <input type="checkbox"/> Pain has no significant effect on my social life apart from limiting my more energetic interests, for example dancing.  <input type="checkbox"/> Pain has restricted my social life and I do not go out as often.  <input type="checkbox"/> Pain has restricted my social life to my home.  <input type="checkbox"/> I have no social life because of pain.</p>
<p><b>Section 4 - Walking</b></p> <p><input type="checkbox"/> Pain does not prevent me walking any distance.  <input type="checkbox"/> Pain prevents me walking more than 1 mile (2.2km).  <input type="checkbox"/> Pain prevents me walking more than ½ mile (1.1km).  <input type="checkbox"/> Pain prevents me walking more than ¼ mile (0.5km).  <input type="checkbox"/> I can only walk using a stick or crutches.  <input type="checkbox"/> I am in bed most of the time and have to crawl to the toilet.</p>	<p><b>Section 9 - Sleeping</b></p> <p><input type="checkbox"/> I have no trouble sleeping.  <input type="checkbox"/> I can sleep well only by using pills.  <input type="checkbox"/> Even when I take pills I have less than 6 hours sleep.  <input type="checkbox"/> Even when I take pills I have less than 4 hours sleep.  <input type="checkbox"/> Even when I take pills I have less than 2 hours sleep.  <input type="checkbox"/> Pain prevents me from sleeping at all.</p>
<p><b>Section 5 - Sitting</b></p> <p><input type="checkbox"/> I can sit in any chair as long as I like.  <input type="checkbox"/> I can only sit in my favorite chair as long as I like.  <input type="checkbox"/> Pain prevents me sitting for more than 1 hour.  <input type="checkbox"/> Pain prevents me from sitting for more than ½ hour.  <input type="checkbox"/> Pain prevents me from sitting for more than 10 minutes.  <input type="checkbox"/> Pain prevents me from sitting at all.</p>	<p><b>Section 10 - Traveling</b></p> <p><input type="checkbox"/> I can travel anywhere without extra pain.  <input type="checkbox"/> I can travel anywhere but it gives extra pain.  <input type="checkbox"/> Pain is bad but I manage trips over 2 hours.  <input type="checkbox"/> Pain restricts me to trips less than 1 hour.  <input type="checkbox"/> Pain restricts me to trips under 30 minutes.  <input type="checkbox"/> Pain prevents me from traveling, except to the doctor and/or hospital.</p>

## ORTHOPAEDIC ASSESSMENT RATING

	TREATMENT 1	TREATMENT 2	TREATMENT 4
POSTERIOR SHEAR TEST (4)			
GAENSLER TEST (2)			
PATRICK FABER TEST (2)			
YEOMANS TEST (2)			
TOTAL OUT OF 10			

## LETTER OF INFORMATION

Mechanical low back pain is one of the most common and disabling musculoskeletal conditions and results in considerable suffering and cost. Despite modern technology, much controversy still exists as to the most efficient and cost effective treatment for this condition.

This research project will propose to determine the impact of chiropractic treatment on this condition and just how effective chiropractic manipulation combined with an additional treatment method is in alleviating the pain and associated symptoms of sacroiliac syndrome ( a common cause of mechanical low back pain) as compared to a placebo treatment.

In order to do this, we appeal to you for assistance by becoming actively involved and informing us about your symptoms and their degree of intensity as well as their affect on your daily life.

A number of questionnaires will be given to you and your honest and objective contribution will give us an opportunity to determine the effect of chiropractic manipulation combined with an additional treatment method for the treatment of sacroiliac syndrome.

The demand for successful, conservative treatment for this condition is quite evident and growing. With your help we can determine whether in fact this treatment method has a place in the medical arena for the management of sacroiliac syndrome and whether we should accept it or reject it as a form of treatment.

Thank you for the courtesy of your assistance.

Jacqui Paton.

## INFORMED CONSENT FORM

To be completed in duplicate by patient.

## TITLE OF RESEARCH

The relative effectiveness of spinal manipulation in conjunction with placebo of the gluteal musculature versus spinal manipulation in conjunction with proprioceptive neuromuscular facilitation of the gluteal musculature in the treatment of sacroiliac syndrome.

## NAME OF RESEARCH STUDENT

Jacqueline Paton

## NAME OF SUPERVISOR

Dr. C. Myburgh

## PLEASE CIRCLE THE APPROPRIATE ANSWER

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

If you have answered no to any of the above, please obtain the necessary clarification before signing.

## PATIENT

Name.....Signature.....

## WITNESS

Name.....Signature.....

## RESEARCHER

Name.....Signature .....