"A STUDY OF THE EFFECTIVENESS OF CHIROPRACTIC SPINAL MANIPULATION ON ITS OWN VERSUS CHIROPRACTIC SPINAL MANIPULATION COMBINED WITH OTHER TREATMENT MODALITIES USED IN A CHIROPRACTIC PRACTICE, IN THE MANAGEMENT OF MECHANICAL LOW BACK PAIN IN NURSES".

"Dissertation submitted to the Faculty of Health Services in partial compliance with the requirements for the Master's Diploma in Technology in the Department of Chiropractic at Technikon Natal".

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"I, Elda Kristina Urli, declare that this work is my own work, both in conception and execution".

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ABSTRACT

The efficacy of chiropractic spinal manipulation on its own versus chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice was evaluated in a single blind, randomised, controlled trial using a patient population of thirty nurses who were experiencing mechanical low back pain.

Only nurses with low back pain of a mechanical nature (as diagnosed using the Kirkaldy-Willis model of classification for mechanical low back pain) were accepted for purposes of this study, and the sample group was drawn from the nursing population of the greater Durban area. Nurses presenting with the same type of low back condition were grouped together, and were then randomly divided into the Experimental and Control group. Nurses in the Experimental group received chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice, whereas nurses in the Control group received chiropractic spinal manipulation on its own. The nurses in both groups received 10 treatments over an average period of 5 weeks.

Subjective measurements included the Numerical Pain Rating Scale which the nurses completed before treatment at each of the 10 visits; and the Oswestry Low Back Pain Disability Questionnaire which the nurses completed before treatment at the 1st, 5th and 10th visit. Objective measurements consisted of ranges of motion (in flexion, extension, and left & right lateral flexion) measured with the Autogon II goniometer before each treatment.

The mechanical low back conditions which were found to be prevalent within a small sample of the nursing profession were the Sacroiliac Syndrome (in 33,333 % of the nurses) and the Myofascial Dysfunction Syndrome of the Quadratus Lumborum (in 6,667 % of the nurses). Sixty percent of the nurses presented with a combination of both syndromes.

The results were analyzed using the Unpaired and Paired t-tests as well as the Mann Whitney U-test and Wilcoxon signed-rank test with the confidence level set at 95 %. The results (which were tabulated and plotted on graphs) showed that an overall statistically and clinically significant difference between the Experimental and Control group existed only for extension. This difference between the groups could possibly be attributed to the fact that nurses in the Control group did not receive as extensive a treatment as nurses in the Experimental group.

An overall statistically and clinically significant difference was noted within both the Experimental and the Control group, as the nurses in both groups demonstrated an improvement [in terms of reduced pain and disability, as well as increased range of motion (in flexion, extension, and left and right lateral flexion)] as the treatment progressed. These results indicated that both forms of chiropractic treatment were effective in the management of mechanical low back pain in a small sample of the nursing profession, with no overall significant difference evident between the two forms of treatment (except for range of motion in extension).

UITTREKSEL

Die doeltreffentheid van chiropraktiese laerugmanipulasie op sigself teenoor chiropraktiese laerugmanipulasie gepaard met ander behandelingsmodaliteite wat in 'n chiropraktiese praktyk gebruik word, is geëvalueer in 'n enkele statistiesgekontroleerde studie van dertig verpleegster pasiente wat aan meganiese laerugpyn lei.

Slegs verpleegsters met laerugpynsimptome van meganiese aard (soos gediagnoseer volgens die Kirkaldy-Willis model van klassifikasie vir meganiese laerugpyn) is gebruik vir die doel van hierdie navorsingsprojek. Die statistiese monstergroep is uit die verpleegstersamelewing van die Durbanse metropolitaanse gebied afkomstig.

Verpleegsters wat dieselfde simptoomverskynsels getoon het, is saam gegroepeer en onderverdeel in 'n eksperimentele en 'n beheer groep. Die verpleegsters in die eksperimentele groep het chiropraktiese laerugmanipulasie saam met ander behandelings-modaliteite wat in die chiropraktiese praktyk gebruik word ontvang, terwyl die verpleegsters in die beheergroep slegs chiropraktiese laerugmanipulasie ontvang het. Die verpleegsters in beide groepe het tien behandelings oor 'n gemiddelde tydperk van vyf weke ontvang.

Subjektiewe metings het die Numeriese Pyngraderingskaal (wat die verpleegsters voor behandeling by elk van die tien besoeke voltooi het), en die Oswestry Laerugpynstremmingsvraelys (wat deur die verpleegsters voor behandeling by die eerste, vyfde, en tiende besoek voltooi is) behels. Objektiewe metings het beweeging (in fleksie, ekstensie, en links & regs laterale fleksie) wat deur middel van die Autogon II goniometer voor behandeling by elk van die tien besoeke gemeet is, behels.

Die meganiese laerugtoestande wat meestal te vore gekom het binne 'n klein monster van die verpleegstersamelewing was die Sakroiliaksindroom (33,333 % van die verpleegsters), en die Miofasiale Sindroom van die Kwadratus Lumborum (6,667 % van die verpleegsters). Sestig persent van die verpleegsters het beide sindrome gemanifesteer.

Die uitslae is ontleed deur middel van die ongepaarde en gepaarde t-toetse, sowel as die Mann Whitney U-toets en die Wilcoxon signed-rank toets, met 'n 95 % betroubaarheidsindeks. Die uitslae is getabuleer en afgebaken op grafieke. Die syfers het getoon dat 'n algehele statistiese en kliniese beduidende verskil tussen die eksperimentele en die beheergroepe net vir ekstensie opgemerk was. Hierdie verskil tussen die groepe kon moontlik toegeskryf word aan die feit dat die verpleegsters in die beheergroep nie sulke ekstensiewe behandeling soos dit waaraan die verpleegsters in die eksperimentele groep onderworpe is nie.

'n Algehele statistiese en kliniese beduidende verskil was binne die eksperimentele sowel as die beheersgroep opgemerk want die verpleegsters in beide groepe het 'n verbetering getoon ten opsigte van afname in pyn en stremming, gepaard met toename in mobiliteit (in fleksie, ekstensie, en links & regs lateraal fleksie) met verloop van die behandeling. Die slotsom was dus dat beide van die behandelings wel doeltreffend was vir die genees van meganiese laerugpyn in 'n klein bevolking van die verpleegstersamelewing, met geen algehele verskil klaarblyklik tussen die twee tiepes behandeling (behalwe vir ekstensie).

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LIST OF ABBREVIATIONS

NPRS	Numerical Pain Rating Scale.
OLBPDQ	Oswestry Low Back Pain Disability Questionnaire.
flex.	flexion.
ext.	extension.
lat. flex.	lateral flexion.
Exp.	Experimental.
Con.	Control.
grp.	group.
T	Treatment.
No. of fav. diff.	Number of favourable differences.
SI syndrome	Sacroiliac syndrome.
MFPDS QL	Myofascial Pain and Dysfunction Syndrome of the Quadratus Lumborum.

CHAPTER 1

THE PROBLEM AND ITS SETTING

1.1. PROBLEM STATEMENT

This study proposed to evaluate the effectiveness of chiropractic spinal manipulation on its own as opposed to chiropractic spinal manipulation combined with other treatment modalities frequently used in a chiropractic practice in the management of mechanical low back pain conditions as experienced by nurses in terms of the diagnostic criteria specified by the Kirkaldy-Willis model in order to determine the prevalence of the different mechanical low back conditions within the sample and to ascertain which of the above-mentioned treatment regimes was the more beneficial in the management of mechanical low back pain in the nursing profession.

1.2. SUBPROBLEMS

1.2.1. Subproblem 1

The first subproblem was to analyse the different mechanical low back pain conditions in this sample of the nursing profession in terms of the Kirkaldy-Willis model in order to determine the prevalence of these mechanical low back conditions and to formulate an appropriate chiropractic management programme for each.

1.2.2. Subproblem 2

The second subproblem was to evaluate the effectiveness of chiropractic spinal manipulation on its own in terms of the nurses' subjective and objective response to treatment in order to determine the extent to which this form of treatment was beneficial in the management of mechanical low back pain in a sample of nurses.

1.2.3. Subproblem 3

The third subproblem was to evaluate the effectiveness of chiropractic spinal manipulation combined with other treatment modalities frequently used in a chiropractic practice in terms of subjective and objective clinical findings in order to determine the extent to which this form of treatment was beneficial in the management of mechanical low back pain in a sample of nurses.

1.2.4. Subproblem 4

The fourth subproblem concerned itself with the integration of the data arising from the previous subproblems in order to determine which of the above-mentioned treatment regimes was the more beneficial, in terms of patient response to treatment, in the management of mechanical low back pain in a sample of the nursing profession.

1.3. HYPOTHESES

1.3.1. Hypothesis 1

It was hypothesised that nurses experience mechanical low back pain in its various forms and that by analysing these forms it was possible to identify those elements necessary for the formulation of a suitable chiropractic management programme.

1.3.2. Hypothesis 2

The second hypothesis was that chiropractic spinal manipulation on its own would be beneficial in the management of mechanical low back pain in nurses.

1.3.3. Hypothesis 3

The third hypothesis was that chiropractic spinal manipulation combined with other treatment modalities frequently used in a chiropractic practice would be beneficial in the management of mechanical low back pain in nurses.

1.3.4. Hypothesis 4

Lastly, it was hypothesised that the two forms of chiropractic treatment would be beneficial to varying degrees in the management of mechanical low back pain in nurses, in that chiropractic spinal manipulation combined with other treatment modalities frequently used in a chiropractic practice would be more effective than chiropractic spinal manipulation alone.

1.4. DELIMITATIONS

a) The study of mechanical low back pain would be limited to the nursing profession in the greater Durban area only.

b) Low back pain attributable to causes other than those of a mechanical nature would be excluded from the study. Low back pain due to visceral, vascular, or neoplastic pathologies, for example, would not be considered.

c) Only the treatment modalities utilized by the chiropractic profession would be used in the management of mechanical low back pain.

d) The classification of mechanical low back pain would be limited to the Kirkaldy-Willis model.

e) Nurses who had undergone spinal surgery would be excluded from the study.

f) Nurses presenting with a concurrent systemic disease which had a direct effect on their mechanical low back pain, or who contracted such a disease during the course of this study would automatically be excluded from the study.

g) Only nurses whose current duties involved patient management as opposed to administrative duties would be considered.

1.5. ASSUMPTIONS

a) It was assumed that nurses experience mechanical low back pain as a result of the type of work that they perform.

b) It was assumed that the Kirkaldy-Willis model is, for the chiropractor, the most appropriate classification for the understanding and management of mechanical low back pain.

c) It was assumed that the nursing profession would be co-operative in the course of this study.

1.6. DEFINING THE TERMS

Mechanical low back pain results from the inherent susceptibility of the lumbar spine to static loads due to muscle and gravity forces and to kinetic deviations from normal function.

Spinal manipulation is the principal therapeutic procedure employed by chiropractors for the management of low back pain therefore spinal manipulation will be defined :

"For chiropractors, manipulative therapy is the art of restoring a full and pain-free range of motion to joints" (Curtis and Bove, 1992).

The Quebec Task Force on Spinal Disorders (QTFSD) defines manipulation as the "abrupt high-velocity and short-amplitude passive movement of a vertebra beyond its physiological range but within its anatomic range" (McKenzie, 1989).

Cassidy and Kirkaldy-Willis (1988) define manipulation as a "passive manoeuvre during which the three-joint complex is suddenly carried beyond the normal physiological range of movement without exceeding the boundaries of anatomical integrity. The usual characteristic is a thrust - a brief, sudden, and carefully administered 'impulsion' that is given at the end of the normal passive range of movement. It is usually accompanied by a cracking noise".

Motion palpation is a palpatory diagnostic procedure performed on osseous structures in motion in order to determine if motion dysfunction exists.

Kirkaldy-Willis model = a classification for mechanical low back pain.

NOTE: Only the diagnostic criteria for the low back conditions found in the nurses who participated in this study will be defined and elaborated upon further in the review of the related literature (Chapter 2). The various possible spinal conditions referred to are :

- posterior facet syndrome
- sacroiliac syndrome
- Maigne's syndrome
- disc herniation
- facet and disc degeneration
- lateral stenosis
- central stenosis
- multilevel stenosis
- myofascial syndrome : gluteus maximus
  gluteus medius
  gluteus minimus
  quadratus lumborum
  piriformis
  tensor fascia latae
  hamstring

1.7. IMPORTANCE OF THE STUDY

1.7.1. Immediate background of the problem

It is generally accepted that between 60 % and 80 % of the general population will suffer from low back pain someday, and that between 20 % and 30 % are suffering from it at any given time (Kirkaldy-Willis, 1988).

Nurses have one of the highest prevalences of mechanical low back pain and this is probably attributable to the duties that they perform, such as lifting heavy patients onto beds. (Gates, 1988). This could interfere with their ability to carry out their duties, affect their attitude towards patients and colleagues, and result in increased absenteeism.

1.7.2. The need for a solution to the problem

The nursing profession might not be fully aware of what chiropractic treatment has to offer in terms of the management of mechanical low back pain in relationship to other forms of care, thus education of the nursing profession concerning the extent to which chiropractic treatment can be beneficial is necessary. It is also important to determine the response of this group (which has a high prevalence of low back pain in comparison to the general population) to chiropractic care.

Chiropractic spinal manipulation combined with other treatment modalities frequently used in a chiropractic practice needs to be compared to chiropractic spinal manipulation on its own in order to determine which of the two chiropractic treatments is more effective in the management of mechanical low back pain in the nursing profession, and the extent to which it is more beneficial. This information will enable future chiropractors to manage mechanical low back pain conditions more efficiently.

1.7.3. Description of the solution

The sample size would be limited to a minimum of 30 nurses who, after giving their informed consent, would each undergo an initial consultation which would include the following:

-Case History.
-General physical examination.
-Low back regional examination including orthopaedic, neurological, motion palpation and possibly radiological examinations (if clinically indicated).
-Diagnosis of the mechanical low back pain condition which would be made according to the Kirkaldy-Willis model.

Nurses presenting with the same type of mechanical low back condition would be grouped together and then divided into two treatment groups: the Experimental group (receiving chiropractic spinal manipulation combined with other treatment modalities frequently used in a chiropractic practice such as: soft tissue therapy, myofascial trigger point therapy, electrotherapy, ice, and McManis traction) and the Control group (receiving chiropractic spinal manipulation on its own).

Each nurse would receive 10 treatments during which case progression in both treatment groups would be assessed subjectively i.e. from the nurse's perspective (in terms of reduced pain and disability), and objectively in the form of clinical findings (e.g. lumbar spine range of motion in flexion, extension, left & right lateral flexion; motion palpation; & orthopaedic and neurological examinations).

The nurses would complete the Oswestry Low Back Pain Disability Questionnaire before treatment at the 1st, 5th and 10th visit; and the Numerical Pain Rating Scale before treatment at each of the 10 visits. Lumbar spine ranges of motion would be measured (using a goniometer) by the researcher before treatment at each of the 10 visits.

By assessing subject response to chiropractic treatment in both the Experimental and Control group, in terms of improvement (or deterioration), it could be ascertained to what extent each form of chiropractic treatment was beneficial in the management of mechanical low back pain in the nursing profession. The efficacy of the two types of chiropractic treatment could thus be compared.

1.7.4. Benefits that will arise from solving the problem

Nurses perform an essential role in the health care team of any nation. Should they themselves suffer from disability due to mechanical low back pain, such could well interfere with the quality and quantity of service that they offer to persons under their care. If so, chiropractic could play a significant role in the more rapid return to health of an even wider spectrum of people than the nurses themselves.

By comparing the results of the two forms of chiropractic treatment, the more effective form of chiropractic treatment for mechanical low back pain can be determined. It is important to disseminate such information to the chiropractic profession, and if chiropractic is shown to be beneficial in the management of mechanical low back pain in nurses, the nursing profession should be informed thereof so that a better understanding between the two professions can develop.

1.7.5. Feasibility of the solution

The solution would be feasible in that chiropractic treatment as a whole had already been shown to be beneficial in the management of most forms of mechanical low back pain (Waagen et al, 1986). Contact with and the co-operation of nursing staff for the purpose of this study would be possible. Treatment would be free, hopefully increasing compliance, and the study would entail minimal costs. Ethical considerations included the customary exposure to x-ray radiation which was necessary to detect any pathologies that would contra-indicate spinal manipulation. The nurses were required to sign the informed consent form after the purpose of the study was explained to them and confidentiality was ensured.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

2.0. Mechanical low back conditions found in the nurses of this study

The mechanical low back conditions which were found in the nurses who participated in this study were the sacroiliac syndrome and the quadratus lumborum myofascial syndrome, therefore only these two syndromes will be elaborated upon further according to the Kirkaldy-Willis model of classification for mechanical low back pain.

2.1. Sacroiliac syndrome:

According to Kirkaldy-Willis (1988: 75), the sacroiliac joint is often incriminated in more than one fifth of the cases of low back pain.

The syndrome presents with pain over one sacroiliac joint in the region of the posterior superior iliac spine that varies in its degree of severity, and this may be accompanied by referred pain in the buttocks, groin, over the greater trochanter, down the back of the thigh to the knee, and occasionally, down the lateral or posterior calf to ankle, foot and toes (Kirkaldy-Willis 1988: 135).

Kirkaldy-Willis (1988: 210) states that the pain pattern of the sacroiliac syndrome is similar to that of posterior facet syndrome and may mimic radicular pain from a herniated nucleus pulposus or lateral spinal stenosis. Furthermore, the lack of nerve root tension signs and absence of motor, reflex, or sensory deficits helps to distinguish sacroiliac joint syndrome from nerve root compression lesions.

According to Kirkaldy-Willis (1988: 135, 210), the signs include tenderness on pressure over the posterior superior iliac spine, in the region of the sacroiliac joint, or in the buttock, and movement of the joint is usually reduced. He goes on to say that minor dysfunction in the sacroiliac joint leads to pain, however pain can also result from sustained contraction of the muscles overlying the joint. He concludes that the diagnosis is confirmed when manipulation to the sacroiliac joint effectively breaks the cycle of pain.

Furthermore, Kirkaldy-Willis (1988: 253) states that the response to treatment is as well defined as the clinical syndrome, the patient nearly always has reduced movement of the sacroiliac joint as well as pain, and manipulation is by far the most certain way of relieving this pain (by reducing hypertonicity in the posterior muscles that maintain the joint in a state of fixation) and restoring the joint movement (by shifting the ilium 1 to 2 mm on the sacrum).

In conclusion, "The sacroiliac syndrome is a well-defined syndrome, and the physician who is cognizant of it and who looks for it will find that it is a commonly seen type of dysfunction" (Kirkaldy-Willis 1988: 137). The presentation is rarely acute and nearly always subacute or chronic, and the symptom complex is well-defined even though the exact pathological nature of the lesion is obscure (Kirkaldy-Willis 1988: 253).

2.2. Myofascial syndrome:

Kirkaldy-Willis (1988: 51, 210, 138, 139) states the following regarding the myofascial syndrome: "The trigger point zone is a region of increased metabolism and/or decreased circulation ... vasoconstriction occurs in trigger point zones in muscle; emotional disturbance acts through the autonomic nervous system to produce local areas of vasoconstriction in muscle; palpation of the trigger point in the symptomatic muscle usually reproduces familiar pain ... and local tenderness in an area characteristic for each muscle, and frequently stimulates referred pain in a distribution specific for each muscle; the affected area of muscle, which may appear to be contracted or in spasm, has an increased muscle tone which produces a ropey consistency to palpation when compared to the unaffected contralateral muscle; and the diagnosis is confirmed by the physical findings and response to treatment by either passive stretching or needling of the trigger point".

Travell and Simons (1992 2: 29, 38) state the following facts regarding the myofascial syndrome of the **quadratus lumborum** muscle: "The quadratus lumborum is one of the most commonly overlooked muscular sources of low back pain; the pain referred from quadratus lumborum trigger points is a persistent deep ache at rest, but may be lancinating during movement; the pain is often severe in any body position but excruciating in the unsupported upright position and in sitting or standing ... ; minimal movement of the lower torso may precipitate a burst of sharp pain with a knifelike cutting quality; and the severity of the pain from quadratus lumborum trigger points may be totally immobilizing, and its persistence emotionally depressing".

They go on to say that trigger points in the cephalad superficial location of the quadratus lumborum refer pain along the crest of the ilium and sometimes to the adjacent lower quadrant of the abdomen, and the pain may extend to the outer upper aspect of the groin. Furthermore, the more caudal superficial trigger points refer pain to the outer aspect of the upper thigh and to the greater trochanter (which can be so tender to pressure that the patient cannot tolerate lying on that side), and pain may prevent weight-bearing by the lower limb on the involved side (Travell and Simons (1992 2: 29).

Travell and Simons (1992 2: 29-31, 38) continue by stating that the more cephalad of the deep trigger points of the quadratus lumborum refer pain strongly to the sacroiliac joint area, and bilaterally these trigger points frequently refer pain that extends across the upper sacral region. Furthermore, the caudal deep trigger points refer pain to the lower buttock. They report that these pain reference zones also exhibit referred tenderness especially in the SI joint area and over the greater trochanter. They mention that a few patients have described a lightning bolt (or jolt) of pain referred from deep quadratus lumborum trigger points to the front of the thigh extending from the anterior superior iliac spine to the lateral side of the upper part of the patella in a narrow band about the width of a finger, and that vigorous contraction of the muscle to stabilize the rib cage during coughing or sneezing can cause brief but overwhelmingly severe referred pain. In addition, the quadratus lumborum muscle is a source of lumbago, backache, and lumbar myalgia. They report additional areas of pain referral from the quadratus lumborum which include a sciatic distribution, the hip, the testicle and scrotum. The authors state that the trigger points in the quadratus lumborum restrict forward bending, patients describe difficulty in turning or leaning to the opposite side, they find climbing stairs and rolling onto either side from the supine position painful and difficult, and they may be forced to creep on hands and knees to the bathroom on awakening.

Travell and Simons (1992 2: 38) conclude by stating that coughing or sneezing can be agonizing for the patient, and rising from the supine position or getting up out of a chair may be difficult or impossible without help from the upper limbs. They mention that patients have also reported heaviness of the hips, cramping of the calves, and burning sensations in the legs and feet. Furthermore, a loss of vitality and endurance is experienced because of the energy required to suppress the pain consciously and subconsciously and remain active in spite of it.

2.3. Low back pain: Introduction

According to Manga et al (1993), low back pain is ubiquitous, and there are numerous epidemiological and related statistical studies documenting its very high incidence and prevalence. They state that disability caused by low back pain has increased dramatically over the past two decades, and health economists have shown that low back pain is amongst the most costly of health problems as it accounts for the single largest percentage of workers' compensation benefit payments for illness and injury.

According to Kirkaldy-Willis (1988: 4) and Harris and Brigham (1990), it is generally accepted that between 60 % and 80 % of the general population will suffer from low back pain someday, and that between 20 % and 30 % are suffering from it at any given time, making it a pervasive medical, social and economic problem. Low back pain is most common between the ages of 25 and 55 (Harris and Brigham, 1990).

According to Gates (1988), back-related injuries are epidemic, with backaches representing 40 % of all recorded workplace absences (being second only to the common cold as the reason for missed work). Waddell (1993) declares that in the UK it is "the second most common cause of physical disability after cardiovascular disease. Moreover, it is increasing faster than any other form of chronic disability... we are now facing an epidemic of lower back disability in all Western societies".

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

Eighty percent of the adult population will have a significant backache during their working life, and 40 % of all time lost claims occur among nursing personnel (Gates, 1988). Griffiths (1988) states that back pain is a major public health problem, with nurses and other health care workers being at especial risk.

Lunn and Waldron (1991) comment about back pain which is statistically shown to be a common problem, particularly amongst nursing staff. They state that even though back pain is not peculiar to nursing staff, they are the group amongst whom it seems most common, and because they are numerically the largest section of health care workers, more nurses with bad backs are seen than anyone else.

Videman (1989) reports that back injuries and back pain are major sources of incapacity and ill-health retirement from the nursing profession, and are attributed to the need to lift, carry, and support patients. He states that the prevalence of back pain and the incidence of back injuries have been shown to be high in the nurses of more than one country, and are higher in nurses than in teachers for example, with newly qualified nurses or those in training at particular risk.

2.4. Studies documenting the incidence and prevalence of back pain in nurses

According to Hubley-Kozey et al (1985), a study of a Nova Scotia teaching hospital reported an incidence rate for low back pain of 18 % for nurses, compared with a total hospital population incidence of 10 % .

According to Harris and Brigham (1990), many occupational elements have a bearing on the prevalence of low back pain (including activities such as lifting, carrying, pulling, pushing and twisting), thus any job with a greater occurrence of these activities is more likely to have a higher incidence of low back pain.

Cust et al (1972) found a low back pain prevalence among female nurses of 34.6 % . Nurses perform many of the occupational tasks listed above, and several analyses suggest that nursing is one of the most hazardous professions for low back pain outcomes [Statistics Canada, 1991; Ontario Workers' Compensation, 1991; Garrett et al, 1992; Wilkinson et al, 1992 (cited in the Manga report, 1993)].

A study by Griffiths (1988) showed the following: 69.3 % of nurses complained of a pain in the back; in 78 % of these nurses this pain started while they were working as a nurse and did not exist prior to entry to nursing school; the nurses were asked to state which task they undertook at work that caused the most problems to their back, and they cited lifting or moving patients as the main obstacle; the nurses felt that patient handling was the factor most relevant to the development of their back pain; and nurses that were too tall or too short were 28 % more likely to experience back pain.

Gates (1988) described a study of more than 500 staff nurses which showed that 52 % of the nurses interviewed had experienced work-related back pain that lasted longer than 14 days; and of the 52 % of nurses with reported back problems, 83 % were under 30 years old, and 9 % had lost time from work. He also stated that nursing is clearly a high risk occupation and nurses who lift are at five times the risk for low back pain and injury as nurses with jobs that require less lifting.

Lunn and Waldron (1991) commented that nurses were required to undertake manual handling tasks of a magnitude which no other section of the working population would tolerate.

They stated that these tasks included lifting patients up and down beds, in and out of beds, into and out of chairs, to and from the ward toilets, in and out of baths and onto and off toilets. They concluded that the ergonomics of the work was appalling and lifting aids were seldom if ever available.

Harber et al (1985) mentioned three activities which appeared to be responsible for the majority of reported back pain in nurses and these were: 1) lifting the patient in bed, 2) helping the patient get out of bed & 3) moving a bed.

According to Klaber Moffett et al (1993), three-quarters of a million working days each year are lost in nursing owing to back pain and one in six of these is caused by patient-handling incidents. Their longitudinal study looked at the incidence of back pain in 376 female student nurses, aged between 18 and 22, from Oxford and London over an 18 to 30 month period. The results of their study were as follows: 64 % of nurses reported low back pain, lasting one day or more, and back pain accounted for 50 % of all reports of pain; the prevalence of back pain was at its highest between nine and twelve months into training and 81 % of nurses reported their first episode of low back pain in the first 12 months; during the 20 months follow-up, 1913 sick-days were recorded and of these 118 were due to back pain;

37 of the 45 nurses who had to take sick leave due to back pain said that at least one episode of pain had been caused by heavy lifting or strain at work; those working in geriatric wards described their work as being largely heavy, physical and involving a lot of bending and lifting and 14 new incidents of low back pain lasting at least 3 days were linked with these wards; in comparison, only 6 new incidents were reported in connection with working in ENT, psychiatric, gynaecological and obstetric wards.

Therefore in the light of their findings, Klaber Moffett et al (1993) suggested that the programme of training for lifting and handling should be modified to take account of the fact that student nurses are most at risk of injuring their backs between 9 and 12 months into training.

2.5. Major predictors of back injury among nurses

According to Gates (1988), job-related tasks involving repetitive lifting and previously reported back injury are among the major predictors of back injury among nurses.

2.5.1. Lifting:

Gates (1988) stated that nurses identified poor lifting techniques as a major cause of injury; and that lifting with outstretched arms, not getting close enough to the patient being moved, twisting at the waist during the lift and lifting without assistance were the most frequently cited reasons for back injury. Furthemore, he stated that a sedentary lifestyle, cigarette smoking, emotional stress, poor posture and obesity increased the chances of pain.

2.5.2. Back injury:

Videman (1989) suggested that the most common type of back injury to a nurse was one in which the first unforeseen event was back pain (not caused by trauma): a typical non-accidental injury to the back without any disruption of the normal pattern of work before the onset of pain. He stated that such injuries appeared to arise from a combination of postural stress and overload, unless a preexisting susceptibility to injury was already present. Furthermore, nurses' backs were also commonly injured when patients fell, and since there was a truly accidental component in these cases, a direct trauma was more likely.

However, he concluded that the distinction between the truly accidental and the non-accidental back injury had never been formally applied to studies of injuries to nurses.

2.5.3. Other factors that need consideration:

According to Gates (1988), 90 % of back pain is related to muscle inadequacy resulting from weak muscle groups lacking flexibility. He states that sedentary lifestyles coupled with poor posture, stress and poor eating habits contribute to the deterioration and weakening of the supportive structures of the spine.

According to Klaber Moffett et al (1993), back pain has been linked to anthropometric measures (such as height and weight), the strength and endurance of the oblique abdominals and spinal extensors, and short hamstring muscles (which may also predispose an individual to back pain). Results of their study (which supported the hypothesis that certain attitudes to pain may predispose an individual to back pain) showed that those nurses who felt they were in control of their health tended to suffer less from minor back pain, but this factor was not found to be predictive of more serious pain.

Manga et al (1993) cited Bigos who reported improper lifting as a cause of back injury. They stated, however, that the more recent view places more emphasis on the total psycho-social life situation and its effect in reinforcing or diminishing the perception of pain (thus cognitive, emotional and motivational aspects of psychologic functioning are all essential when considering the causes of back injury). Furthermore, they stated that psychosocial stress at work may also be of significance to pain perception. They concluded that behavioural and cognitive methods have therefore been successful in the treatment of chronic back pain.

It was suggested by Curtis and Bove (1992), that back pain "provides a classic example of the biopsychosocial model of illness in which social and psychologic factors play major roles in pain control, disability, and rehabilitation. Yet the tools commonly used by family physicians to treat back pain tend to be those of biomedicine and referral rather than behavioral and direct manual therapy, and this may explain why patients are more satisfied with care from chiropractors, who are much more focused on musculoskeletal problems and the context in which they occur".

Waddell (1987) states that other reasons for medical frustration with back pain have been given in the United Kingdom: "Modern medicine can successfully treat many serious spinal diseases and persisting nerve compression but has completely failed to cure the vast majority of patients with simple low back pain; over-emphasis of pain alone, over-dependence on a nominal diagnosis of disc prolapse, and over-prescription of rest may indeed be a major cause of iatrogenic disability".

2.6. Implications of back pain in the nursing profession

According to Lunn and Waldron (1991), back pain has important consequences for both the nurse and the employer: for the student nurse it may mean days or weeks of discomfort, time lost from work (which if prolonged may result in the postponement of qualification), and in severe cases it may be necessary for the nurse to leave the profession; for the employer the result of back pain amongst the nursing staff means disruption of the wards and clinics and a considerable financial penalty because of the need to employ agency staff to cover for staff who are absent and because of potentially large awards which may have to be paid by way of compensation to those who are forced to leave the profession.

2.7. Chiropractic management of mechanical low back pain (evidence for and against)

2.7.1. Evidence for:

The first true controlled efficacy study of chiropractic therapy for low back pain was conducted by Waagen et al (1986). The authors stated that prior to this study "'any efficacy of chiropractic therapy can only be inferred from the studies of manipulative therapy for the treatment of low back pain which have been performed utilizing medical, osteopathic or physiotherapy-trained practitioners of manipulation". However, because chiropractors specialize in the delivery of specific spinal adjustments and receive a longer period of formal training than other manipulators, the authors of this study believed that it was not possible to extrapolate the results of previous trials in manipulative therapy directly to chiropractic.

Cassidy et al (1985) stated that considerable skill and expertise is required to perform manipulation for low back pain. "The treatment of back pain by spinal manipulation is not a simple matter. It is an art that requires considerable experience and dexterity".

"Manipulation requires much practice to acquire the necessary skills and competence. It is a fulltime vocation: few medical practitioners have the time or inclination to study it" (Kirkaldy-Willis and Cassidy, 1985).

A review of educational programs suggests that chiropractors are not only the practitioners best qualified to perform spinal manipulation, but they are also the only ones who generally receive adequate training to do so (Manga et al, 1993).

Results of the study conducted by Waagen et al (1986) showed that the experimental patients had significantly more relief from pain than control patients immediately after the first treatment and after two weeks of treatment. Experimental patients also showed significantly better improvement on the objective measurements of spinal mobility than the control patients. Therefore, on the first occasion that chiropractic manipulation was assessed by formal trial, it was found both subjectively and objectively to be effective at relieving low back pain when measured against a manual placebo treatment. A major limitation of this study was the small sample size.

In a Canadian study undertaken by a specialist in orthopaedics, Kirkaldy-Willis, and a chiropractor, Cassidy, 283 patients with chronic low back and leg pain were treated by spinal manipulation for 2 or 3 weeks (Kirkaldy-Willis and Cassidy, 1985). Results showed that 81 % of the patients with referred pain improved markedly and had no pain, or mild intermittent pain and no restriction for work or other activities; and 48 % of patients with nerve compression experienced a similar marked improvement in their condition.

Assendelft et al (1992) undertook a review which focused on randomized controlled trials in which chiropractors were the therapists providing manipulation. As such, the specific objective of this medical review was to assess the efficacy of chiropractic for patients with low back pain. In all, five chiropractic trials were identified, and the authors stated that "no similarity to chiropractic standards could be detected in any of the non-chiropractic trials". The authors concluded that, even though there were relatively few chiropractic trials on low back pain and these trials had varied methodological quality, chiropractic seemed to be an effective treatment of back pain. They also concluded that more studies with a better research methodology are definitely needed, and at least five studies in progress on chiropractic trials on low back pain were identified.

Manga et al (1993) make reference to New Zealand because of the Report of the Commission of Inquiry into Chiropractic in 1979. This inquiry was the most comprehensive and detailed independent examination of chiropractic ever undertaken in any country. The Commission's findings were very supportive of chiropractic, declaring it safe and effective for musculoskeletal spinal disorders, including low back pain, and several other conditions. The Commission found that no other health professional was as well qualified to carry out a diagnosis for spinal dysfunction or to perform manipulation therapy. This inquiry found chiropractic care to be cost-effective and recommended government funding for chiropractic services (Manga et al, 1993).

2.7.2. Evidence against:

The place of manipulation in back pain has been reviewed by Jayson (1986), who concluded that any minor benefits seemed to be confined to those with acute pain of recent onset, that there was no evidence that manipulation helped those with severe or chronic back problems, and that it did not reduce long term complications or prevent recurrences.

In a Canadian study, Godfrey et al (1984) conducted a randomized controlled clinical trial of manipulation in which a total of 81 patients, with back pain of less than 14 days duration, participated. Upon entry into the study, patients were randomized into one of four groups: manipulation and soft-tissue massage alone, manipulation and placebo electro-stimulation, massage alone (control), or electro-stimulation alone (control). The manipulation (which consisted of a brisk rotational thrust in the direction away from the greatest restriction) was performed by a physician and a chiropractor, after agreeing on a standardized technique. The efficacy of the various treatments were measured on scales quantifying symptoms, activities of daily life, mobility, tenderness to palpation, aggravation of pain by coughing or sneezing, limitation of motion on testing, and forward flexion. Patients were assessed at the beginning of the trial and again after a maximum of five treatments for these outcomes.

The results of the study by Godfrey et al (1984) showed that both treated and control patients improved rapidly in the two to three week observation period. However, there was no statistically significant difference between the improvement scores of the two on any of the scales. The authors concluded that "manipulation in a population with acute low back pain without any specific organic cause is not clearly superior to two physiotherapeutic manoeuvres that we considered unlikely to have any effect".

Koes et al (1991) reviewed 35 randomized clinical trials comparing spinal manipulation with other treatments. In addition to analyzing the efficacy of spinal manipulation as a treatment, the authors also examined the quality of methods used in these trials. Most of the trials that they analyzed were found to have been of poor quality, and although there were many randomized clinical trials of manipulation, most showed major methodological flaws. This review indicated that manipulation is not consistently better than other therapies. The authors concluded that "although there are some promising results, so far the efficacy of manipulation has not been convincingly shown. Any further research should pay more attention to the methodological quality of the study design".

2.8. Chiropractic versus medical management of mechanical low back pain

The Medical Research Council study was published in the British Medical Journal in 1990 (Meade et al, 1990). The study was a prospective randomized controlled trial in which 741 patients aged 18 - 65 were randomly assigned to chiropractic and hospital outpatient clinics in 11 centres. The characteristics of patients under hospital outpatient care and chiropractic care were very similar. The treatment alternatives were discretionary but chiropractors used manipulation on virtually all patients and the hospital staff (usually physiotherapists) used mostly Maitland mobilization or manipulation or both. Patients were tracked for two years. The principal outcome measures were changes in the score on the Oswestry Pain Disability Questionnaire and in the results of tests of straight leg raising and lumbar flexion. Outcome measures were taken at recruitment, weekly intervals for six weeks, at six months, and then at one and two years after entry.

The results of this randomized clinical trial were as follows:

(a) chiropractic care confers significantly long-term benefit in comparison with hospital outpatient treatment;

(b) the advantages of chiropractic management starts soon after treatment begins;

(c) the effects of chiropractic treatment is long-term whereas for those treated by hospital staff the benefits deteriorate after six months or a year;

(d) the longer term benefits of chiropractic care are not due to further chiropractic treatment since between year one and year two only 17 % of those initially treated by chiropractors had further chiropractic care, while 24 % of the hospital group had further hospital treatment;

(e) the benefit is seen mainly in those patients with chronic or severe low back pain.

Meade's study (1990) showed that for patients with low back pain in whom manipulation was not contraindicated, chiropractic almost certainly confered worthwhile long-term benefit in comparison with hospital outpatient management, and the benefit was seen mainly in those with chronic or severe low back pain.

The above study showed the following: the changes in Oswestry disability scores for those patients treated by chiropractic was consistently greater than that for those treated in hospital; at two years the patients treated by chiropractic had improved by 7 % more than those treated in hospital; the change in straight leg raising and lumbar flexion was greater in those treated by chiropractic than those treated in hospital, and patients treated by chiropractors did better than those treated in hospital for nearly all other subsidiary measures; patients treated by chiropractors were not only no worse off than those treated in hospital but almost certainly fared considerably better and maintained their improvement for at least two years; and finally, chiropractic was particularly effective in those with fairly intractable pain - that is, those with a history of severe pain.

According to Meade's study there is economic support for the use of chiropractic in the management of low back pain, though the obvious clinical improvement in pain and disability attributable to chiropractic treatment is in itself an adequate reason for considering the use of chiropractic.

Meade restated the conclusions of this study in a Canadian Broadcasting Corporation radio interview in October 1990:
"Our trial showed that chiropractic is a very effective treatment, more effective than conventional hospital out-patient treatment for low back pain, particularly in patients who had back pain in the past and who got severe problems. So, in other words, it is most effective in precisely the group of patients that you would like to be able to treat ... The improvements in the patients who were treated by chiropractors was between three quarters and twice as great as it was for patients who had been treated in hospital ... and one of the unexpected findings was that the treatment difference - the benefit of chiropractic over hospital treatment - actually persists for the whole of that three year period ... it looks as though the treatment that the chiropractors give does something that results in a very long-term benefit".

There were the inevitable commentaries on the clinical trial both positive and critical. The criticisms were largely minor and included: (a) alleged restraints on busy hospital physiotherapists; (b) limiting the comparison to physiotherapists; (c) some back pain disappears spontaneously; (d) the adequacy of the Oswestry Scale as an outcome measure; and (e) variables other than treatment modalities may have affected outcomes.

These criticisms are relatively easily rebutted and none seriously challenges the principal findings of the trial. Medical reviewers have proclaimed the trial (which is the longest and largest clinical trial of chiropractic effectiveness to date) "to be one of the better trials in this field" (Assendelft, 1991).

In a new trial in the U.S.A., Waagen et al (publication pending) compared medical and chiropractic management of patients with low back pain by randomly assigning 68 patients with chronic or repetitive low back pain to one of three groups: general medical care, chiropractic manipulative therapy, and sham manipulation. Assessment of treatment was by functional questionnaire and by visual analog scale at three months, with follow-up at one and two years after cessation of the treatment. Patients assigned to the active care groups, both medical and chiropractic, improved more than those in the control group (sham manipulation). However, the improvement was statistically significant only for those in the chiropractic group, and this improvement was seen both initially and on long-term follow-up (Manga et al, 1993).

Rupert et al (1985) conducted a randomized controlled trial to evaluate the efficacy of chiropractic adjustments in the treatment of low back pain among Egyptian workers. Three treatments were compared in this trial: chiropractic adjustments (given by two experienced chiropractors); drugs and bed-rest (given by a team of medical orthopaedic specialists); and placebo (sham manipulation comprising non-therapeutic massage). In total, 148 preselected patients were randomly allocated into each of these treatment groups. Results of this trial showed that pain relief resulting from chiropractic adjustments was greater than that resulting from the other two treatments.

From Utah, Kane et al (1974) reported in the Lancet that, using the Bush instrument to measure functional status, patients treated by chiropractors showed greater improvement than those treated by physicians. They also found that chiropractors scored better than medical doctors in terms of patient satisfaction, explanation offered to patients, comfort and confidence in treating patients, and the ability of the practitioner to return patients to their previous functional levels.

In a study that compared patient satisfaction with chiropractic and physician management of various conditions, but specifically including low back pain, Cherkin and MacCornack (1989) concluded that "the percentage of chiropractic patients who were 'very satisfied' with the care they received for low back pain was triple that for patients of family physicians (66 % versus 22 %, $P < 0.001$)". In this study, the family physician and chiropractic patient samples were similar in terms of age and sex but chiropractic patients had significantly more episodes of pain and had experienced pain for a longer period of time, which is to say that the patients who sought chiropractic care had a worse health status on average. The total sample included 215 patients who received their care from family physicians and 242 patients who obtained their care from chiropractors. Only enrollees who visited physicians or chiropractors for low back pain were included in the study sample.

Brontfort (1989) conducted a pilot randomized trial to compare the effectiveness of chiropractic versus general medical treatment of low back pain. Medical treatment consisted mostly of analgesics, injections, bedrest and physiotherapy, whereas chiropractic treatment (provided by a chiropractor) consisted of manipulative procedures. The results of this trial did not indicate any outcome differences between the two treatments after one month. However, after three and six months, the chiropractic treatment group reported greater subjective improvement than the general medical treatment group. The author concluded that "given the small number of patients in this study (nineteen patients) resulting in low statistical power ... , there is no basis for drawing any conclusions yet as to the effectiveness of chiropractic spinal manipulative therapy compared to medical treatment for low back pain".

In summary, Manga et al (1993) state that with respect to the effectiveness of medical versus chiropractic management of low back pain, the literature favours chiropractic. The literature is negative, inconclusive or virtually non-existent concerning many medical treatments, including the mainstay of bed rest if prolonged beyond two or three days. The many neutral to very positive findings on chiropractic manipulation, with no trial reporting ineffectiveness, presents a curious contrast full of irony.

Manga et al (1993) go on to say that on the basis of the clinical research it would be reasonable for private and public insurance managers to now call firstly upon the medical profession to provide better evidence for the effectiveness of the standard therapies it uses. Yet, at present, it is the public perception because of many factors, a central one of which is medical criticism of chiropractic treatment as unscientific, that it is chiropractors who have most to prove concerning the efficacy and effectiveness of their therapeutic modalities. There is, for example, the thought-provoking claim from an eminent neurosurgeon in the USA that approximately 90% of the 250,000 back surgeries performed annually in that country could be avoided (Burton et al, 1992).

Manga et al (1993) maintain that although many other forms of treatment exist for low back pain, none has been as extensively examined as has manipulative therapy. Few trials have been conducted assessing the effectiveness of other forms of treatment for low back pain.

According to Manga et al (1993), relevant questions that either or both of the medical profession and third party payers of medical care ought to answer are just 'how and why do so many medical technologies and procedures used in the medical management of low back pain get adopted and diffused so widely without clinical evidence of their effectiveness?' However, a number of recent studies have investigated not only the efficacy but also the safety of certain medical therapies, both conservative and invasive.

After analyzing the literature for the effectiveness of conservative therapy for low back pain, Deyo (1983) concluded that at that time there was no convincing evidence to support the efficacy of corsets, bed rest, TENS, conventional traction, or drug use.

Manga et al (1993) maintain that on the evidence, particularly the most scientifically valid clinical studies, spinal manipulation applied by chiropractors is shown to be more effective than alternative treatments for low back pain. The clinical evidence is corroborated by meta-analysis, case-control studies and properly constituted clinical guidelines panels.

Manga et al (1993) conclude by stating the following: "There is no clinical or case-control study that demonstrates or even implies that chiropractic spinal manipulation is unsafe in the treatment of low back pain; some medical treatments are equally safe, but others are unsafe and generate iatrogenic complications for low back pain patients; the literature shows clearly that many medical therapies are of questionable validity or judged to be inadequate; and the literature also suggests that chiropractic manipulation is far safer than medical management of low back pain".

Manga et al (1993) state that while it is prudent to call for even further clinical evidence of the efficacy of chiropractic management of low back pain, what the literature reveals is the much greater need for clinical evidence of the validity of medical management of low back pain. Several existing medical therapies of low back pain are, on the basis of the existing clinical trials, generally contraindicated. There is also some evidence in the literature to suggest that spinal manipulations are less safe and less effective when performed by non-chiropractic professionals.

2.9. Evidence against medical management of low back pain

According to Manga et al (1993) there is evidence that questions the effectiveness, efficacy and the safety of medical therapies for low back pain. The literature declares them in most instances ineffective, and some even harmful. It is surprising to discover how "unscientific" traditional medical therapies for low back pain are and, further, how slowly clinical research affects actual medical practice. They state that most low back surgery is not founded on evidence from randomized or even non-randomized clinical trials. An example of this is lumbar spinal fusion. They further comment on the poor guidelines on use for many surgical therapies, and serious questions raised by rates of complications and regional variations in practice. They add that the economic cost of medical management is high.

According to Deyo et al (1991), more clinical trials of the medical therapies are warranted and physicians should be better informed about the treatment approaches that are harmful and otherwise counterproductive. They emphasize iatrogenic disability from medical treatment and wasted resources in a recent major review of low back pain and its economic costs.

In another review, assessing the different diagnoses and therapies for low back pain and published in the British Medical Journal, Frank (1993) concluded that "a strictly medical approach to management is disadvantageous". He also suggested that "medical training may hinder a satisfactory therapeutic approach". He concluded that "manipulation has been found effective in reducing pain of longer duration ... patients with acute and chronic pain showed early benefits from manipulation". It also has been noted that short continuing education courses to improve physicians' management of low back pain have proven to be disappointing (Manga et al, 1993).

2.10. Additional views regarding the management of low back pain

Lunn and Waldron (1991) state that in the treatment of back pain, bed rest and inactivity are frequently counter-productive in the absence of neurological signs (as might happen with an acute prolapsed disc), and a regime of proper exercises is much to be preferred.

Lunn and Waldron (1991) maintain that some consideration should be given to devoting some clinical sessions to the services of a physician with a special interest in orthopaedics, as having such a person as part of the occupational health team has been shown from experience to be of great value. They go on to say that there is some evidence that exercises designed to strengthen the muscles of the back, especially the erector spinae, are successful in reducing the prevalence of back pain (of muscular origin) to some degree.

Gates (1988) states that the key to preventing back pain and back injury is to be physically fit through participation in a regular strengthening and stretching exercise programme. He maintains that back hygiene should be the goal of every staff nurse. To employ someone with the special responsibility of training nurses to exercise and to lift properly has been shown to be cost-effective (Lunn and Waldron, 1991).

It should be noted that a chiropractic management programme includes: lifestyle modification which deals with aspects such as posture, stress and nutrition; and patient education which includes correct lifting methods. Chiropractors also emphasise the importance of exercising and stretching the muscles and prescribe specific exercises to their patients.

2.11. Cost-effectiveness of chiropractic management of mechanical low back pain

"Low back pain is one of the most - if not the most - costly diseases or disabilities in Canada, a phenomena which is not generally appreciated or understood in medical and governmental circles" (Manga et al, 1993).

A review of the literature by Johnson et al (1985) showed that among the 17 studies reviewed, 14 reflected a lower total cost to the health care system for patients treated by chiropractors, explained always and mainly by lower hospital costs, drug expenditure and related medical costs, and quite often but not always by lower professional costs. Additionally, in all but one of the studies, chiropractic care resulted in lower and in most cases significantly lower time-loss from work than physician care. In most of the studies, chiropractors are noted to have given more treatments (visits) than physicians, though this did not result in higher health care costs.

In a study undertaken in Australia, Ebrall (1992) studied mechanical low back pain claimants for a year in Victoria, Australia where treatment was solely by a chiropractor or a physician. He concluded that "the chiropractic management of mechanical low back pain clearly produces wide-ranging savings".

One of the clearest statements on the cost-effectiveness of chiropractic care comes from the British trial (Meade et al, 1990). Meade et al (1990) declared that "the potential economic, resource, and policy implications of our results are extensive". They stated that if 72,000 patients with mechanical back pain and no contra-indications to manipulation receiving hospital outpatient treatment under the National Health Service were instead treated by chiropractors, the savings in health care costs alone would be about $8 million annually. The reduction in time loss would lead to further savings to industry of $26 million in output and another $6 million to government for reduced social security payments.

"There is, therefore, economic support for use of chiropractic in low back pain ... consideration should be given to recognizing appropriately trained and experienced chiropractors and to providing chiropractic within the NHS, either in hospitals or by purchasing chiropractic treatment in existing clinics" (Meade et al, 1990).

According to Manga et al (1993) the overall body of evidence shows that major savings following chiropractic management come from fewer auxiliary costs, fewer hospitalizations, and a significant reduction in chronic problems and disability. They state that chiropractic therapy is almost wholly hands-on care in which there is a minimal use of auxiliary services, no use of drugs, and little hospitalization. They further state that payments to chiropractors for services they provide is 80 % or more of the total cost of care, and that for physician management of low back pain the proportions are virtually reversed.

Manga et al (1993) go on to say that prescription drugs, laboratory tests, referrals to specialists, and hospital in-patient care lead to a four or five increase in total health care costs of the physician's own billing for medical services. While it is difficult to compare the unit-time fees of chiropractors and physicians, it seems likely that chiropractors' hourly fees are less than those of physicians. Certainly they are not more [Price Waterhouse (1992) (cited in the Manga report, 1993)].

Manga et al (1993) conclude by emphasizing the importance of cost-effectiveness in the management of low back pain. There is evidence from Australia, Canada, the U.K., and the U.S.A. including much expert testimony of potential savings of many millions of dollars annually if more of the management of low back pain was in fact transferred from physicians to chiropractors. The magnitude of the estimates of saving is very impressive, and demands serious attention and response in light of the painful cost pressures faced in the health care system in Ontario, Canada and other countries. A comparison of health care costs for chiropractic and medical patients "suggest a significant cost-saving potential for users of chiropractic care, and the results also suggest the need to re-examine insurance practices and programs that restrict chiropractic coverage relative to medical coverage" (Stano, 1993).

Because nurses are at such a high risk for experiencing low back pain of a mechanical nature, and because of the important nature of their work, it is necessary to determine a cost-effective method for treating this problem in the nursing profession.

The purpose of this study, therefore, was to determine the extent to which two forms of chiropractic treatment (namely chiropractic spinal manipulation on its own versus chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice) were effective in the management of mechanical low back pain in a sample of nurses. The treatment which demonstrated the greater clinical improvement in pain and disability would be considered to be the most beneficial, and this would have favourable long-term economic implications.

2.12. Summary

Manga et al (1993) state that low back pain has become one of the most costly causes of illness and disability in Canada - a phenomenon which is not generally appreciated or understood in medical and governmental circles in Canada. Furthermore, studies on the prevalence and incidence of low back pain suggest that it is ubiquitous, probably the leading cause of disability and morbidity in middle-aged persons, and by far the most expensive source of workers' compensation costs in Ontario - as indeed in most other jurisdictions.

The high incidence of back pain, its chronic and recurrent nature in many patients and its contribution as a main cause of absence from work are well established. No general consensus exists about the most effective treatment. Largely anecdotally, patients and therapists often claim great improvements after manipulative treatment by alternative practitioners, including chiropractors.

According to Lunn and Waldron (1991), back pain is statistically shown to be a common problem, particularly amongst nursing staff. Videman (1989) states that back injuries and back pain are major sources of incapacity and ill-health retirement from the nursing profession, and are attributed to the need to lift, carry, and support patients.

Burton and Cassidy (1992) report that leading medical and chiropractic authorities in the U.S.A. and Canada see greater potential for cost savings in the field of management of low back pain than anywhere else in the health care system.

According to Manga et al (1993), there is an overwhelming body of evidence indicating that chiropractic management of low back pain is more cost-effective than medical management. The evidence includes studies showing lower chiropractic costs for the same diagnosis and episodic need for care.

Manga et al (1993) report that the literature clearly and consistently shows that the major savings from chiropractic management come from fewer and lower costs of auxiliary services, much fewer hospitalizations, and a highly significant reduction in chronic problems, as well as in levels and duration of disability. Furthermore, workers' compensation studies report that injured workers with the same specific diagnosis of low back pain returned to work much sooner when treated by chiropractors than by physicians, and this leads to very significant reductions in direct and indirect costs.

According to Manga et al (1993) the constellation of the evidence of (a) the effectiveness and cost-effectiveness of chiropractic management of low back pain, (b) untested, questionable and even harmful use of medical therapies by physicians, (c) the economic efficiency of chiropractic over physician care for low back pain (d) the safety of chiropractic care and (e) the preference and satisfaction expressed by patients of chiropractic, together offers an overwhelming case in favour of much greater use of chiropractic services for the management of low back pain.

In the light of the above literature, it is evident that mechanical low back pain is highly prevalent in the nursing profession, and is attributable to the duties that nurses are required to perform. It is also evident that chiropractic has been shown to be both effective and cost-effective in the management of mechanical low back pain, especially when compared to medical management for the same condition.

CHAPTER 3

THE DATA, THEIR TREATMENT, AND INTERPRETATION.

3.0. INTRODUCTION

This chapter concerns itself with the following:

- The methods, techniques and measurements.
- The type and nature of the data.
- The location of the data and the sample.
- Criteria governing the admissibility of the data.
- Capturing and securing the data.
- The statistics used.

3.1. METHODS, TECHNIQUES AND MEASUREMENTS

The nurses of hospitals in the greater Durban area were approached (personally and via advertisements placed in two newspapers, nursing newsletters, and hospital noticeboards - with the Matrons' and Medical Superintendents' permission) and asked to participate in this study, explaining to them that treatment would be free.

The sample size was limited to 30 nurses, as this was the number of subjects that both time and funding would allow. The candidates were first screened to determine whether their low back pain was mechanical in nature, and only those nurses with true mechanical low back pain were considered for the purpose of this study. The purpose of the trial was explained to eligible subjects after which their informed consent was required (Appendix A).

On the initial consultation, each nurse was required to fill in the Symptom Diagram (Appendix F) after which a full case history was taken (Appendix G). Each nurse then underwent a full physical examination (Appendix H) followed by a regional examination of the low back (Appendix I). A radiographic examination of the lumbar spine and pelvis was only performed if clinically indicated. A diagnosis was then made according to the Kirkaldy-Willis model of classification for mechanical low back pain (Appendix B).

The nurses presenting with the same type of mechanical low back pain condition were identified and grouped together in order to match the groups as much as possible in terms of the diagnosis. Each of these groups was then further divided into the Experimental and Control group on an alternating basis.

The Experimental group was managed using chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice, such as: soft tissue therapy, myofascial trigger point therapy, electrotherapy, ice and McManis traction. The Control group was managed using chiropractic spinal manipulation alone. The nurses received ten treatments each, even if they had fully recovered before the tenth treatment, in order to ensure consistency of intervention.

Each nurse completed the Numerical Pain Rating Scale (Appendix D) before treatment at each of the 10 visits, and the Oswestry Low Back Pain Disability Questionnaire (Appendix C) before the 1st, 5th, and 10th treatments at each of these respective visits. These were the subjective measures of outcome.

Objective measures of outcome included lumbar spine ranges of motion in forward flexion, extension, and lateral flexion to the left and right (Appendix E), motion palpation and orthopaedic and neurological examinations, which were also assessed before treatment at each of the 10 visits, in both the Experimental and Control group.

Lumbar spine ranges of motion were measured using the Autogon II goniometer (Smith and Nephew, Rolyan Inc.). This goniometer consisted of two arms (19.4 cm and 20.8 cm in length respectively) joining at a centre of rotation which formed a fulcrum around which the arms could move. The arms were linked to an electronic device which recorded the ranges of the various motions (in degrees) as they were being measured.

The button on top of the electronic device switched the goniometer on and off. The arms of the goniometer were moved around the fulcrum until the angle between them was 180 degrees. This allowed for a reading of 0 degrees to be displayed on the 'degrees' screen of the electronic device. The green button was then pressed in order to record this initial measurement of zero degrees.

The fulcrum and the arms of the goniometer were positioned at different landmarks on the subject, depending on which motion was being performed:
For <u>forward flexion</u> and <u>extension</u> the fulcrum was positioned on the lateral aspect of the subject at the level of the lower costal margin (i.e. L3 level), the top arm of the goniometer was in line with the posterior axillary line, and the bottom arm of the goniometer was in line with the femur.

For lateral flexion the fulcrum was placed midway between the posterior superior iliac spines (i.e. S2 level), the top arm of the goniometer was in line with a mark (drawn by the researcher) overlying the 11th or 12th thoracic vertebra, and the bottom arm of the goniometer was in line with the gluteal cleft.
It should be noted that the goniometer did not allow for the measurement of rotation, therefore lumbar spine motion in rotation could not be included in this study.

The goniometer was positioned over the respective landmarks with the subject standing in the neutral position, and the initial 0 degree measurement was recorded (as mentioned previously). The subject then either forward flexed/extended/ laterally flexed their lumbar spine as far as they could (with their feet together and knees straight) and remained in this position until the researcher relocated the arms of the goniometer over the same landmarks (it should be noted that the fulcrum remained stationary throughout this procedure). The green button was then pressed in order to record the degree of motion, after which the subject returned to the neutral position. The procedure was repeated for all the ranges.

The electronic device allowed the researcher to review the results which were displayed on two small screens. One screen displayed the degrees of each of the motions that were measured, and the other screen displayed the joint number (this represented the motions, including the initial 0 degree measurements, which were automatically numbered as they were being measured, therefore it was important for the researcher to record the order in which the motions were performed). The results were recalled by pressing the Mode button followed by the (up) arrow. This arrow first allowed for the initial reading of 0 degrees to be displayed on the 'degrees'screen. When it was pressed again, the degrees of the motion that was measured on the subject was displayed on the same screen. At the same time, the number allocated to the respective motion was displayed on the 'joint number' screen. The (up) arrow was pressed again in order to recall the range of the remainder of the motions.

3.2. TYPE AND NATURE OF THE DATA

The data of this research was of two kinds, namely primary and secondary data.

3.2.1. The Primary Data

1) The responses of the nurses (in both groups) to:
   a) the Oswestry Low Back Pain Disability Questionnaire; and
   b) the Numerical Pain Rating Scale.
2) Nurse response to respective chiropractic treatment in terms of objective clinical criteria such as lumbar spine range of motion, motion palpation, orthopaedic and neurological examinations.

3.2.2. The Secondary Data

The secondary data was obtained from a search of the related literature. Previous research regarding the incidence and prevalence of mechanical low back pain in the nursing profession, and studies documenting the efficacy of chiropractic (as opposed to medical) management for mechanical low back pain were needed.

3.3. LOCATION OF THE DATA AND THE SAMPLE

Nurses of hospitals in the greater Durban area were approached. The data needed for testing the hypothesis of subproblem one was obtained from the case history and low back regional examination of the nurses concerned, with reference to the Kirkaldy-Willis classification for mechanical low back pain.

As this study dealt with both the subjective and objective response of nurses to one of two forms of chiropractic management for mechanical low back pain (depending on the treatment group in which they were placed), the data needed for testing the hypotheses of subproblems two, three and four were found in the questionnaire response and objective clinical assessment of nurses in both the Experimental and Control group. The secondary data were collected from books and journal articles obtained from libraries countrywide.

3.4. CRITERIA GOVERNING THE ADMISSIBILITY OF THE DATA

Only the responses of nurses suffering from low back pain of a mechanical nature were considered. The other criterion for patient eligibility was that they should have no contra-indication to manipulation. The purpose of the study was explained to eligible subjects after which their informed consent was required. A radiographic examination of the lumbar spine and pelvis was performed only if clinically indicated. Details of the type, frequency, and duration of treatment were at the discretion of the researcher and depended on the nature of the condition presented.

Only the data from the questionnaires completed under the personal supervision of the researcher were used (it should be noted that the subjects were guaranteed that the information they provided would not be released to anyone on an individual basis, thus ensuring confidentiality). The objective clinical criteria were assessed by the researcher. If the subjects became non-compliant, they were automatically excluded from the study.

3.5. CAPTURING AND SECURING THE DATA

The data needed for subproblem one was collected at the initial consultation by means of a case history and physical examination findings (from the general physical, and low back regional examination), the results of which were recorded. The different forms of mechanical low back pain were thus identified and classified according to the Kirkaldy-Willis model of classification for mechanical low back pain, and this in turn enabled the researcher to formulate an appropriate management programme for each.

The data needed for testing the hypotheses of subproblems two, three and four were obtained from 1) the nurses' response to the Oswestry Low Back Pain Disability Questionnaire and the Numerical Pain Rating Scale (which comprised their subjective response to treatment) and 2) the objective clinical criteria [such as lumbar spine range of motion (in forward flexion, extension, and lateral flexion to the left and right), motion palpation, orthopaedic & neurological examinations and X-ray] assessed by the researcher.

It should be noted that the results of the Oswestry Low Back Pain Disability Questionnaire were recorded before the 1st, 5th, and 10th treatments at each of these respective visits; the results of the Numerical Pain Rating Scale were recorded before treatment at each of the 10 visits; and the objective clinical criteria (range of motion, motion palpation, orthopaedic & neurological examinations) were also recorded before treatment at each of the 10 visits.

The Oswestry Low Back Pain Disability Questionnaire gave scores for 10 sections (eg. intensity of pain, difficulty with lifting, walking and travelling). The result was expressed on a scale ranging from 0% (no disability) to 100% (highest score for disability on all items). In the Numerical Pain Rating Scale, the intensity of pain ranged from 0 (no pain) to 10 (indicating unbearable pain).

Range of motion was measured with a goniometer and the optimal measurement for each of the ranges was the standard average range used for orthopaedic purposes, namely: 90 degrees for forward flexion (written simply as flexion for practical reasons); 50 degrees for extension; and 30 degrees for both left and right lateral flexion. The closer the ranges of motion were to the above-mentioned average values, the more favourable was the result. If range of motion was found to exceed these average values, the results were considered to be even more favourable as they indicated greater mobility of the lumbar spine.

3.7. STATISTICS

The technique that was used was in the form of convenience sampling, and the measurement scales used were of a continuous nature.

The statistical tests that were applied were: the Mann Whitney U-test, the Wilcoxon signed-rank test, the unpaired t-test, and the paired t-test.

The Mann Whitney U-test was used for ranges of motion (in flexion, extension, left lateral flexion, and right lateral flexion) and the Numerical Pain Rating Scale, in order to determine whether a significant difference existed between the Experimental and Control group at any of the treatments, especially at the last treatment (i.e. at treatment number 10).

The Wilcoxon signed-rank test was used for ranges of motion (in flexion, extension, left lateral flexion, and right lateral flexion) and the Numerical Pain Rating Scale, in order to determine whether a significant difference existed within each of the groups at the following treatments: 1 minus 5, 5 minus 10, and 1 minus 10, paying special attention to the difference between the first and last treatment within each group.

The unpaired t-test was used for the Oswestry Low Back Pain Disability Questionnaire in order to determine whether a significant difference existed between the Experimental and Control group at treatments 1, 5, and 10, paying special attention to treatment 10.

The paired t-test was used for the Oswestry Low Back Pain Disability Questionnaire in order to determine whether a significant difference existed within each of the two groups at the following treatments: 1 minus 5, 5 minus 10, and 1 minus 10, paying special attention to the difference between the first and last treatment within each group.

The statistical program used to analyse the results was the SGPLUS (Statgraphics Plus Version 6.0, supplied by Manugistics, Inc.).

Two graphs were drawn for each of the following: flexion, extension, left lateral flexion, right lateral flexion, and the Numerical Pain Rating Scale. The first graph was for the Mann Whitney U-test, and the second graph was for the Wilcoxon signed-rank test. Two graphs were also drawn for the Oswestry Low Back Pain Disability Questionnaire: one for the unpaired t-test, and the other for the paired t-test. The program used to plot the graphs was Lotus 123 (R) 2.3.

For the next set of statistics, the nurses in both the Experimental and Control group presenting with the same type of low back condition/syndrome (diagnosed according to the Kirkaldy-Willis classification for mechanical low back pain) were grouped together (still remaining in their respective Experimental / Control group). A pie diagram was drawn to illustrate the distribution of the mechanical low back conditions that were found within this sample of the nursing profession.

Two graphs were drawn for each of the following: Range of motion (in flexion, extension, left lateral flexion, and right lateral flexion); the Numerical Pain Rating Scale; and the Oswestry Low Back Pain Disability Questionnaire. One graph was for the sub-groups in the Experimental group, and the other was for the sub-groups in the Control group.

It is important to note that no statistical tests could be performed due to the limited sample size within each of these sub-groups, therefore the statistics used were purely of a descriptive nature as the graphs consisted simply of an <u>average</u> value on the 'Y' axis, and the <u>treatment number</u> on the 'X' axis.

CHAPTER 4

THE RESULTS

4.0. INTRODUCTION

The sample size consisted of 30 nurses : 15 in the Experimental group (receiving chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice), and 15 in the Control group (receiving chiropractic spinal manipulation on its own). All the data gathered was represented graphically and in tabular form.

Confidence interval : 95 %

Ho : There is no statistically significant difference between / within the data of the 2 groups.

H1 : There is a statistically significant difference between / within the data of the 2 groups.

A value for P which is less or equal to 0,05 indicates a statistically significant difference.

4.1. NUMERICAL PAIN RATING SCALE

4.1.1. Mann Whitney U-test

The Mann Whitney U-test was performed for the Experimental versus the Control group in order to compare the average rank of the values for the Numerical Pain Rating Scale in both groups from treatment 1 up to and including treatment 10. The results were tabulated after which a graph was drawn to depict the results.

Table 4.1: Mann Whitney U-test of the Numerical Pain Rating Scale for the Experimental versus the Control group (treatments 1 to 10).

	T 1	T 2	T 3	T 4	T 5
EXP.	18.233	18.133	18.633	18.633	18.567
CONTROL	12.767	12.867	12.367	12.367	12.433

	T 6	T 7	T 8	T 9	T 10
EXP.	18.167	17.8	17.167	15.4	15.767
CONTROL	12.833	13.2	13.833	15.6	15.233

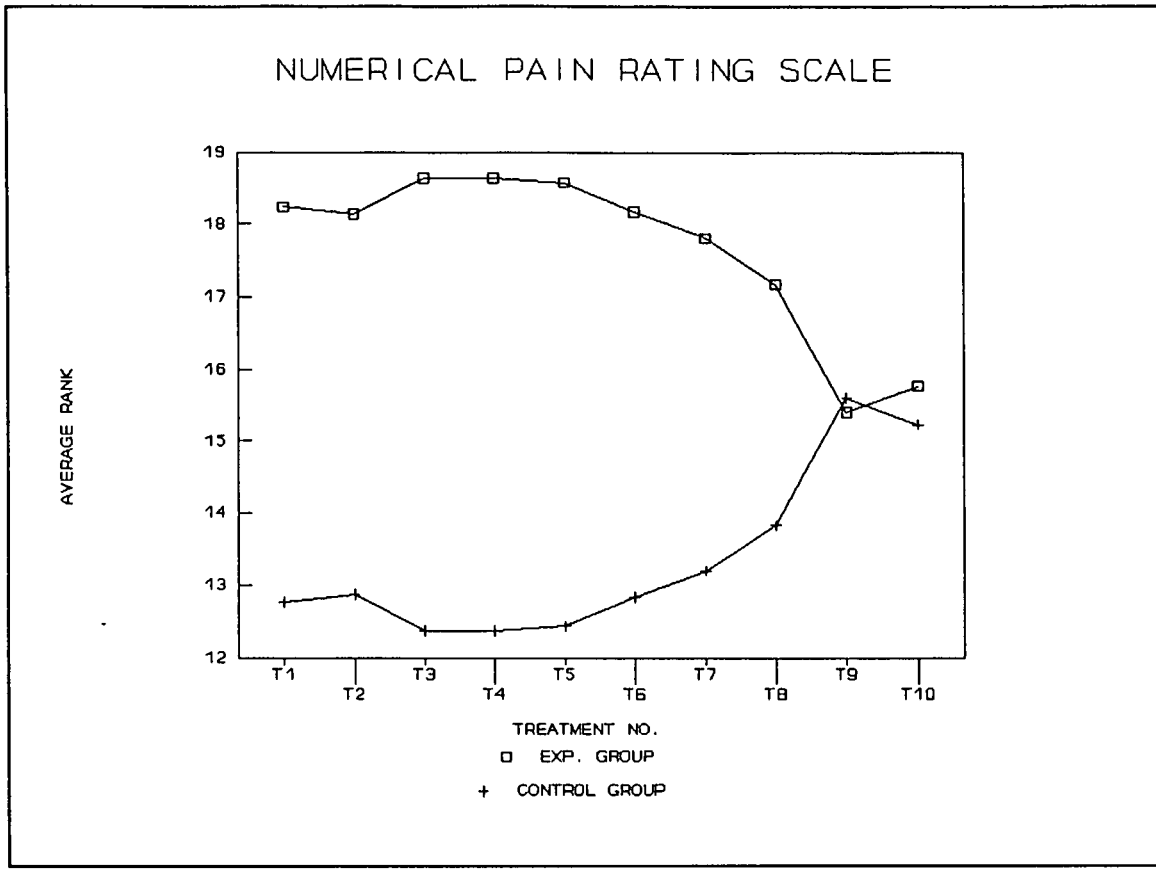


Fig. 4.1: Average rank of the Numerical Pain Rating Scale for the Experimental versus the Control group at each of the 10 treatments.

A statistically significant difference between the Experimental and Control group was noted at treatment number 3 where P = 0,04995. Therefore the Mann Whitney U-test rejected Ho for the Numerical Pain Rating Scale at treatment no. 3 at the 5 % level of significance. However, there was no statistically significant difference present at treatment number 10 (or at any of the other treatments).

4.1.2. Wilcoxon signed-rank test

The Wilcoxon signed-rank test was performed for both the Experimental and Control group where the number of favourable differences (assigned a positive value in this case) were plotted for both groups at the following treatments: T1-T5, T5-T10 and T1-T10. Note that the (-) symbol represents the minus sign.

The number of favourable differences was assigned a positive value, as the value for pain intensity was expected to decrease during the course of the treatment. The value for pain intensity was expected to be high initially but was expected to decline thereafter as a direct result of the treatment received. This reduction in pain would indicate a favourable result.

Table 4.2: Wilcoxon signed-rank test of the Numerical Pain Rating Scale for both the Experimental and Control group (treatments: 1-5; 5-10; 1-10).

	T1 - T5	T5 - T10	T1 - T10
EXP.	13	11	15
CONTROL	15	6	15

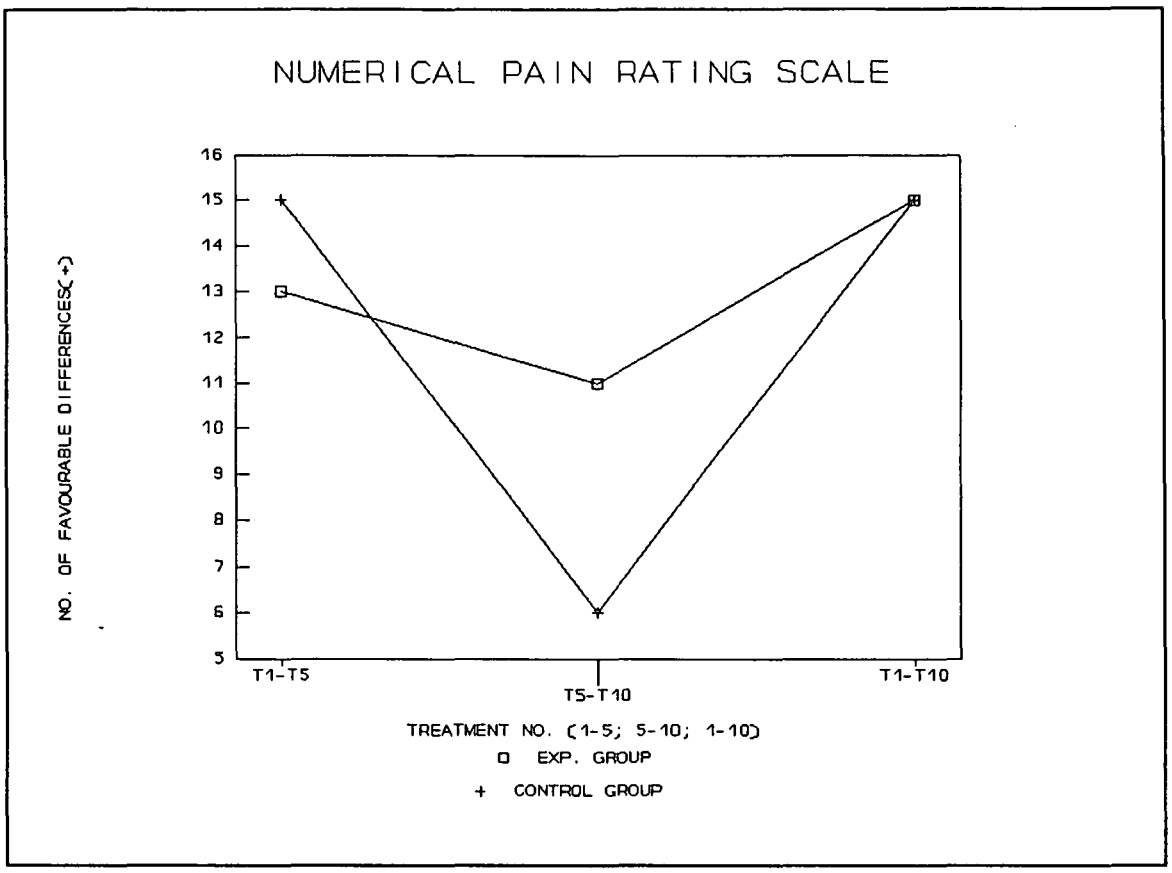


Fig. 4.2: Number of favourable differences (+) for the Numerical Pain Rating Scale in the Experimental and Control group at treatments: 1-5; 5-10 and 1-10.

The most statistically significant difference within the Experimental group was noted at T1-T10 where P = 0,0006. There were also statistically significant differences noted at T1-T5 and T5-T10. Therefore the Wilcoxon signed-rank test rejected Ho for the Numerical Pain Rating Scale in the Experimental group at the 5 % level of significance. A statistically significant difference within the Control group was noted at T1-T5 and T1-T10 where P = 0,0006. Therefore the Wilcoxon signed-rank test rejected Ho for the Numerical Pain Rating Scale in the Control group for T1-T5 and T1-T10 at the 5 % level of significance.

4.2. OSWESTRY LOW BACK PAIN DISABILITY QUESTIONNAIRE

4.2.1. Unpaired t-test

The unpaired t-test was performed for the Experimental versus the Control group where the average percentage for disability was plotted for each group at treatments 1, 5 and 10.

Table 4.3: Unpaired t-test of Oswestry Low Back Pain Disability Questionnaire for Experimental versus Control group (treatments 1, 5 and 10).

	T1	T5	T10
EXP.	27.667	22.6	13.267
CONTROL	22.133	11.733	8.533
CONF. INTERVAL	(-4.257 ; 15.324)	(1.902 ; 19.832)	(-1.263 ; 10.730)

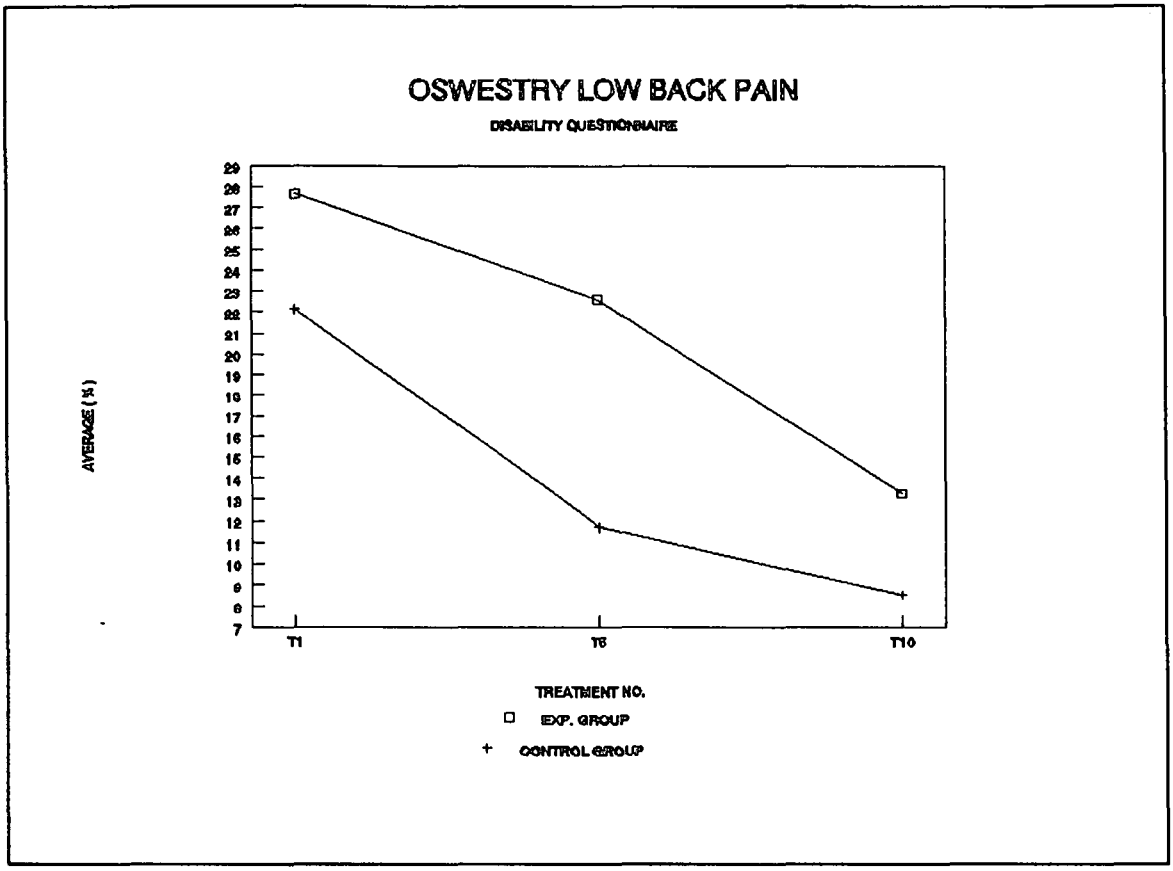


Fig 4.3: Average percentage of the Oswestry Low Back Pain Disability Questionnaire for the Experimental versus the Control group at treatments 1, 5 and 10.

A statistically significant difference was noted between the Experimental and Control group only at treatment number 5 where P = 0,019. Therefore the unpaired t-test rejected Ho for the Oswestry Low Back Pain Disability Questionnaire at treatment 5. This test did not reject Ho for treatment number 10 (or treatment number 1) however, as there was no statistically significant difference present at these respective treatments.

4.2.2. Paired t-test

The paired t-test was performed within both the Experimental and Control group where the number of favourable differences (assigned a positive value in this case) was plotted for each group at the following treatments: T1-T5; T5-T10 and T1-T10.

The number of favourable differences was assigned a positive value, as the percentage for disability was expected to decrease (a favourable result) during the course of treatment as a result of the treatment that the nurses received.

Table 4.4: Paired t-test of Oswestry Low Back Pain Disability Questionnaire for Experimental and Control group (treatments: 1-5; 5-10 and 1-10).

	T1 - T5	T5 - T10	T1 - T10
EXP.	11	13	15
CONTROL	14	10	15

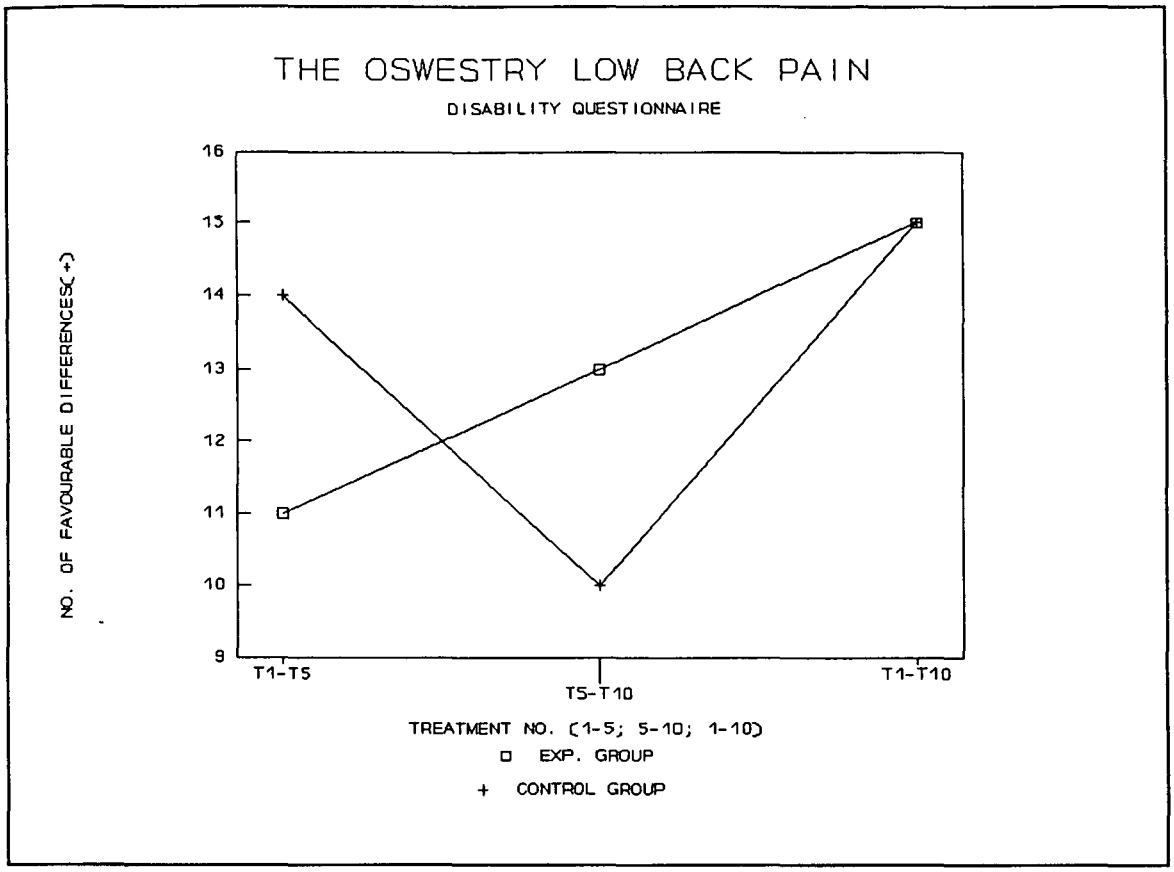


Fig. 4.4: Number of favourable differences (+) for the Oswestry Low Back Pain Disability Questionnaire in the Experimental and Control group at treatments: 1-5, 5-10 and 1-10.

The most statistically significant difference within the Experimental group was noted at T1-T10 where P = 0.0006. Another statistically significant difference within this group was noted at T5-T10 (P = 0,0031). The most statistically significant difference within the Control group was noted at T1-T10 where P = 0.0006. Other statistically significant differences within this group were noted at T1-T5 (P = 0,0008) and T5-T10 (P = 0,0086). Therefore the paired t-test rejected Ho in the Experimental group at T1-T10 and T5-T10, and in the Control group at T1-T5, T5-T10 and T1-T10 at the 5 % level of significance.

4.3. RANGE OF MOTION (FLEXION)

4.3.1. Mann Whitney U-test

The Mann Whitney U-test was performed for the Control versus the Experimental group where the average rank for flexion was plotted for both groups from treatment 1 up to and including treatment 10.

Table 4.5: Mann Whitney U-test of average rank in flexion for Control versus Experimental group (treatments 1 to 10).

	T1	T2	T3	T4	T5
CONTROL	17.667	18.133	18.433	18.5	18.767
EXP.	13.333	12.867	12.567	12.5	12.233

	T6	T7	T8	T9	T10
CONTROL	18.467	18.4	17.8	17.9	18
EXP.	12.533	12.6	13.2	13.1	13

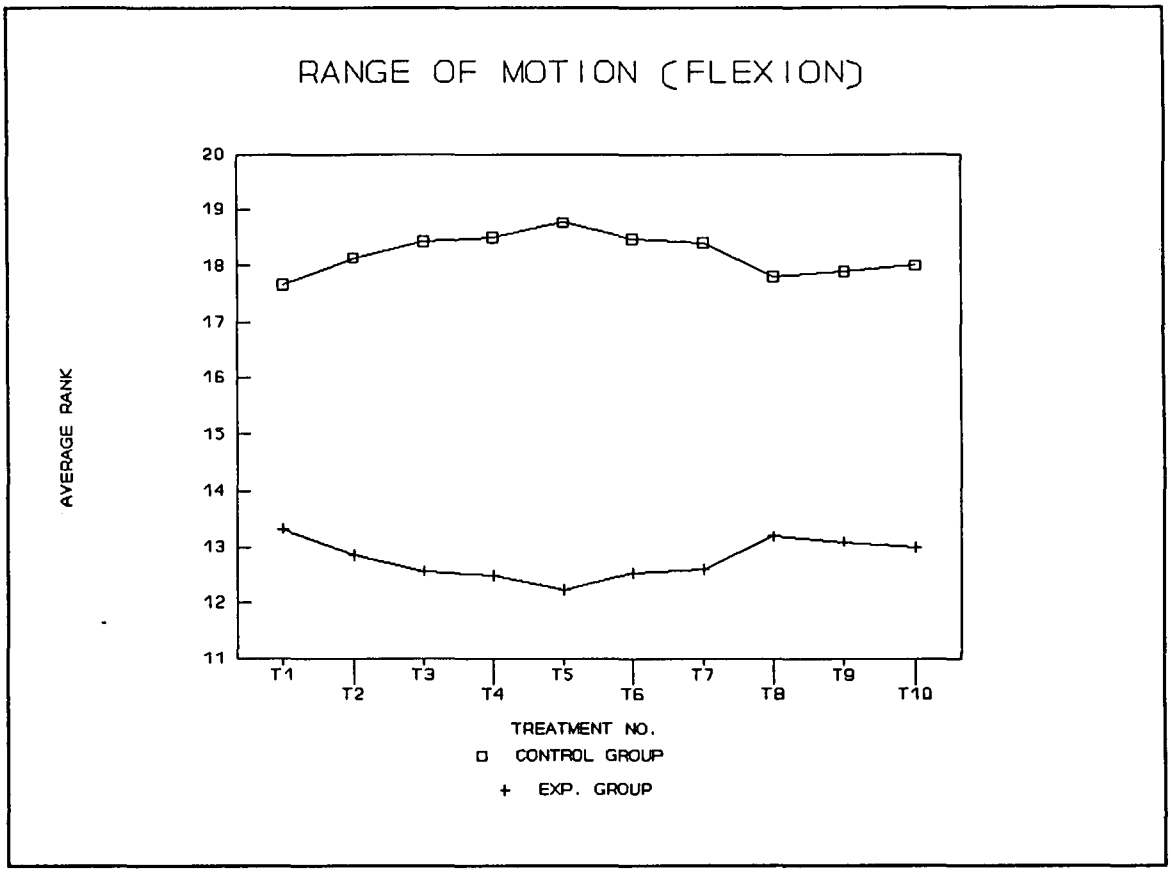


Fig. 4.5: Average rank in flexion for the Control versus the Experimental group at each of the 10 treatments.

A statistically significant difference between the Control and Experimental group was noted only at treatment number 5 where P = 0,0441. Therefore the Mann Whitney U-test rejected Ho for flexion at treatment 5. This test did not reject Ho for flexion at treatment 10, as there was no statistically significant difference between the two groups at the 10th treatment.

4.3.2. Wilcoxon signed-rank test

The Wilcoxon signed-rank test was used for the Control and Experimental group where the number of favourable differences for flexion (assigned a negative value in this case) was plotted for both groups at the following treatments: T1-T5; T5-T10 and T1-T10.

The number of favourable differences was assigned a negative value for all the ranges of motion (i.e. for flexion, extension, left lateral flexion, and right lateral flexion) because range of motion was expected to increase during the course of treatment as a result of the treatment received by the nurses in both groups. The negative values thus indicated a favourable result as they represented increased mobility.

Table 4.6: Wilcoxon signed-rank test of the no. of favourable differences in flexion for the Control and Experimental group (treatments 1-5; 5-10 and 1-10).

	T1 - T5	T5 - T10	T1 - T10
CONTROL	15	13	15
EXP.	13	15	15

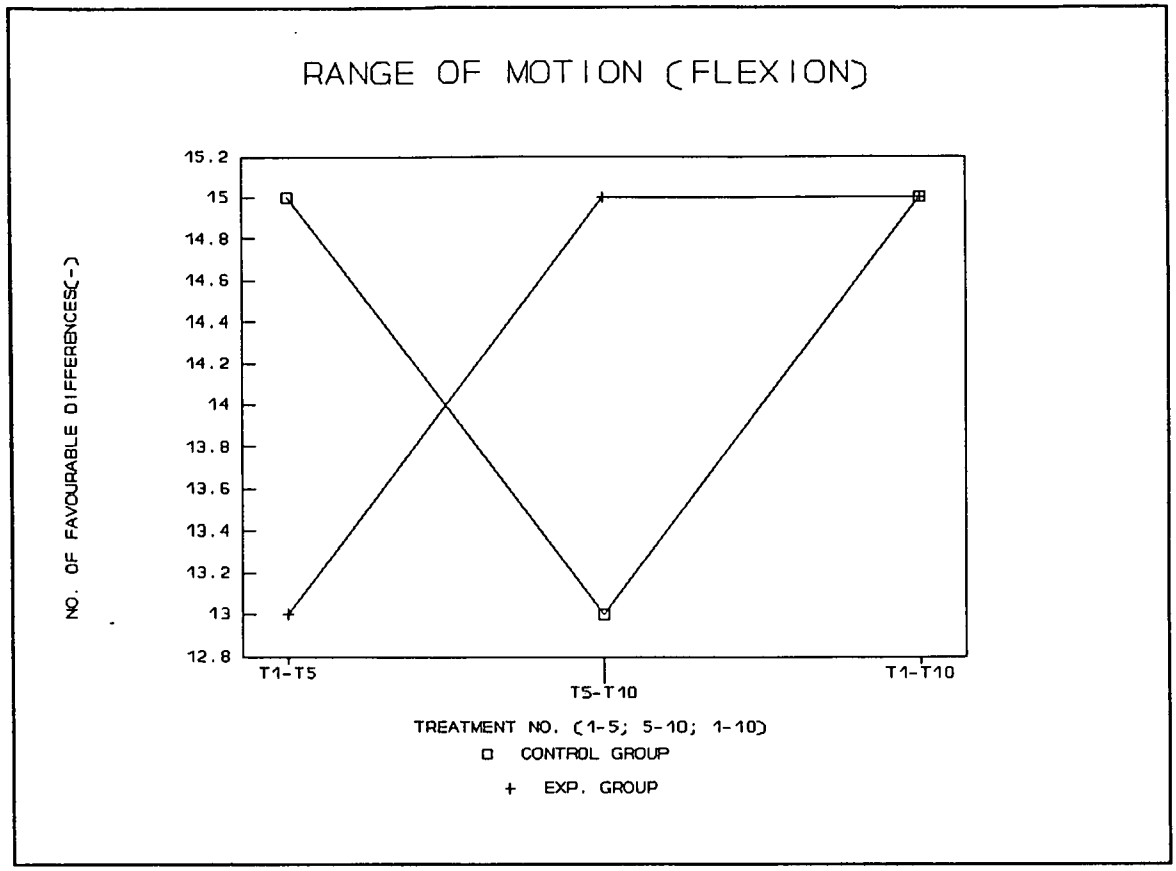


Fig. 4.6: Number of favourable differences (-) in flexion for the Control and Experimental group at treatments: 1-5, 5-10 and 1-10.

The most statistically significant difference within the Control group was noted at T1-T5 and T1-T10 where P = 0,0006. There was also a statistically significant difference noted at T5-T10 (P = 0,0020). The most statistically significant difference within the Experimental group was noted at both T5-T10, and T1-T10 where P = 0,0006. A statistically significant difference was also noted at T1-T5 (P = 0,0020) within this group. Therefore the Wilcoxon signed-rank test rejected Ho for flexion in both groups at T1-T5, T5-T10, and T1-T10 at the 5 % level of significance.

4.4. RANGE OF MOTION (EXTENSION)

4.4.1. Mann Whitney U-test

This test was used for the Control versus the Experimental group where the average rank for extension was plotted for both treatment groups at each of the 10 treatments.

Table 4.7: Mann Whitney U-test for average rank in extension for the Control versus Experimental group (treatments 1 to 10).

	T1	T2	T3	T4	T5
CONTROL	19.333	19.467	19.233	18.867	19.8
EXP.	11.667	11.533	11.767	12.133	11.2

	T6	T7	T8	T9	T10
CONTROL	19.633	19.767	19.267	19.6	18.7
EXP.	11.367	11.233	11.733	11.4	12.3

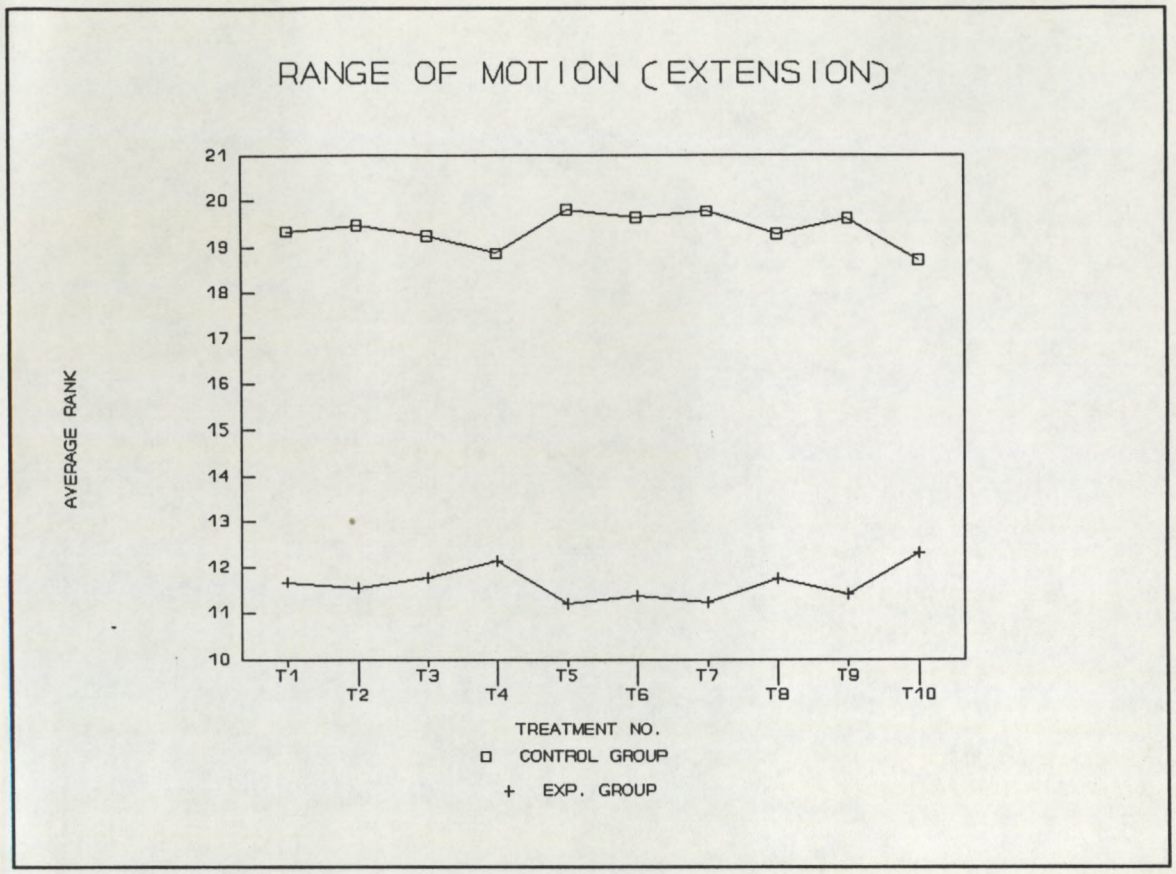


Fig. 4.7: Average rank in extension for the Control versus the Experimental group at each of the 10 treatments.

The most statistically significant difference between the Control and Experimental group was evident at treatment number 5 where P = 0,0078. The next closest statistically significant difference between the two groups was noted at treatment number 7 where P = 0,0083. It should be noted that there was a statistically significant difference between the two groups at all the treatments, including treatment 10, therefore the Mann Whitney U-test rejected Ho for extension at the 5 % level of significance.

4.4.2. Wilcoxon signed-rank test

This test was used for the Control and Experimental group where the number of favourable differences in extension (assigned a negative value) was plotted for each group at the following treatments: T1-T5; T5-T10 and T1-T10.

Table 4.8: Wilcoxon signed-rank test for extension in the Control and Experimental group (treatments 1-5; 5-10 and 1-10).

	T1 - T5	T5 - T10	T1 - T10
CONTROL	15	13	14
EXP.	12	15	15

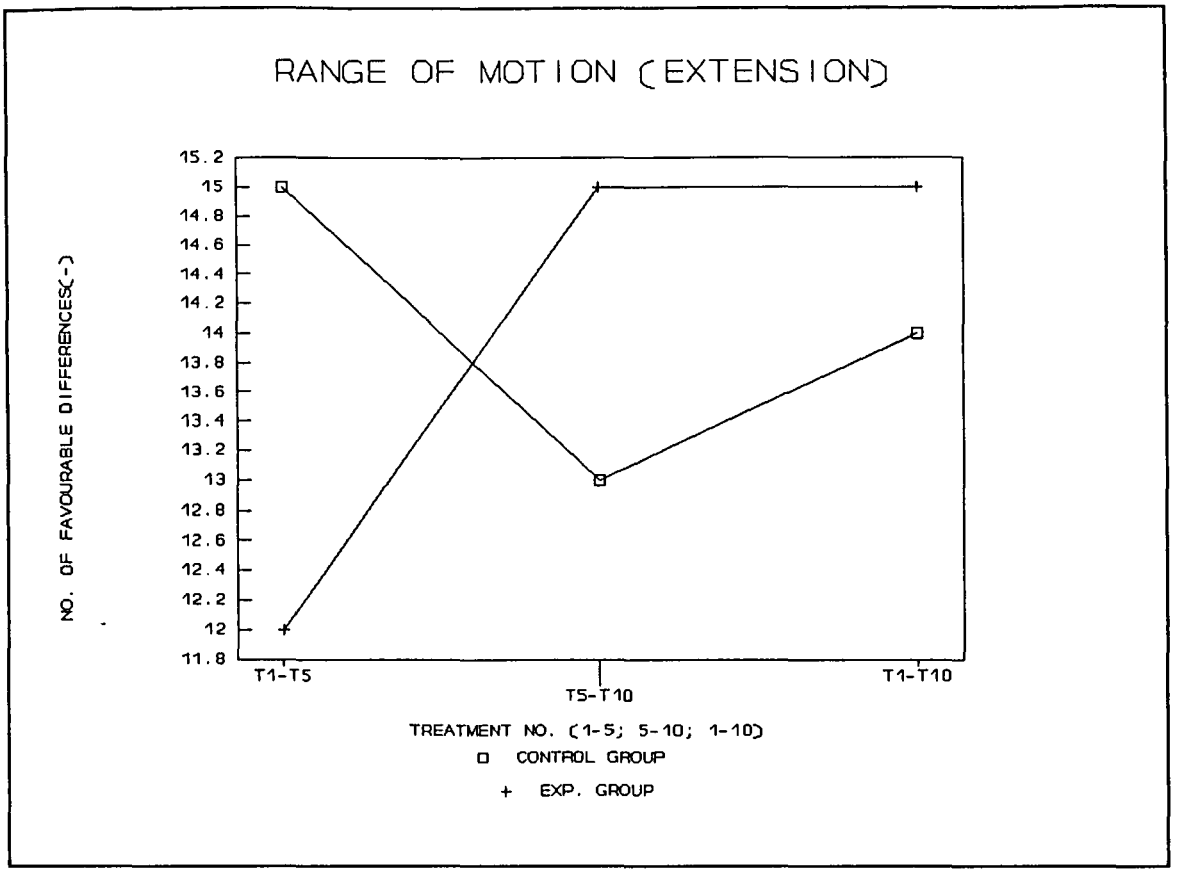


Fig. 4.8: Number of favourable differences (-) in extension for the Control and Experimental group at treatments: 1-5, 5-10 and 1-10.

The most statistically significant difference in the Control group was evident at T1-T5 where P = 0,0006. The most statistically significant difference in the Experimental group was evident at both T5-T10 and T1-T10 where P = 0,0006. It should be noted that a statistically significant difference was noted in both the Control and Experimental group at treatments: 1-5; 5-10 and 1-10, therefore the Wilcoxon signed-rank test rejected Ho for extension at the 5 % level of significance.

4.5. RANGE OF MOTION (LEFT LATERAL FLEXION)

4.5.1. Mann Whitney U-test

This test was used for the Control versus the Experimental group where the average rank for left lateral flexion was plotted for both groups at each of the 10 treatments.

Table 4.9: Mann Whitney U-test of average rank for left lateral flexion in the Control versus Experimental group (treatments 1 to 10).

	T1	T2	T3	T4	T5
CONTROL	15.633	15.533	14.5	14.733	16.567
EXP.	15.367	15.467	16.5	16.267	14.433

	T6	T7	T8	T9	T10
CONTROL	15.6	14.933	14.833	14.333	15.433
EXP.	15.4	16.067	16.167	16.667	15.567

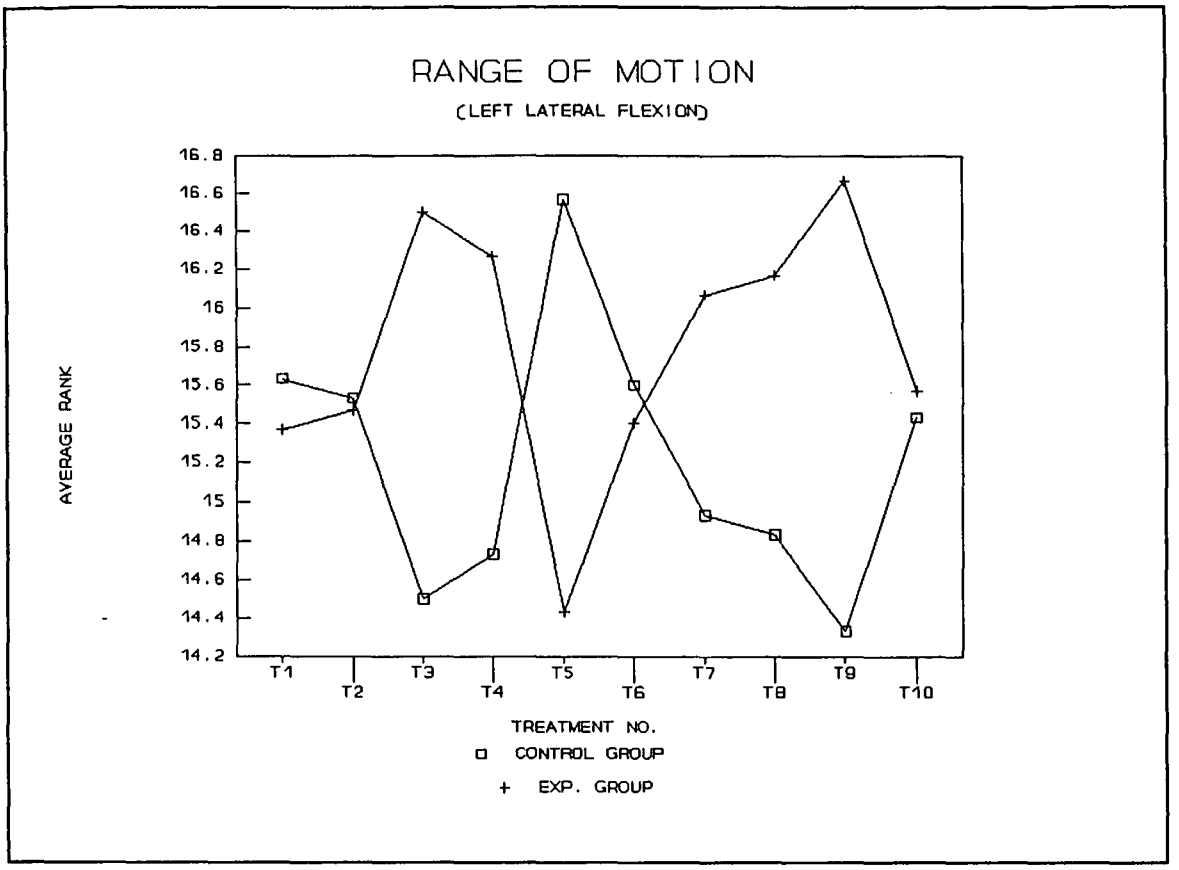


Fig. 4.9: Average rank in left lateral flexion for the Control versus the Experimental group at each of the 10 treatments.

There was no statistically significant difference between the Control and Experimental group for left lateral flexion at any of the treatments, therefore the Mann Whitney U-test did not reject Ho for left lateral flexion at the 5 % level of significance.

4.5.2. Wilcoxon signed-rank test

This test was used for the Control and Experimental group where the number of favourable differences (assigned a negative value) in left lateral flexion was plotted for both groups at treatments: 1-5; 5-10 and 1-10.

Table 4.10: Wilcoxon signed-rank test for the no. of favourable differences in left lateral flexion for the Control and Experimental group at T1-T5; T5-T10 and T1-T10.

	T1 - T5	T5 - T10	T1 - T10
CONTROL	14	14	15
EXP.	12	13	15

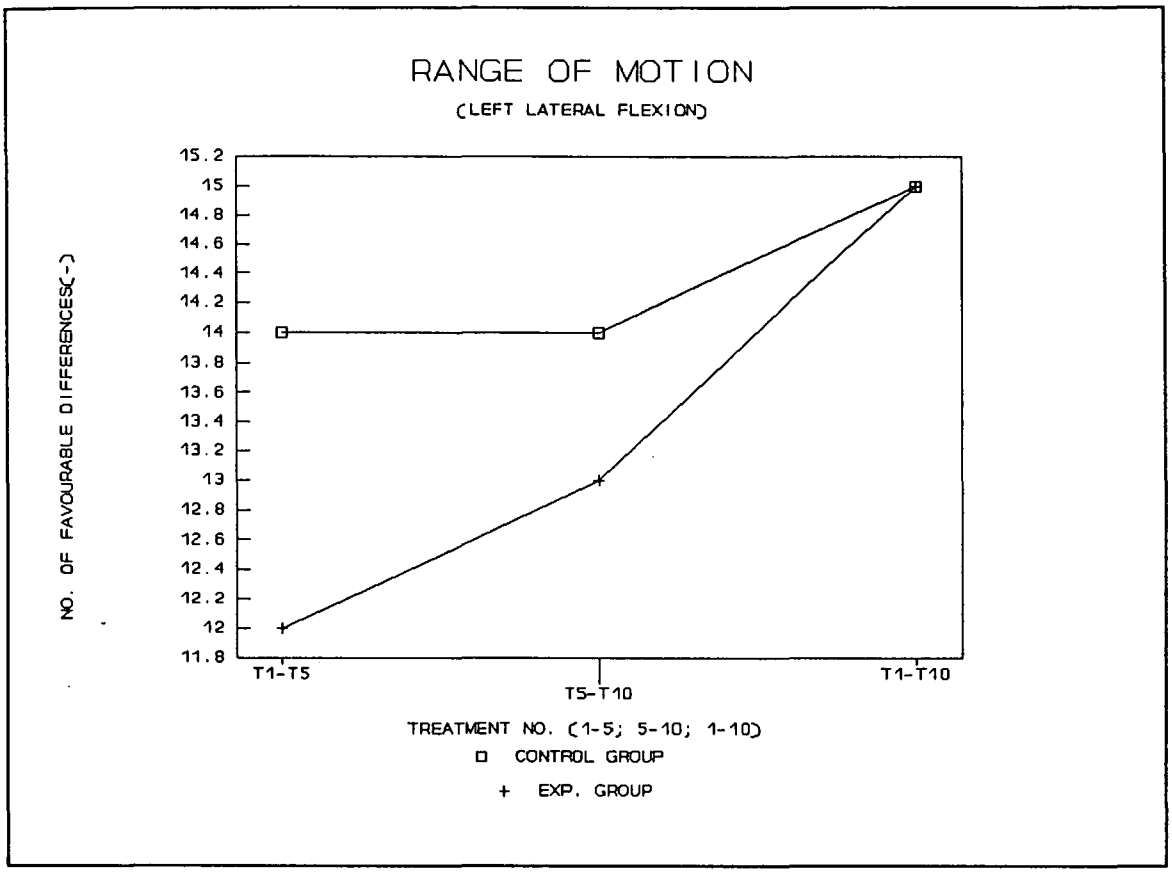


Fig. 4.10: Number of favourable differences (-) in left lateral flexion for the Control and Experimental group at treatments: 1-5, 5-10 and 1-10.

The most statistically significant difference within both the Control and the Experimental group was evident at T1-T10 where P = 0,0006. It should be noted that there was a statistically significant difference at treatments: 1-5; 5-10 and 1-10 within both groups, therefore the Wilcoxon signed-rank test rejected Ho for left lateral flexion at the 5 % level of significance.

4.6. RANGE OF MOTION (RIGHT LATERAL FLEXION)

4.6.1. Mann Whitney U-test

This test was used for the Control versus the Experimental group where the average rank in right lateral flexion was plotted for both groups at each of the 10 treatments.

Table 4.11: Mann Whitney U-test for average rank in right lateral flexion for the Control versus the Experimental group (treatments 1 to 10).

	T1	T2	T3	T4	T5
CONTROL	16.733	17.333	17.5	16.833	18.1
EXP.	14.267	13.667	13.5	14.167	12.9

	T6	T7	T8	T9	T10
CONTROL	17.2	17.2	15.533	15.267	17.267
EXP.	13.8	13.8	15.467	15.733	13.733

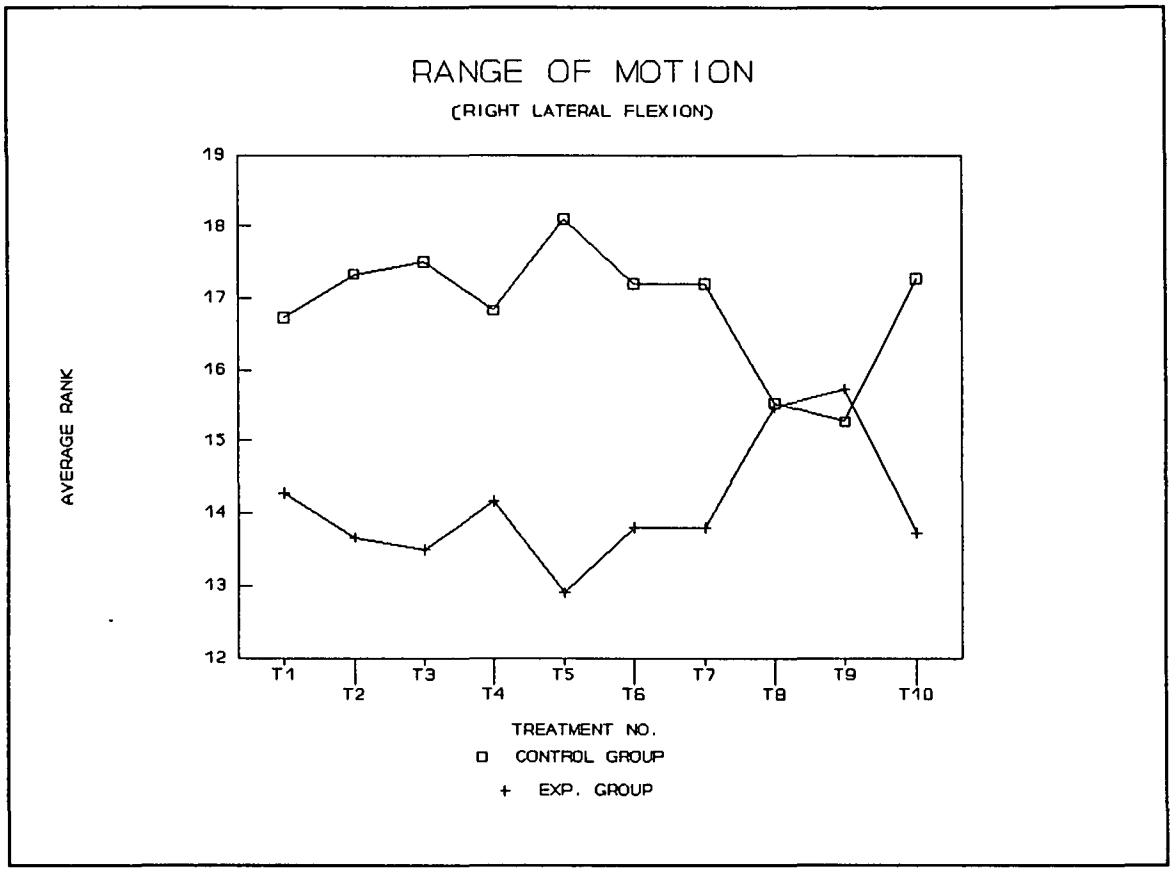


Fig. 4.11: Average rank in right lateral flexion for the Control versus the Experimental group at each of the 10 treatments.

No statistically significant difference was noted between the Control and Experimental group at any of the treatments, therefore the Mann Whitney U-test did not reject Ho for right lateral flexion at the 5 % level of significance.

4.6.2. Wilcoxon signed-rank test

This test was used for both the Control and Experimental group where the number of favourable differences (assigned a negative value) in right lateral flexion was plotted for both groups at the following treatments: T1-T5; T5-T10 and T1-T10.

Table 4.12: Wilcoxon signed-rank test for the number of favourable differences in right lateral flexion for the Control and Experimental group (treatments: 1-5; 5-10 and 1-10).

	T1 - T5	T5 - T10	T1 - T10
CONTROL	14	13	15
EXP.	13	13	15

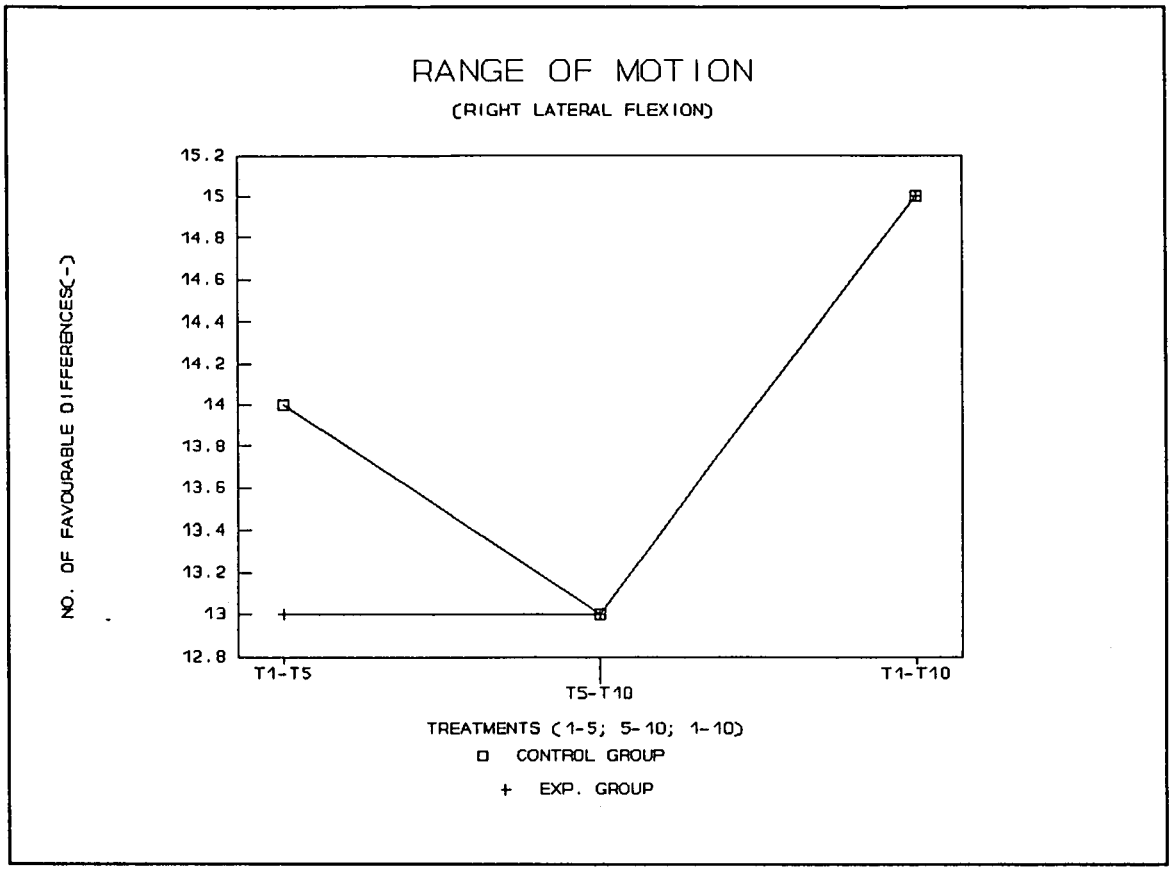


Fig 4.12: Number of favourable differences (-) in right lateral flexion for the Control and Experimental group at treatments: 1-5, 5-10 and 1-10.

The most statistically significant difference within both the Control and the Experimental group was evident at T1-T10 where P = 0,0006. It should be noted that there was a statistically significant difference within both groups at treatments: 1-5; 5-10 and 1-10, therefore the Wilcoxon signed-rank test rejected Ho for right lateral flexion at the 5 % level of significance.

4.7. ADDITIONAL STATISTICS

For the following statistics, the nurses in both the Experimental and Control group presenting with the same type of mechanical low back condition / syndrome (diagnosed according to the Kirkaldy-Willis classification for mechanical low back pain) were grouped together (still remaining in their respective Experimental / Control group).

GROUP A: 60 % of the nurses presented with a sacroiliac syndrome associated with a myofascial dysfunction syndrome of the quadratus lumborum.

GROUP B: 33.333 % of the nurses presented solely with a sacroiliac syndrome (SI SYNDROME).

GROUP C: 6.667 % of the nurses presented solely with a myofascial dysfunction syndrome of the quadratus lumborum (MFPDS QL).

The following Pie diagram depicts these results.

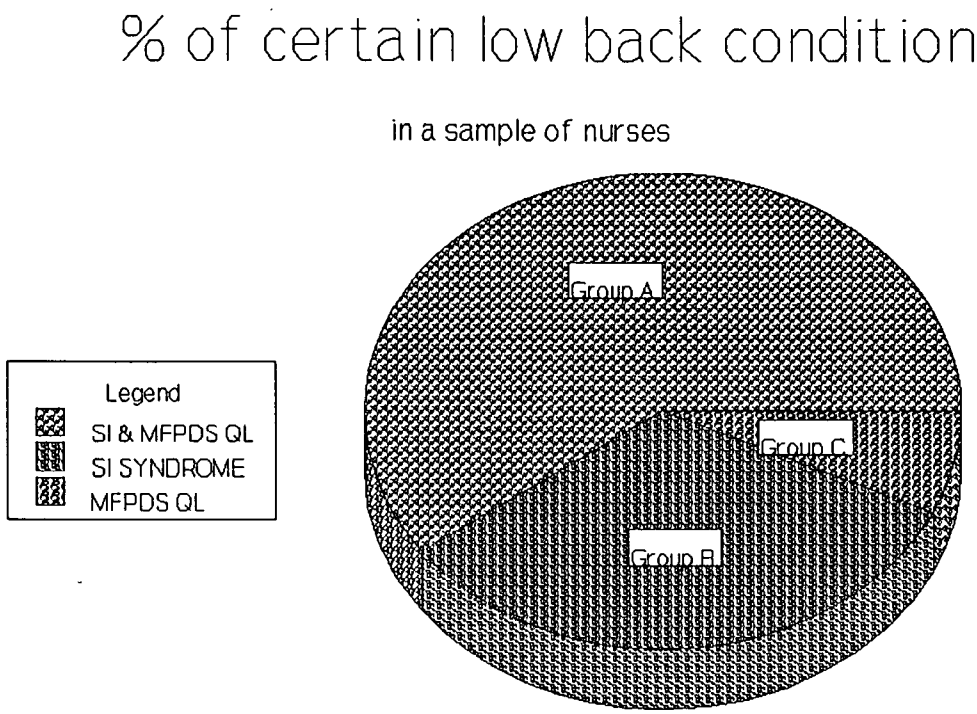


Fig. 4.13: Pie diagram demonstrating the distribution of certain prevalent mechanical low back conditions within a small sample of the nursing profession.

Two graphs were drawn for each of the following: the Oswestry Low Back Pain Disability Questionnaire; the Numerical Pain Rating Scale; and ranges of motion (in flexion, extension, left lateral flexion, and right lateral flexion). The one graph was for Groups A, B, and C in the Experimental group; and the other was for Groups A, B, and C in the Control group.

4.7.1. Oswestry Low Back Pain Disability Questionnaire

The average percentage for disability was plotted at treatments 1, 5 and 10 for Groups A, B and C in the Experimental and Control group.

Table 4.13: Average percentage for disability for Groups A, B and C in the Experimental group (treatments 1, 5 and 10).

	T1	T5	T10
GROUP A	27.333	26	14
GROUP B	30.2	16.6	12.6
GROUP C	18	22	10

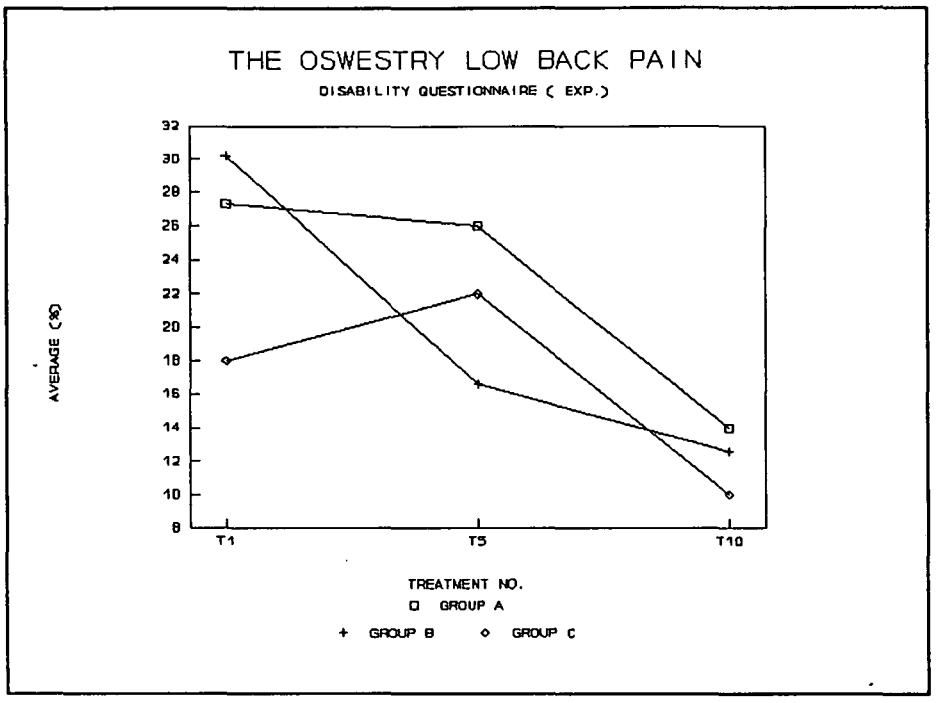


Fig.4.14: Average percentage of the Oswestry Low Back Pain Disability Questionnaire for Groups A, B and C in the Experimental group at treatments 1, 5 and 10.

Table 4.14: Average percentage for disability for Groups A, B and C in the Control group (treatments 1, 5 and 10).

	T1	T5	T10
GROUP A	22.222	11.667	8.222
GROUP B	22.4	10.6	8
GROUP C	20	18	14

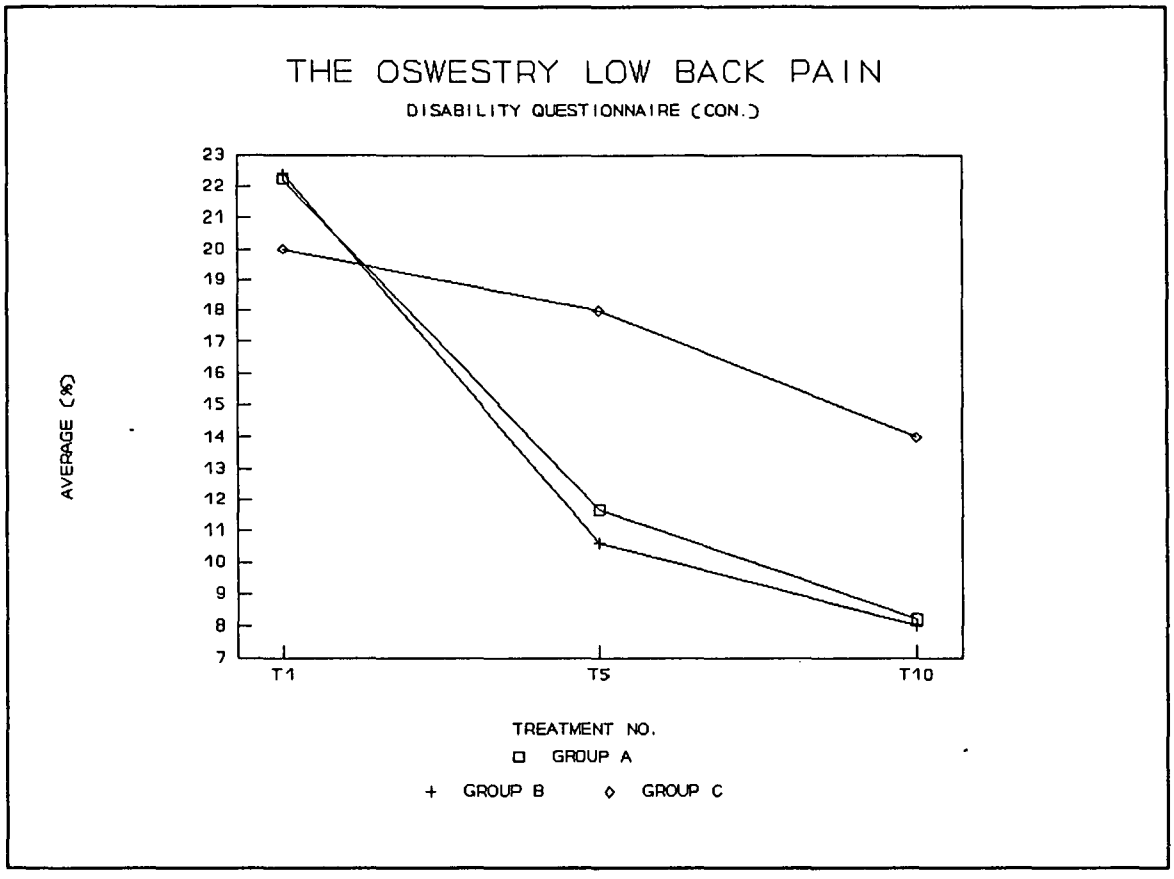
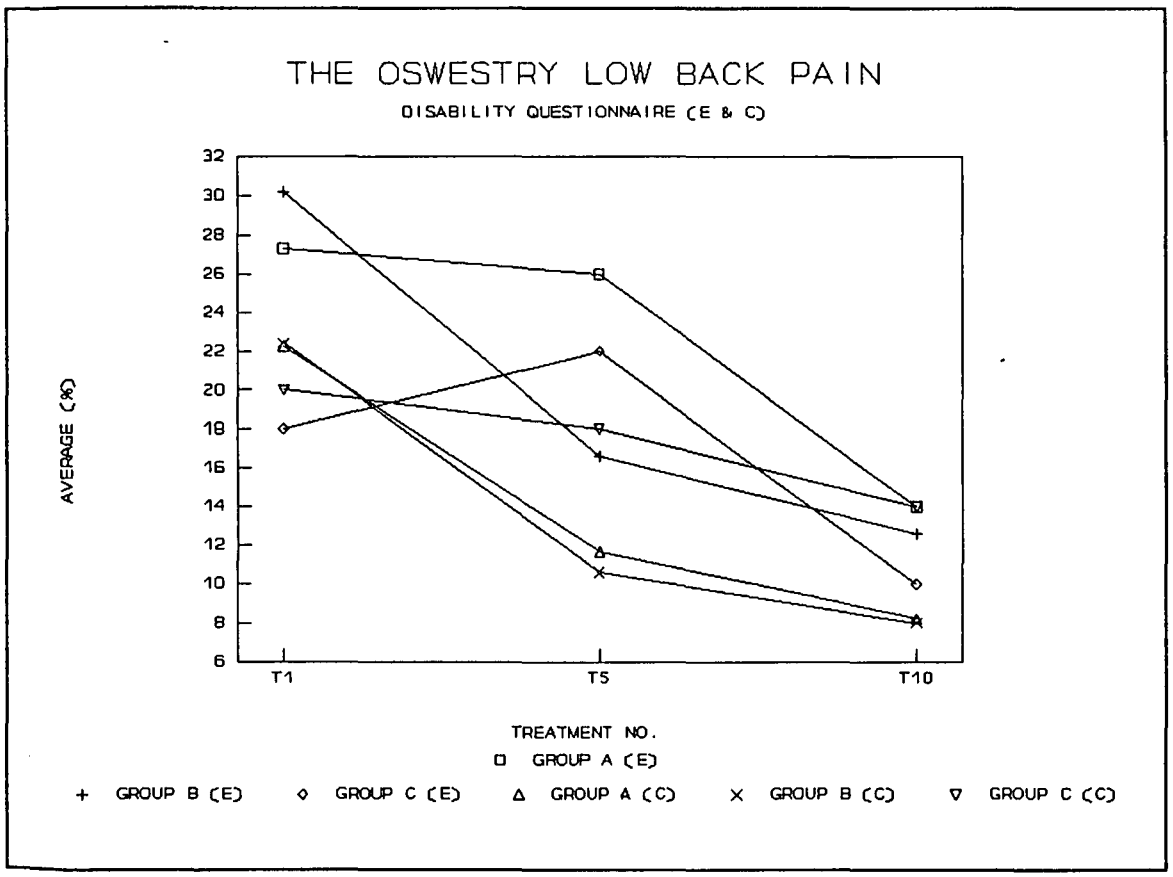


Fig. 4.15: Average percentage of the Oswestry Low Back Pain Disability Questionnaire for Groups A, B and C in the Control group at treatments 1, 5 and 10.

Fig. 4.16: The following is a combined graph of the average percentage of disability for Groups A, B and C in both the Experimental and Control group (treatments 1, 5 and 10).



4.7.2. Numerical Pain Rating Scale

Table 4.15: Average value for the Numerical Pain Rating Scale for Groups A, B and C in the Experimental group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	7.333	3.889	3.222	2.444	3.333
GROUP B	7.4	5.6	4.6	5.4	2.8
GROUP C	7	5	5	3	2

	T6	T7	T8	T9	T10
GROUP A	2.556	2.556	1.889	1.889	1.222
GROUP B	3.8	3.6	2	2	1.6
GROUP C	3	2	4	2	0

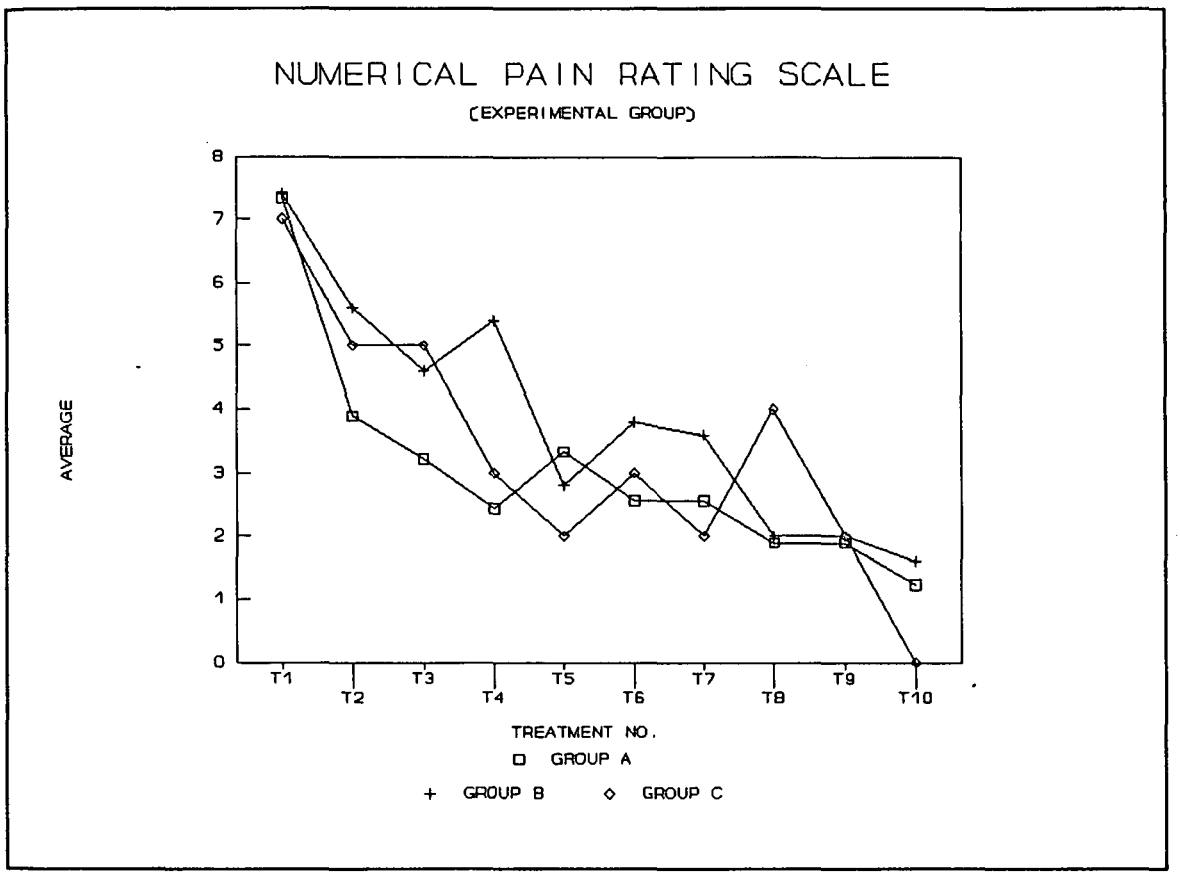


Fig. 4.17: Average value of the Numerical Pain Rating Scale for Groups A, B and C in the Experimental group at each of the 10 treatments.

Table 4.16: Average value for the Numerical Pain Rating Scale for Groups A, B and C in the Control group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	6.444	3	2	1.778	1.444
GROUP B	6.2	3.2	3.2	2	1.4
GROUP C	6	1	2	2	3

	T6	T7	T8	T9	T10
GROUP A	2.556	2.444	1.111	1.889	1.222
GROUP B	1.6	1	1.6	1.4	1
GROUP C	1	1	2	3	1

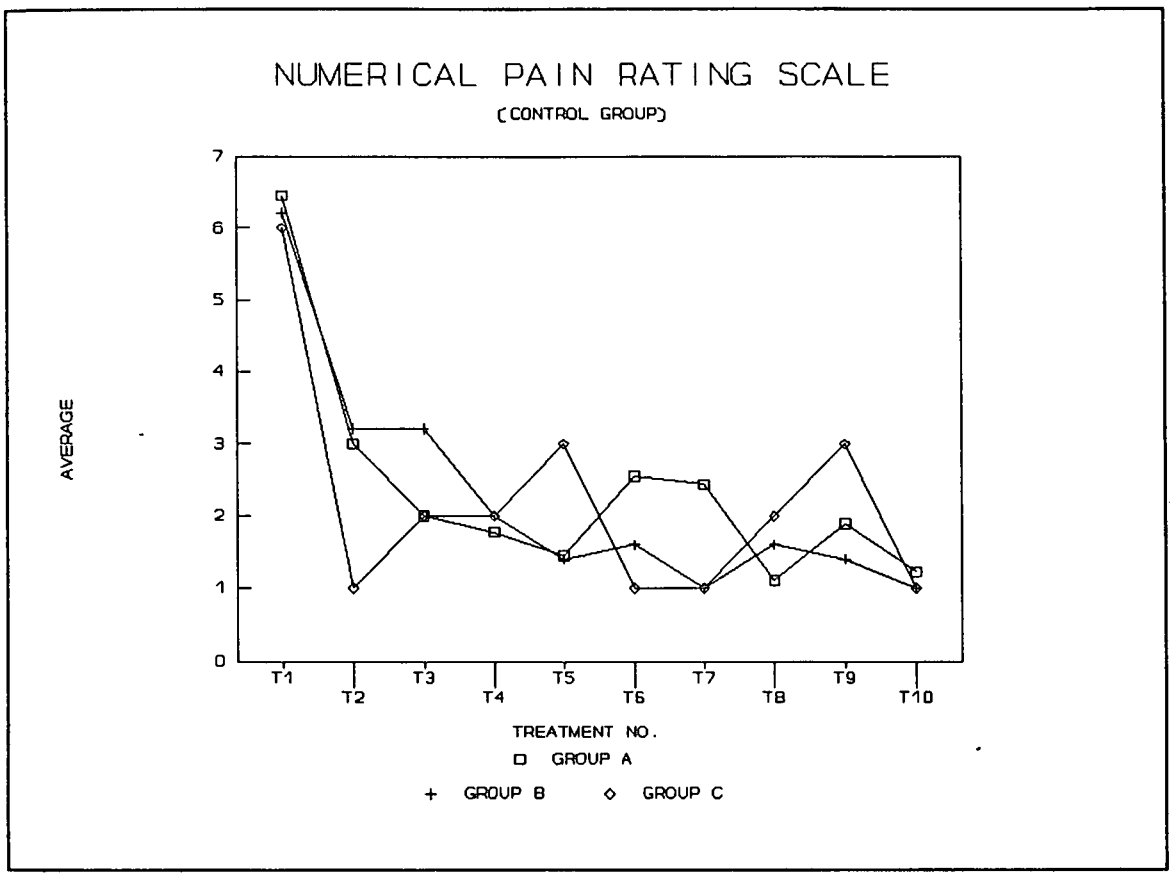


Fig. 4.18: Average value of the Numerical Pain Rating Scale for Groups A, B and C in the Control group at each of the 10 treatments.

4.7.3. Range of motion (flexion)

Table 4.17: Average value for flexion for Groups A, B and C in the Experimental group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	63.889	66.222	65.889	68.556	67.444
GROUP B	56	58.4	60.4	61.2	64.4
GROUP C	82	85	87	89	91

	T6	T7	T8	T9	T10
GROUP A	69.222	70.889	72.667	72.778	75.444
GROUP B	62.2	63.2	66.4	68.2	71.6
GROUP C	90	92	91	93	96

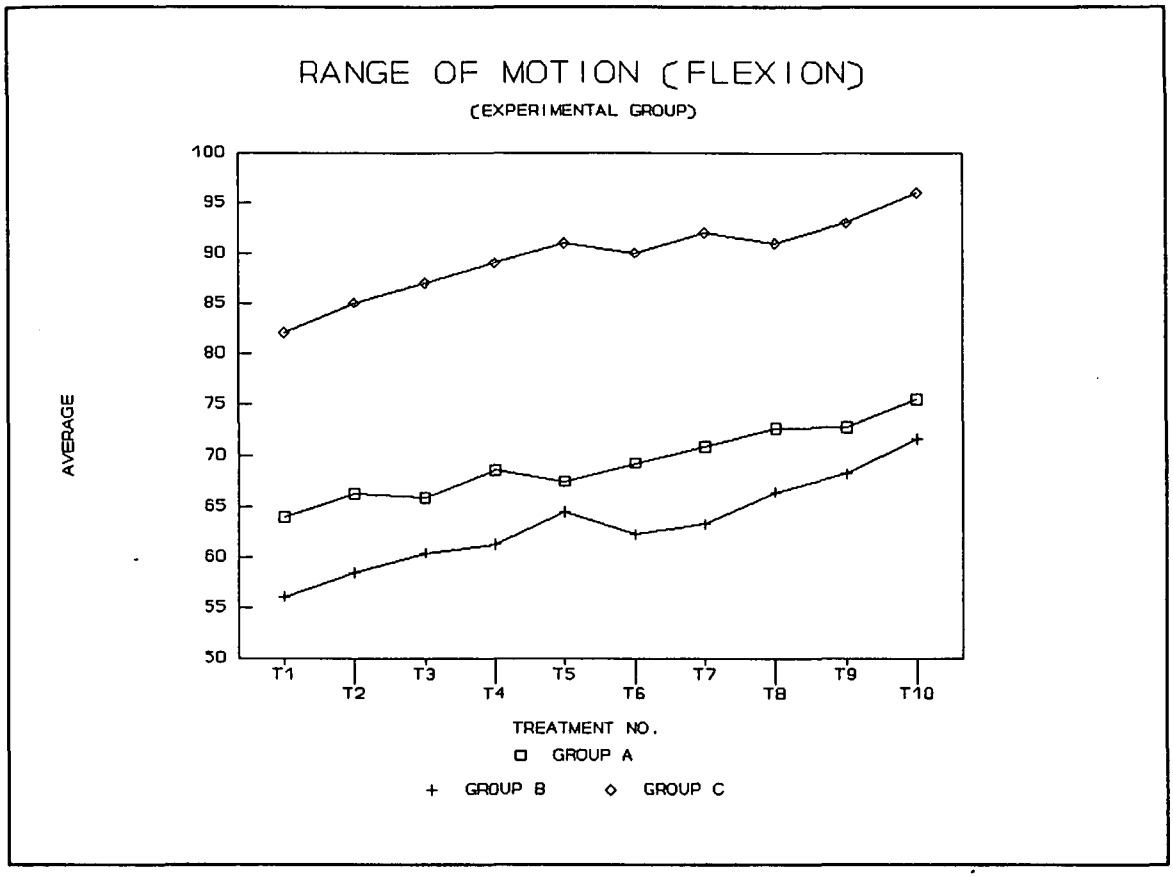


Fig. 4.19: Average value in flexion for Groups A, B and C in the Experimental group at each of the 10 treatments.

Table 4.18: Average value for flexion for Groups A, B and C in the Control group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	70.667	74.444	77.444	78.333	80.556
GROUP B	70.6	74	73.2	76.8	77.6
GROUP C	74	76	78	79	75

	T6	T7	T8	T9	T10
GROUP A	79.667	79.889	82.222	81.889	84.444
GROUP B	77.2	80	79.6	81	82.8
GROUP C	78	76	79	76	78

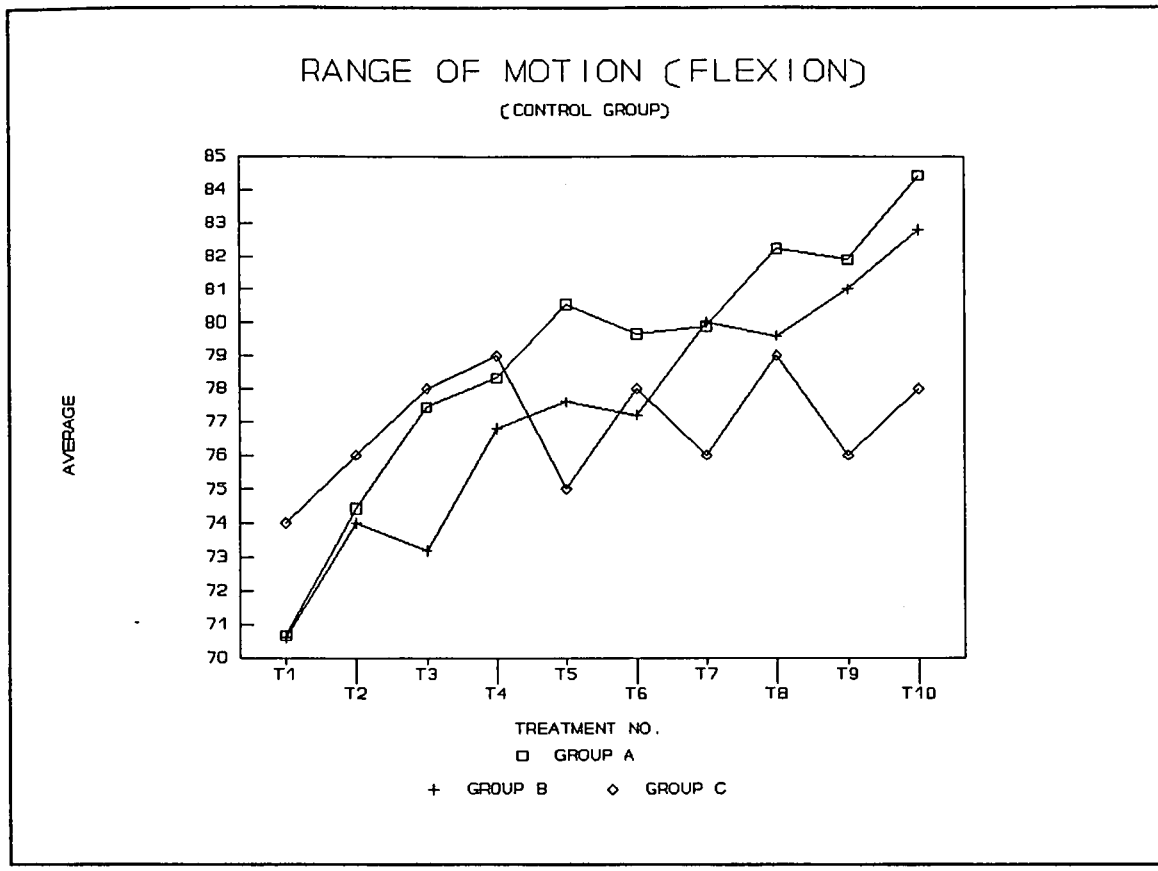


Fig. 4.20: Average value in flexion for Groups A, B and C in the Control group at each of the 10 treatments.

4.7.4. Range of motion (extension)

Table 4.19: Average value for extension for Groups A, B and C in the Experimental group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	28	30.667	30.667	32.889	30.667
GROUP B	25.8	27.2	30.2	29.6	31.4
GROUP C	37	39	41	44	43

	T6	T7	T8	T9	T10
GROUP A	32.222	33.111	35.333	34.556	38.444
GROUP B	31.2	31.6	34.4	34.6	36.8
GROUP C	41	44	42	45	48

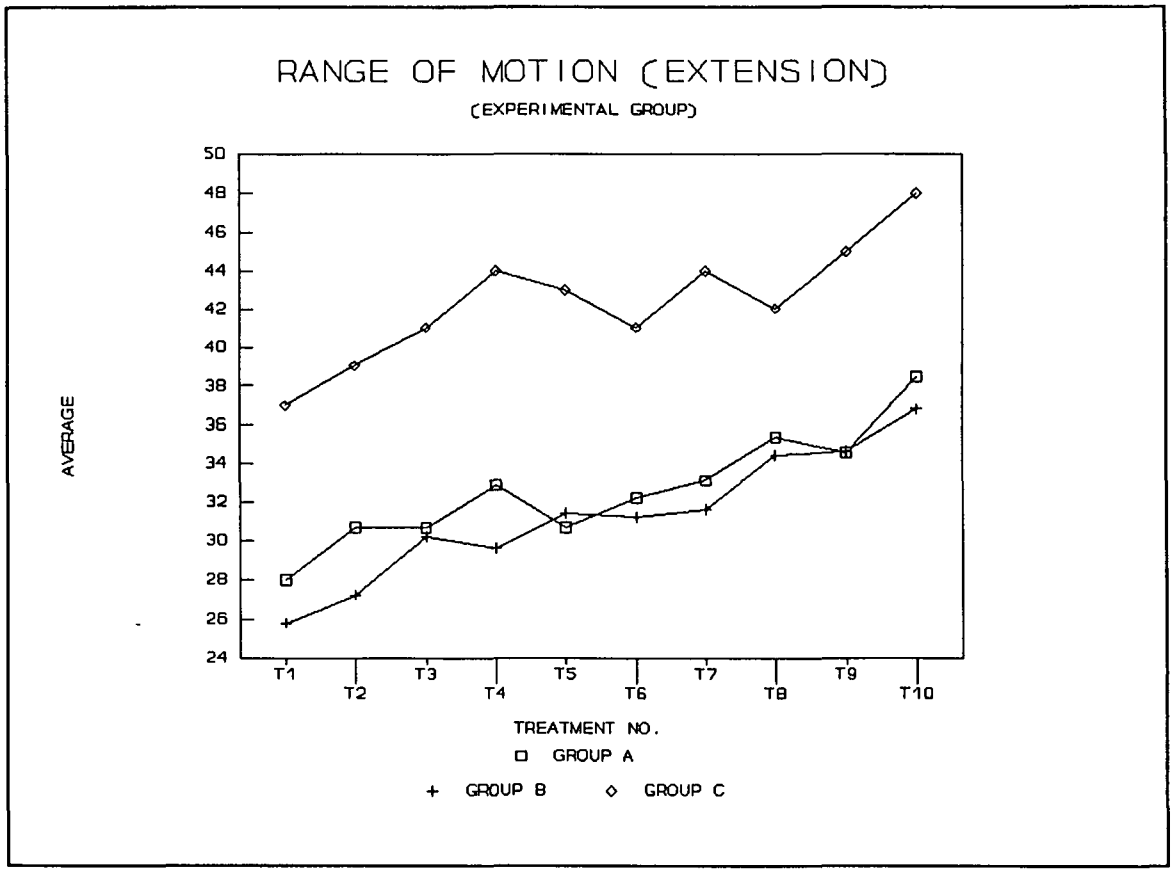


Fig. 4.21: Average value in extension for Groups A, B and C in the Experimental group at each of the 10 treatments.

Table 4.20: Average value for extension for Groups A, B and C in the Control group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	32.889	36	37.667	38.444	39.444
GROUP B	33.8	36	37.2	40	42
GROUP C	20	21	23	25	23

	T6	T7	T8	T9	T10
GROUP A	39.222	39.222	41.444	40.889	43.333
GROUP B	42.8	45	45.6	46.8	48.4
GROUP C	26	25	24	22	26

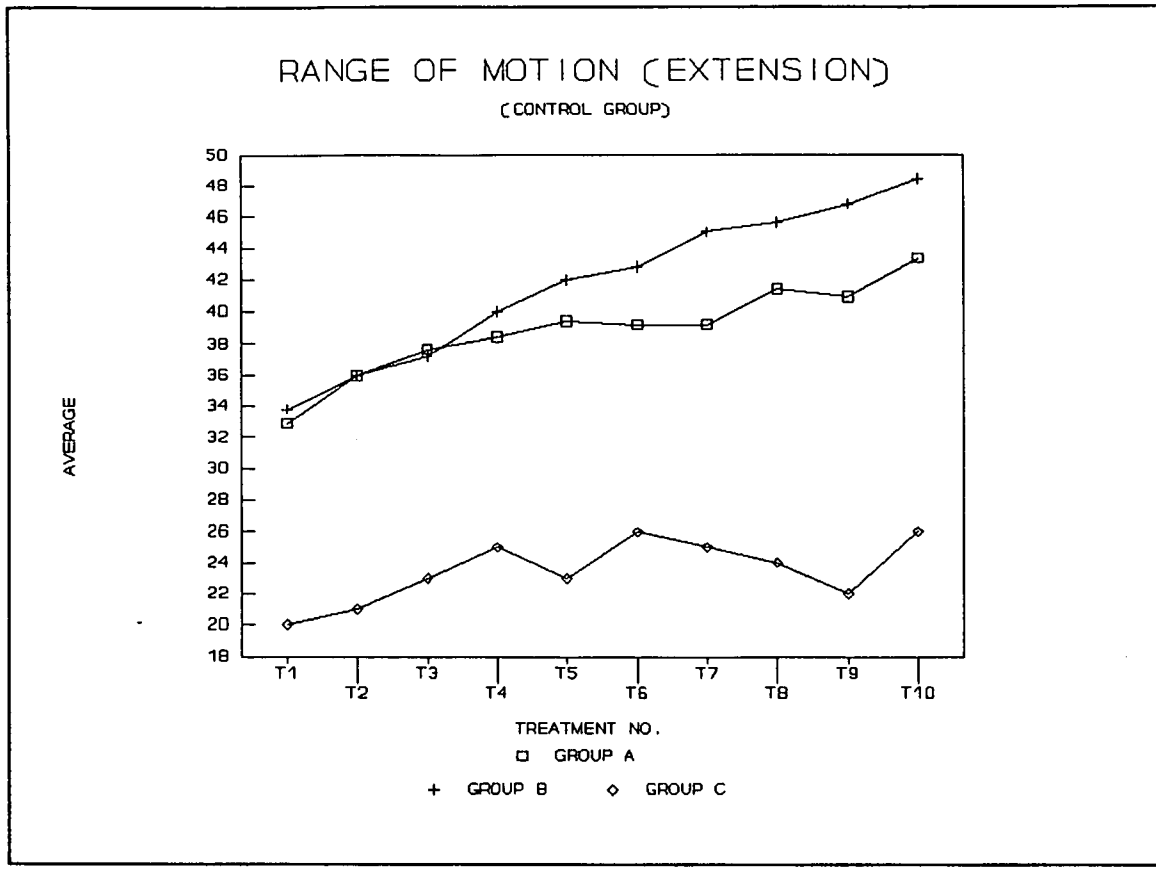


Fig. 4.22: Average value in extension for Groups A, B and C in the Control group at each of the 10 treatments.

4.7.5. Range of motion (left lateral flexion)

Table 4.21: Average value for left lateral flexion for Groups A, B and C in the Experimental group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	21	22	23.111	24.222	22.778
GROUP B	17	17.4	20.2	20.4	21.4
GROUP C	25	27	26	28	26

	T6	T7	T8	T9	T10
GROUP A	24.556	25.333	25.889	27	27.556
GROUP B	20.6	21.8	24	24.4	24.6
GROUP C	27	28	26	27	28

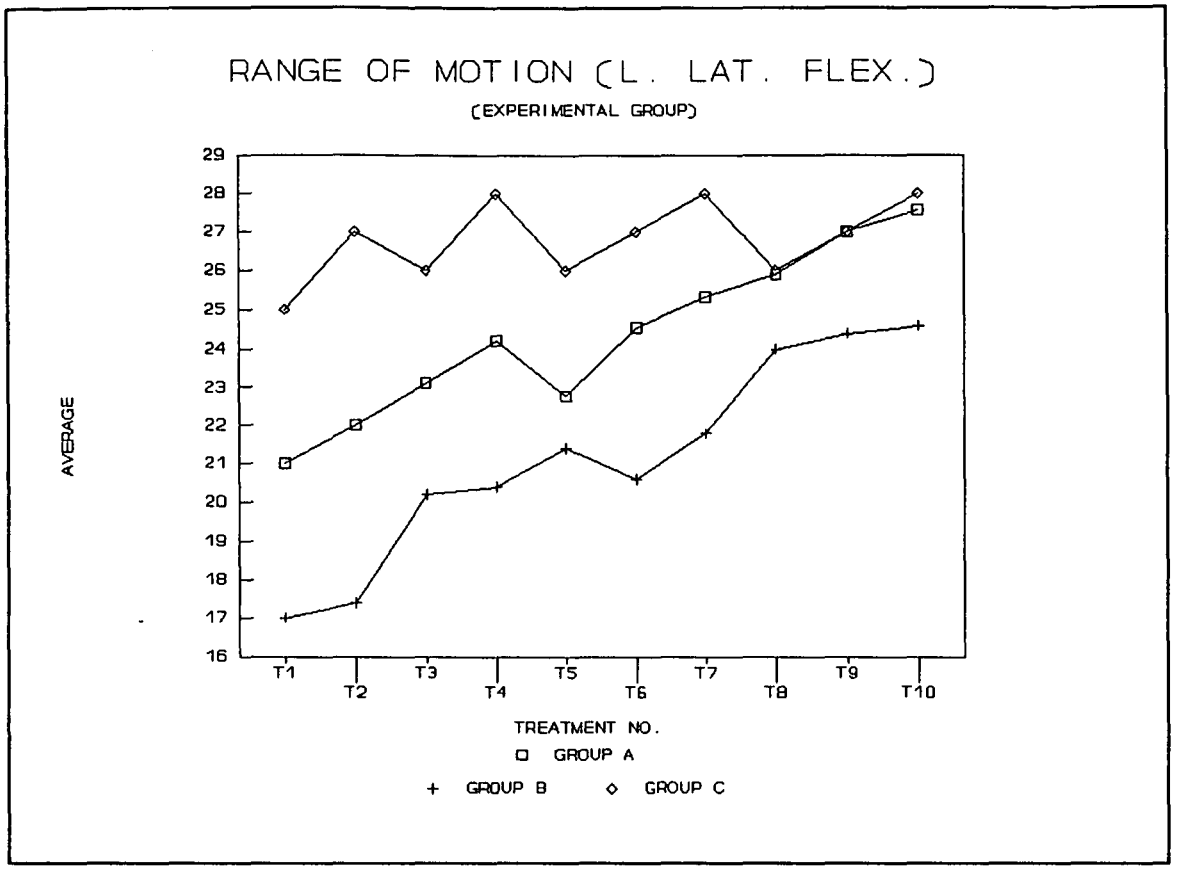


Fig. 4.23: Average value in left lateral flexion for Groups A, B and C in the Experimental group at each of the 10 treatments.

Table 4.22: Average value for left lateral flexion for Groups A, B and C in the Control group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	18.667	20.778	21.556	22	23.222
GROUP B	21.8	21.6	21.8	23.4	24.8
GROUP C	19	20	20	24	25

	T6	T7	T8	T9	T10
GROUP A	23.667	23.222	24.667	25.222	26.222
GROUP B	24.6	27	25.6	26.8	27.8
GROUP C	23	24	26	24	27

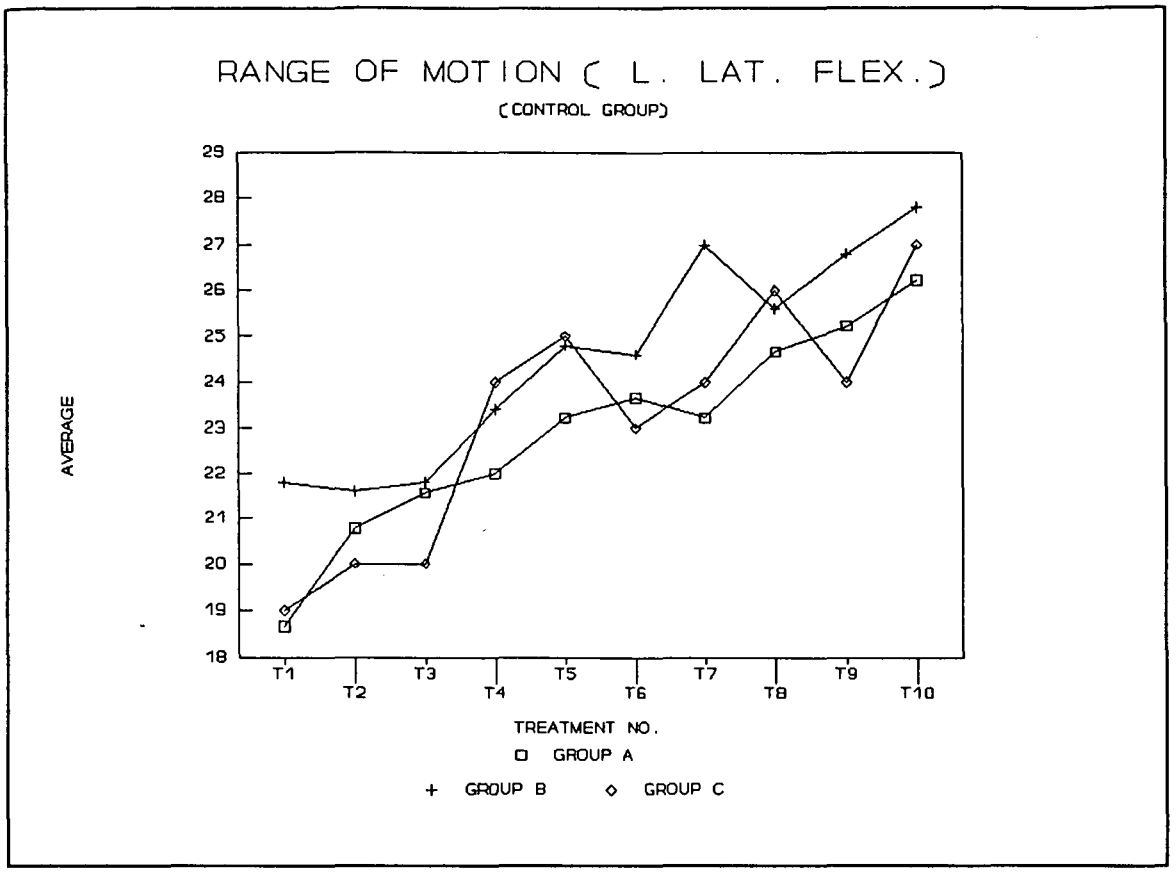


Fig. 4.24: Average value in left lateral flexion for Groups A, B and C in the Control group at each of the 10 treatments.

4.7.6. Range of motion (right lateral flexion)

Table 4.23: Average value for right lateral flexion for Groups A, B and C in the Experimental group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	19.444	20.889	21.222	22.667	21.556
GROUP B	16	17.2	19.8	19.8	21.2
GROUP C	27	26	25	27	28

	T6	T7	T8	T9	T10
GROUP A	23.333	24.111	25.667	25.333	26.111
GROUP B	20.8	21.6	23.6	23.8	24.4
GROUP C	26	28	25	27	29

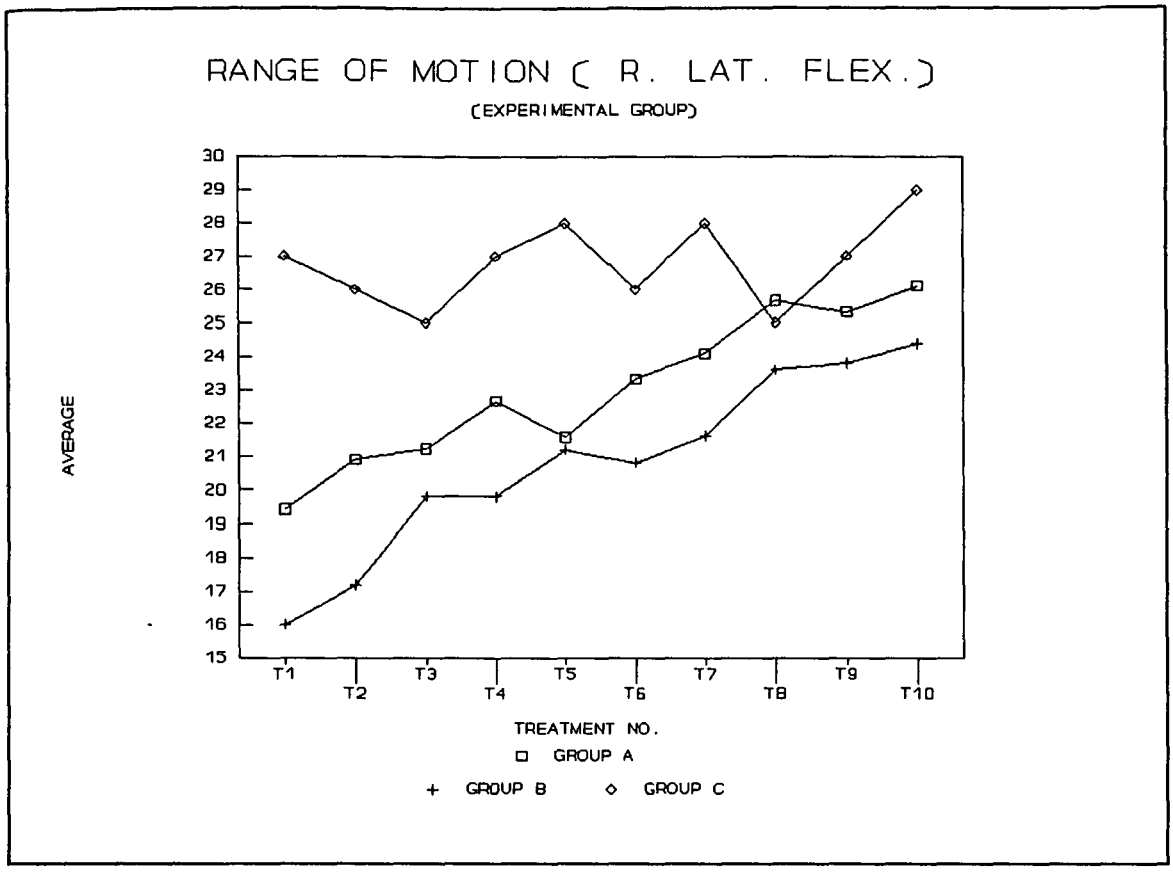


Fig. 4.25: Average value in right lateral flexion for Groups A, B and C in the Experimental group at each of the 10 treatments.

Table 4.24: Average value for right lateral flexion for Groups A, B and C in the Control group at each of the 10 treatments.

	T1	T2	T3	T4	T5
GROUP A	19.778	21.556	22.667	22.667	24.444
GROUP B	20.2	21.8	21.4	24.2	24.2
GROUP C	18	20	23	25	22

	T6	T7	T8	T9	T10
GROUP A	24.333	24.111	25.222	24.889	26.444
GROUP B	23.6	26	25.6	25.2	27.2
GROUP C	24	26	24	23	25

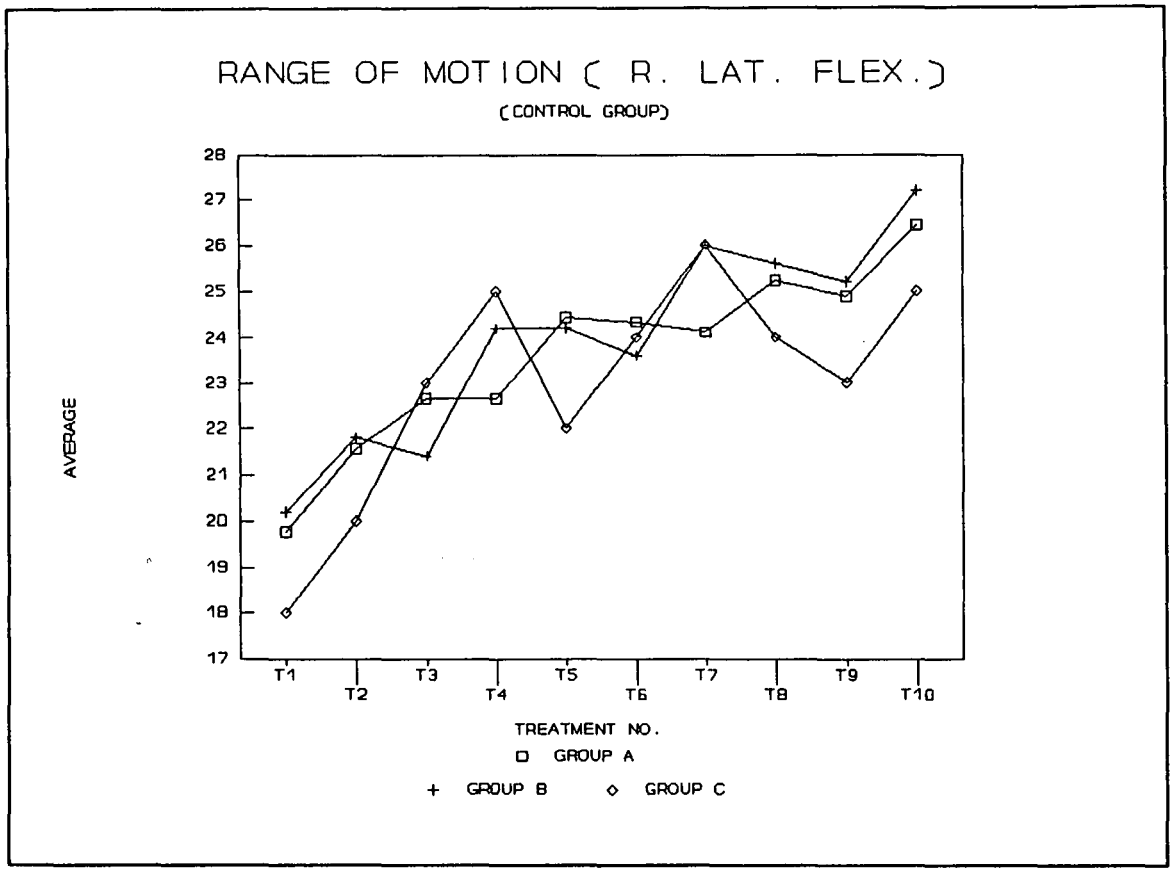


Fig. 4.26: Average value in right lateral flexion for Groups A, B and C in the Control group at each of the 10 treatments.

CHAPTER 5

5. DISCUSSION

5.0. INTRODUCTION

This chapter deals with the discussion of the results presented in Chapter 4. The data will be discussed in terms of the following headings: Numerical Pain Rating Scale, Oswestry Low Back Pain Disability Questionnaire, and range of motion (in flexion, extension, left lateral flexion, and right lateral flexion). The results for groups A, B, and C in both the Experimental and Control group will then be discussed under the same headings.

5.1. NUMERICAL PAIN RATING SCALE

5.1.1. Mann Whitney U-test

This test was used in order to determine whether there was a significant difference in the average rank of the values for the Numerical Pain Rating Scale between the Experimental and Control group at treatments 1 to 10.

It was evident from the results that a statistically significant difference between the Experimental and Control group was present only at treatment number 3 where P = 0,04995 (and this could have possibly been due to the more extensive treatment received by the nurses in the Experimental group). However, no statistically significant difference was noted at treatment number 10. The significant difference was thus not maintained to the 10th treatment therefore there was no overall clinically significant difference noted between the two groups.

5.1.2. Wilcoxon signed-rank test

This test was used in order to determine whether a significant difference existed within the Experimental and Control groups, in terms of the number of favourable differences (assigned a positive value) that were evident at the following treatments: T1-T5; T5-T10; and T1-T10.

The most statistically significant difference within the Experimental group was noted at T1-T10 where P = 0,0006. Other statistically significant differences were noted at T1-T5 (P = 0,0012), and T5-T10 (P = 0,0037). Thus there was a statistically significant difference (in terms of reduced pain) within the Experimental group at treatments: 1-5; 5-10; and 1-10, with the most significant difference evident between the first and tenth treatment. These results were both statistically and clinically significant as they indicated that all 15 of the nurses within the Experimental group experienced a reduction in pain from the first to the tenth treatment as a result of the treatment that they received.

A statistically significant difference within the Control group was noted at T1-T5 and T1-T10 where P = 0,0006. The graph for the Control group was not consistent however, as there was no significant difference within this group at T5-T10. This could possibly have been due to the fact that the Control group did not receive as extensive a treatment as the Experimental group. However, the results indicated that all 15 of the nurses in the Control group demonstrated a reduction in pain from the first to the tenth treatment as a result of the treatment that they received, and this was of overall statistical and clinical significance.

5.2. OSWESTRY LOW BACK PAIN DISABILITY QUESTIONNAIRE

Since the scores for the questionnaires were converted to percentages, the unpaired and paired t-tests were used to test for significant differences between and within the two treatment groups.

5.2.1. Unpaired t-test

This test was used in order to determine whether a significant difference (in terms of reduced disability) existed between the average/means of the Experimental and Control group at treatments 1, 5, and 10.

A statistically significant difference between the two treatment groups was evident only at treatment number 5 (where P = 0,019), and this could be attributed to the fact that the nurses in the Experimental group received far more extensive treatment than those in the Control group. However, there was no statistically significant difference present at treatment 10 or at treatment 1, therefore these results were of no overall clinical or statistical significance. It should be noted that the average percentage for disability decreased in both the Experimental and Control group as the treatment progressed, indicating that both groups responded favourably to their respective treatment.

5.2.2. Paired t-test

This test was used in order to determine whether a significant difference existed within each of the two treatment groups in terms of the number of favourable differences (assigned a positive value) that were present at treatments: 1-5; 5-10; and 1-10.

The most statistically significant difference within the Experimental group was noted at T1-T10 where P = 0,0006. The other statistically significant difference was noted at T5-T10 where P = 0,0031. Thus a statistically significant difference within the Experimental group did become evident as the treatment progressed and was most marked between the first and the tenth treatment [where all 15 nurses demonstrated an improvement (in terms of reduced disability) due to the treatment that they received]. Therefore, these results were of overall clinical significance.

The most statistically significant difference within the Control group was noted at T1-T10 (P = 0,0006), followed by T1-T5 (P = 0,0008) and T5-T10 (P = 0,0086). It should be noted that the results of the Control group were not consistent in that the lowest significant difference was evident at T5-T10 (therefore the graph for the Control group was not a straight line like that of the Experimental group), and this could be attributable to the fact that the Control group did not receive as extensive a treatment as the Experimental group. However, a statistically significant difference was noted within the Control group at T1-T5; T5-T10; and T1-T10, with the most significant difference evident between the first and the tenth treatment (where all 15 nurses experienced a reduction in disability due to the treatment that they received), therefore these results were of overall clinical significance.

5.3. RANGE OF MOTION (FLEXION)

5.3.1. Mann Whitney U-test

This test was used in order to determine whether a significant difference existed between the Experimental and Control group in terms of the average rank for flexion at each of the 10 treatments.

A statistically significant difference was noted between the two groups only at treatment number 5 where P = 0,0441. The data suggested that this could be due to the difference in the type of treatment that each group received. However, no other statistically significant difference was noted at any of the other treatments, therefore these results were of no clinical significance overall.

5.3.2. Wilcoxon signed-rank test

This test was used in order to determine whether a significant difference existed within each of the two treatment groups in terms of the number of favourable differences (assigned a negative value) for flexion at the following treatments:
T1-T5; T5-T10; and T1-T10.

The most statistically significant difference within the Control group was noted at T1-T10 as well as at T1-T5 (P = 0,0006) where all 15 nurses demonstrated an increase in flexion. The other statistically significant difference was noted at T5-T10 (P = 0,0020) where 13 of the 15 nurses demonstrated an increase in flexion. It should be noted that the graph for the Control group did not demonstrate consistency, as evidenced by the smallest significant difference being present at T5-T10. However, a statistically significant difference was noted within the Control group at T1-T5; T5-T10; and T1-T10 therefore these results were of overall clinical significance. The data suggested that the nurses in this treatment group demonstrated an overall improvement in terms of increased range of motion in flexion as the treatment progressed due to the treatment that they received.

The most statistically significant difference within the Experimental group was noted at T5-T10 and T1-T10 (P = 0,0006) where all 15 nurses demonstrated increased flexion. A statistically significant difference was also noted at T1-T5 (P = 0,0020) where 13 of the 15 nurses demonstrated an increase in flexion. Thus the data showed that the Experimental group demonstrated an improvement in terms of increased range of motion in flexion during the course of treatment (due to the type of treatment that they received), and these results were of overall clinical significance.

5.4. RANGE OF MOTION (EXTENSION)

5.4.1. Mann Whitney U-test

This test was used in order to determine whether a significant difference existed between the Experimental and Control group in terms of average rank in extension at each of the 10 treatments.

The most statistically significant difference between the two treatment groups was noted at treatment number 5 where P = 0,0078. This was closely followed by treatment number 7 where P = 0,0083. The data suggested that a statistically significant difference in extension was present between the Experimental and Control group at each of the 10 treatments, and this could be attributable to the difference in the type of treatment administered to the nurses within each of these groups. Therefore these results were of overall statistical and clinical significance.

5.4.2. Wilcoxon signed-rank test

This test was used in order to determine whether a significant difference existed within each of the two treatment groups in terms of the number of favourable differences in extension (assigned a negative value) at the following treatments: T1-T5; T5-T10; and T1-T10.

The most statistically significant difference within the Control group was evident at T1-T5 (P = 0,0006) where all 15 nurses demonstrated increased extension. It should be noted that a statistically significant difference was also noted at T5-T10 and at T1-T10 (where 13 and 14 of the nurses respectively demonstrated an increase in extension). The data indicated that there was an overall improvement within the Control group in terms of increased range of motion in extension as the treatment progressed, because of the type of treatment administered to nurses within this group, and these results were of overall clinical significance.

The most statistically significant difference within the Experimental group was noted at T5-T10 and T1-T10 (P = 0,0006) where increased extension was noted in all 15 nurses. A statistically significant difference was also noted at T1-T5 where 12 of the 15 nurses demonstrated an increase in extension. Thus the data showed an improvement (in terms of increased range of motion in extension) within the Experimental group during the course of the treatment, and these results were clinically significant overall.

The graph for the Experimental group was consistent when compared to that for the Control group, in that the most significant difference was maintained (and this could possibly be due to the more extensive treatment received by nurses within the Experimental group). However, it should be noted that an overall statistically and clinically significant difference was evident within both groups (in terms of increased range of motion in extension) as the treatment progressed, irrespective of whether the nurses received chiropractic spinal manipulation on its own or whether they received chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice.

5.5. RANGE OF MOTION (LEFT LATERAL FLEXION)

5.5.1. Mann Whitney U-test

This test was used in order to determine whether a significant difference existed between the Experimental and Control group in terms of the average rank for left lateral flexion at each of the 10 treatments. The data revealed no statistically significant difference in left lateral flexion between the Experimental and Control group at any of the 10 treatments, therefore the results were of no statistical or clinical significance.

5.5.2. Wilcoxon signed-rank test

This test was used in order to determine whether a significant difference existed within the Experimental and Control groups in terms of the number of favourable differences (assigned a negative value) in left lateral flexion at treatments: 1-5; 5-10; and 1-10.

The most statistically significant difference within both the Control and Experimental group was noted at T1-T10 (P = 0,0006) where all 15 nurses within each group demonstrated an increase in left lateral flexion. Statistically significant differences were also noted at T1-T5 and T5-T10 within both groups. The data suggested an overall improvement (in terms of increased range of motion in left lateral flexion) within both the Control and Experimental group, most evident between the first and the tenth treatment. Therefore the results for both treatment groups were clinically significant overall.

5.6. RANGE OF MOTION (RIGHT LATERAL FLEXION)

5.6.1. Mann Whitney U-test

This test was used in order to determine whether a significant difference existed between the Experimental and Control group in terms of the average rank in right lateral flexion at each of the 10 treatments.

The data revealed no statistically significant difference between the Experimental and Control group at any of the 10 treatments, thus there was no statistically or clinically significant difference (in terms of increased range of motion in right lateral flexion) between the nurses receiving chiropractic spinal manipulation on its own or those receiving chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice.

5.6.2. Wilcoxon signed-rank test

This test was used in order to determine whether a significant difference existed within the Experimental and Control group in terms of the number of favourable differences (assigned a negative value) in right lateral flexion at the following treatments: T1-T5; T5-T10; and T1-T10.

The most statistically significant difference within both the Control and Experimental group was noted at T1-T10 (P = 0,0006) where all 15 nurses within each group demonstrated increased right lateral flexion. Other statistically significant differences were noted at T1-T5 and T5-T10. Thus the data demonstrated an overall improvement (in terms of increased range of motion in right lateral flexion) within both the Control and Experimental group, which was most marked between the first and the tenth treatment. Therefore, the results for both treatment groups were clinically significant overall.

5.7. ADDITIONAL STATISTICS

The nurses in both the Experimental and Control group presenting with the same type of mechanical low back condition / syndrome (diagnosed according to the Kirkaldy-Willis classification for mechanical low back pain) were grouped together (still remaining within their respective Experimental/Control groups), in order to determine which of the mechanical low back conditions were prevalent (including the percentage distribution of these conditions) within a small sample of the nursing profession.

Two syndromes were found to be prevalent within this small sample of nurses, namely the Sacroiliac Syndrome (SI SYNDROME) and Myofascial Dysfunction Syndrome of the Quadratus Lumborum (MFPDS QL). The third condition was a combination of the above-mentioned syndromes i.e. Sacroiliac Syndrome associated with Myofascial Dysfunction Syndrome of the Quadratus Lumborum.

The nurses were divided into 3 groups: Groups A, B, and C.

Group A consisted of 60 % of the nurses, and these presented with SI SYNDROME associated with MFPDS QL.

Group B consisted of 33,333 % of the nurses, and these presented with SI SYNDROME.

Group C consisted of 6,667 % of the nurses, and these presented with MFPDS QL.

It was interesting to note that none of the nurses presented with any other form of mechanical low back pain (as classified by the Kirkaldy-Willis model).

It should be noted that only the average values were plotted for Groups A, B, and C at the respective treatments for the Oswestry Low Back Pain Disability Questionnaire, the Numerical Pain Rating Scale, and ranges of motion. No statistical tests could be performed because of the small sample size within each of these groups.

5.7.1. Oswestry Low Back Pain Disability Questionnaire

Experimental group:

Groups A, B, and C demonstrated the most improvement in terms of reduced disability at treatment number 10. The results suggested that this improvement might have continued had the nurses received more treatments. The graphs for Groups A and B showed a consistent decline in disability, however the graph for Group C was inconsistent in that it showed an increase in disability at treatment number 5 before there was a decrease in disability which was evident at treatment number 10. However, the data demonstrated an overall improvement in Groups A, B, and C within the Experimental group in that the nurses experienced less disability by the tenth treatment compared to the initial amount of disability that they presented with before the commencement of treatment.

Control group:

Groups A, B, and C in the Control group demonstrated the most improvement in terms of reduced disability at treatment number 10. The graphs for the three groups showed consistency (in that the percentage for disability was reduced at a consistent rate) from the first to the tenth treatment. When looking at the graph it seems that the improvement in Group C is not as marked as that in the other two groups, however, there was only one nurse within this group and thus the average percentage values of that nurse alone were taken into consideration.

When looking at the combined graph of Groups A, B, and C in the Experimental and Control group, it was evident that there was an overall improvement (in terms of reduction in disability due to mechanical low back pain) in each of these groups in both the Experimental and Control group which was most marked at treatment number 10, irrespective of whether the nurses received chiropractic spinal manipulation on its own, or whether it was combined with other treatment modalities used in a chiropractic practice.

The discrepancy noted in Group C of the Experimental group at treatment number 5 could have been due to a number of factors: there was only one nurse within this group (therefore only the average values of that nurse could be taken into consideration); the nurse had her QL trigger points needled as she had MFPDS QL and was in the Experimental group, and this could have made her more sensitive to pain thus contributing to her level of disability temporarily; or she could have injured her low back while she was on duty as it should be noted that some nurses had to return to work immediately after treatment and therefore could not rest their backs. However, the nurse did show a marked improvement in terms of reduced disability by treatment number 10.

5.7.2. Numerical Pain Rating Scale

Experimental group:

The lowest average value (and thus the most favourable result) for the Numerical Pain Rating Scale was evident at treatment number 10 in Groups A, B, and C. The graph demonstrated an erratic pattern for all the groups during the course of treatment which could be due to the fact that the nurses could not rest between treatments as they had to return to their shifts (during which they continued to perform their duties which included lifting and moving patients etc.). This would explain the occasional exacerbations that were noted which inevitably hindered their progress. It should be noted that this could also have been a normal reaction to the type of treatment that the subjects received.

However, the overall trend of the graph was downwards for Groups A, B, and C in the Experimental group indicating a marked improvement (in terms of a reduction in pain intensity) from the first to the tenth treatment.

Control group:

In the Control group, the lowest average value for pain intensity was noted at: T8 followed by T10 in Group A;

T7 and T10 in Group B; and

T2, T6, T7, and T10 in Group C.

The data suggested that Group C started showing a marked improvement (in terms of reduced pain intensity) earlier than the other two groups (i.e. at T2) and demonstrated the same improvement at T6, T7, and T10, even though there were exacerbations in between (possibly for the same reasons as mentioned before). Group C fared better than Group B as it showed the same maximum improvement at four treatments (as opposed to two in Group B). Group A showed the most improvement at T8 but then deteriorated slightly in that the next lowest value for pain intensity was at T10. Therefore Group A experienced the least pain at T8 followed by T10 (in which the value for pain intensity was slightly higher than in T8). The graph for all 3 groups demonstrated an erratic pattern possibly for the same reasons as before, however there was an overall downward trend indicating an improvement in terms of reduced pain in Groups A, B, and C of the Control group which was especially evident between the first and last treatment in groups B and C.

5.7.3. Range of motion (flexion)

Experimental group:

The highest average value (and therefore the most favourable result as it indicated increased mobility) was found at T10 in Groups A, B, and C in the Experimental group. The graph for these groups demonstrated an overall upward trend with improvement (in terms of increased range of motion in flexion) most marked between T1 and T10.

Control group:

The highest average value for flexion was noted at T10 in Groups A and B, and at T4 & T8 in Group C. The next highest value in Group C (which was only one degree less than the average value for flexion at T4 & T8) was noted at treatments: 3, 6, and 10. Therefore, even though an erratic pattern was evident in the graph for Group C, this group demonstrated an overall improvement. The data showed that there was a general improvement in flexion in Groups A, B, and C in the Control group as evidenced by the overall upward trend of the graph for these respective groups.

5.7.4. Range of motion (extension)

Experimental group:

The most improvement (in terms of greatest degree of range of motion in extension) was noted at T10 in Groups A, B, and C. The overall trend of the graph was upwards indicating an overall improvement within each of these groups from the first to the tenth treatment.

Control group:

Groups A, B, and C showed the greatest improvement (in terms of increased range of motion in extension) at T10. Group C showed this improvement earlier at T6 after which extension became progressively less until T10 when maximum extension for that group was reached once again. Group C demonstrated an erratic pattern possibly for the same reasons mentioned previously. The overall trend of the graph for the 3 groups was upwards indicating an overall improvement in terms of increased extension between the first and tenth treatment.

5.7.5. Range of motion (left lateral flexion)

Experimental group:

The greatest degree of left lateral flexion was achieved at T10 in Groups A and B, thus an improvement (in terms of increased range of motion in left lateral flexion) was noted from the first to the last treatment in both groups, and this was confirmed by the upward trend of the graph for both these groups. Group C demonstrated the greatest degree of left lateral flexion at T4, T7, & T10, i.e. this group achieved its greatest range of motion in left lateral flexion at three different treatments compared to one (as in Groups A and B). However, left lateral flexion was reduced by the next treatment after T4 & T7 in Group C. This erratic pattern in Group C demonstrated inconsistency in left lateral flexion, thus no specific trend was noted within this group. The reason for this is that only one observation was present in Group C.

Control group:

The greatest degree of left lateral flexion was achieved at T10 in Groups A, B, and C of the Control group. All groups were consistent in terms of greatest improvement at T10. An erratic pattern was evident in all groups possibly due to the fact that the nurses within these groups returned to work immediately after their treatment, thus not allowing their backs to rest between treatments (thereby hindering optimal recuperation). The small sample size within each of these groups contributed to the fluctuations evident in the graph, however the general trend was upwards which indicated an overall improvement (in terms of increased range of motion in left lateral flexion).

5.7.6. Range of motion (right lateral flexion)

Experimental group:

Groups A, B, and C of the Experimental group achieved their greatest degree of right lateral flexion at T10. Thus an improvement was noted from the first to the last treatment and this was confirmed by the upward trend of the graph. Once again, an erratic pattern was evident within the groups but was most marked in Group C (in which the results of only one nurse were recorded). However, an overall improvement (in terms of increased range of motion in right lateral flexion) was noted in all the groups.

Control group:

Groups A and B demonstrated the greatest degree of right lateral flexion at T10, thus an improvement was noted between T1 and T10 in both these groups. Group C demonstrated the greatest degree of right lateral flexion at T7, after which it decreased gradually over the next two treatments and then increased again at T10 to a value which was one degree less than that at T7. The results of Group C were inconsistent and demonstrated an erratic pattern probably due to the small sample size of this group (namely one nurse). It should be noted, however, that an overall improvement was evident within Groups A, B, and C of the Control group and this was confirmed by the overall upward trend of the graph (especially for Groups A and B).

5.7.7. Comments

It was evident that some of the graphs demonstrated an erratic pattern, even though an overall improvement was noted. There were exacerbations evident throughout the treatments in some cases and this could possibly be explained by the fact that some nurses could not rest their backs between treatments as they had to return to work immediately after the treatment and resume their duties (which included the lifting and moving of heavy patients among other things). Some nurses injured their back at work which exacerbated their condition thus hindering their progress.

Advising the nurses about correct lifting methods did not seem to make much of a difference as many pointed out the impracticalities of such methods in a hospital setting epecially with respect to time constraints in an emergency situation.

The problem with Group C was that there was only one nurse within the Experimental and Control group respectively. The small sample size within each of these groups would thus explain the discrepancy in the trend of Group C when compared to the other two groups. The greater the sample size, the smoother the curve (as there are more observations to work from), therefore fluctuations were evident in the graphs for Group C as only one observation was noted at each of the treatments.

5.8. PROBLEMS ENCOUNTERED IN THE PROJECT

There was a poor response of the nursing profession to the advertisements for this particular study due to their time constraints and lack of transport. The nurses worked different shifts, therefore some could only be treated weekly whereas others could be treated twice or three times a week (depending on their availability for treatment). There was thus no uniformity in the frequency of treatments among the nurses, and this could explain some of the variation in response of the nurses to treatment. Another problem was that the nurses could not rest between treatments as they had to return to work where they continued to subject their backs to the strain of lifting and moving patients. Some nurses had to return to work immediately after treatment thereby not giving their low back a chance to recuperate and simultaneously predisposing themselves to further injury.

Finally, the goniometer used for purposes of this study was not very accurate as a means of measuring the ranges of motion for the following two reasons:

(1) The arms of the instrument were too short therefore the researcher was unable to superimpose them over the relevant landmarks and thus had to resort to 'aiming' the arms at the landmarks instead. This introduced problems of reliability of the measuring instrument.

(2) The design of the goniometer did not allow for the measurement of rotation.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1. CONCLUSION

It was evident from the data that nurses in both the Experimental group and the Control group responded favourably to their respective treatment.

A statistically significant difference was noted between the Experimental and Control group in terms of:

(a) A reduction in pain intensity (only at treatment 3).
(b) A reduction in disability resulting from mechanical low back pain (only at treatment 5).
(c) Increased range of motion in forward flexion (only at treatment 5).
(d) Increased range of motion in extension (at each of the 10 treatments).

With the exception of extension, there was no statistically significant difference present between the Experimental and Control group at treatment number 10 [or at any of the other treatments except for the ones mentioned in (a), (b), and (c) above].

Notwithstanding the results found in extension, it would be fair to say that there was no clinically significant difference between the two groups. It should be noted that there was no statistically significant difference evident for left or right lateral flexion between the Experimental and Control group at any of the treatments. The hypothesis that chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice would be more effective than chiropractic spinal manipulation on its own, was thus rejected. It is clear though, that spinal manipulative therapy is the most effective intervention. Further larger studies are needed to more clearly evaluate the value (if any) of combined therapy. Alternatively, spinal manipulative therapy alone would seem to be the treatment of choice in the management of the sacroiliac syndrome and myofascial pain and dysfunction syndrome of the quadratus lumborum.

However, a statistically significant difference was noted between the two groups at treatment 10 (and at all other treatments) in (d) above, therefore only the results for ranges of motion in extension were of statistical and clinical significance. The statistically significant differences between the Experimental and Control group for extension could be attributed to the fact that nurses in the Control group did not receive as extensive a treatment as the nurses in the Experimental group.

A statistically significant difference was noted within both the Experimental and Control group, where all 15 nurses (within each of these groups) demonstrated an improvement between the first and the last treatment in terms of:

(a) Reduction in pain intensity.

(b) Reduction in disability.

(c) Increased range of motion in flexion, extension (14 out of the 15 nurses in the Control group - still statistically significant), left and right lateral flexion.

These results were of overall statistical and clinical significance, and indicated that the nurses in both treatment groups responded favourably to their respective form of chiropractic treatment. Therefore, the hypotheses stating that both forms of chiropractic treatment would be beneficial in the management of mechanical low back pain in nurses (hypothesis 2 and 3) were accepted.

The Sacroiliac Syndrome (SI SYNDROME) and the Myofascial Dysfunction Syndrome of the Quadratus Lumborum (MFPDS QL) were the mechanical low back conditions found to be most prevalent within this small sample of the nursing profession.

- 60 % of nurses presented with SI SYNDROME associated with MFPDS QL (Group A).
- 33,333 % of nurses presented with SI SYNDROME (Group B).
- 6,667 % of nurses presented with MFPDS QL (Group C).

Nurses in Groups A, B and C within both the Experimental and Control group demonstrated an overall improvement in terms of: a marked reduction in disability and pain intensity resulting from mechanical low back pain ; and an increased range of motion in forward flexion, extension, left lateral flexion and right lateral flexion (irrespective of whether they received chiropractic spinal manipulation on its own or whether it was combined with other treatment modalities used in a chiropractic practice).

6.2. RECOMMENDATIONS

It is recommended that a larger sample size be used in future studies in order to increase the validity of the study. A more accurate goniometer should be used in order to eliminate problems of reliability of the instrument. Future studies should attempt to group the nurses together in terms of similarities such as age, years of nursing experience, height, build, race etc. in order to eliminate as many variables as possible. A larger sample size would be required in order to achieve this. Future studies should also attempt to determine whether a larger sample size reveals a greater variety of mechanical low back pain conditions (as classified by the Kirkaldy-Willis model) or the absence of conditions other than those found to be prevalent in this study. It would be advisable to re-evaluate the nurses after one month, six months, and a year, in order to monitor the nurses' progress and to determine whether the improvement has been maintained and for how long.

The long-term efficacy of chiropractic spinal manipulation on its own versus chiropractic spinal manipulation combined with other treatment modalities used in a chiropractic practice could thus also be ascertained. Future studies should attempt to ensure that all nurses are treated at similar time intervals over the same time period. The researcher should insist that the nurses rest between treatments and that they refrain from lifting and moving patients during the course of treatment if possible (however, this may prove to be impractical and is therefore only a suggestion).

In conclusion, it is evident from this study that nurses do experience low back pain of a mechanical nature, and this condition can be successfully managed using chiropractic. The results of this study showed that the nurses responded favourably to their treatment, irrespective of whether they received chiropractic spinal manipulation on its own or whether it was combined with other treatment modalities used in a chiropractic practice (such as: soft tissue therapy, myofascial trigger point therapy, electrotherapy, ice and McManis traction).

The nurses within both treatment groups demonstrated an improvement in that they experienced a reduction in pain and disability, and an increased range of motion which was most evident when comparing results from the first to the last treatment. No overall significant difference was noted between the two treatment groups, except for increased range of motion in extension. In view of the results of this study, it is imperative that the nursing profession be made aware of the benefits of chiropractic care which also includes patient education regarding correct lifting methods as well as specific stretching and strengthening exercises for the back in order to reduce the risk of back injury, especially to the lumbar spine.

CHAPTER 7

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CHAPTER 8

APPENDICES

Table 8.1: List of appendices and what their symbols represent.

Appendix A	Patient consent form
Appendix B	Kirkaldy-Willis classification for mechanical low back pain
Appendix C	Oswestry Low Back Pain Disability Questionnaire
Appendix D	Numerical Pain Rating Scale
Appendix E	Lumbar spine ranges of motion
Appendix F	Symptom diagram
Appendix G	Case history form
Appendix H	Physical examination form
Appendix I	Low back regional examination form

APPENDIX A

PATIENT INFORMED CONSENT FORM

Dear patient,

Your participation in this research study concerning the management of mechanical low back pain in nurses will require the disclosure of certain personal details such as age, address and telephone number.

You will be questioned extensively as to your low back condition and your health in general. A thorough physical examination will be undertaken together with x-rays if indicated, and management will consist of ten treatments. It should be noted that there will be no charge for treatments or x-rays.

Please be as accurate as possible when completing the questionnaires and the rating scales. It is also important to adhere to the designated management programme and to comply with any instructions or requests of the researcher.

We assure you that all information disclosed will be kept strictly confidential and we thank you for your co-operation.

Date:_____

I, the undersigned, am willing to participate in this research study and give my consent to be questioned, examined, x-rayed and treated for research purposes at Technikon Natal Chiropractic Day Clinic, 11 Ritson Road, Durban, 4001.

_____ _____

Patient (printed name) Signature

_____ _____

Witness (printed name) Signature

APPENDIX B

THE KIRKALDY - WILLIS MODEL OF CLASSIFICATION FOR MECHANICAL LOW BACK PAIN.

posterior facet syndrome

sacroiliac syndrome

Maigne's syndrome

disc herniation

facet and disc degeneration

lateral stenosis

central stenosis

multilevel stenosis

myofascial syndrome : gluteus maximus

gluteus medius

gluteus minimus

quadratus lumborum

piriformis

tensor fascia latae

hamstring

Exhibit 7.3 The Oswestry Low Back Pain Disability Questionnaire

How long have you had back pain? ..... Years ..... Months ..... Weeks

How long have you had leg pain? ..... Years ..... Months ..... Weeks

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

Section 1 — Pain Intensity
- ☐ I can tolerate the pain I have without having to use pain killers.
- ☐ The pain is bad but I manage without taking pain killers.
- ☐ Pain killers give complete relief from pain.
- ☐ Pain killers give moderate relief from pain.
- ☐ Pain killers give very little relief from pain.
- ☐ Pain killers have no effect on the pain and I do not use them.

Section 2 — Personal Care (Washing, Dressing, etc)
- ☐ I can look after myself normally without causing extra pain.
- ☐ I can look after myself normally but it causes extra pain.
- ☐ It is painful to look after myself and I am slow and careful.
- ☐ I need some help but manage most of my personal care.
- ☐ I need help every day in most aspects of self care.
- ☐ I do not get dressed, wash with difficulty and stay in bed.

Section 3 — Lifting
- ☐ I can lift heavy weights without extra pain.
- ☐ I can lift heavy weights but it gives extra pain.
- ☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, eg on a table.
- ☐ Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned.
- ☐ I can lift only very light weights.
- ☐ I cannot lift or carry anything at all.

Section 4 — Walking
- ☐ Pain does not prevent me walking any distance.
- ☐ Pain prevents me walking more than 1 mile.
- ☐ Pain prevents me walking more than ½ mile.
- ☐ Pain prevents me walking more than ¼ mile.
- ☐ I can only walk using a stick or crutches.
- ☐ I am in bed most of the time and have to crawl to the toilet.

Section 5 — Sitting
- ☐ I can sit in any chair as long as I like.
- ☐ I can only sit in my favourite chair as long as I like.
- ☐ Pain prevents me sitting more than 1 hour.
- ☐ Pain prevents me from sitting more than ½ hour.
- ☐ Pain prevents me from sitting more than 10 mins.
- ☐ Pain prevents me from sitting at all.

Section 6 — Standing
- ☐ I can stand as long as I want without extra pain.
- ☐ I can stand as long as I want but it gives me extra pain.
- ☐ Pain prevents me from standing for more than 1 hour.
- ☐ Pain prevents me from standing for more than 30 mins.
- ☐ Pain prevents me from standing for more than 10 mins.
- ☐ Pain prevents me from standing at all.

Section 7 — Sleeping
- ☐ Pain does not prevent me from sleeping well.
- ☐ I can sleep well only by using tablets.
- ☐ Even when I take tablets I have less than six hours sleep.
- ☐ Even when I take tablets I have less than four hours sleep.
- ☐ Even when I take tablets I have less than two hours sleep.
- ☐ Pain prevents me from sleeping at all.

Section 8 — Sex Life
- ☐ My sex life is normal and causes no extra pain.
- ☐ My sex life is normal but causes some extra pain.
- ☐ My sex life is nearly normal but is very painful.
- ☐ My sex life is severely restricted by pain.
- ☐ My sex life is nearly absent because of pain.
- ☐ Pain prevents any sex life at all.

Section 9 — Social Life
- ☐ My social life is normal and gives me no extra pain.
- ☐ My social life is normal but increases the degree of pain.
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, eg dancing, etc.
- ☐ Pain has restricted my social life and I do not go out as often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have no social life because of pain.

Section 10 — Travelling
- ☐ I can travel anywhere without extra pain.
- ☐ I can travel anywhere but it gives me extra pain.
- ☐ Pain is bad but I manage journeys over two hours.
- ☐ Pain restricts me to journeys of less than one hour.
- ☐ Pain restricts me to short necessary journeys under 30 minutes.
- ☐ Pain prevents me from travelling except to the doctor or hospital.

Comments .....

.....

Scoring (not seen by patients)

For each section the total possible score is 5; if the first statement is marked the section score = 0, if the last statement is marked it = 5.

If all ten sections are completed the score is calculated as follows:

Example: $\frac{16}{50}$ (total scored) / (total possible score) x 100 = 32%

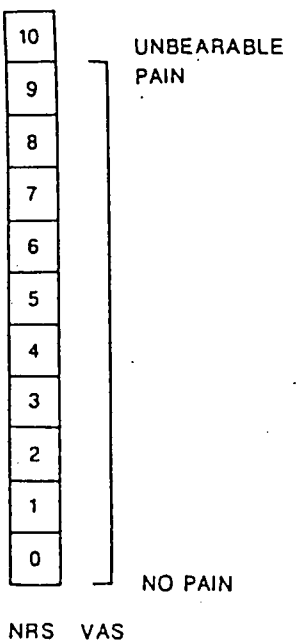
If one section is missed or not applicable the score is calculated:

Example: $\frac{16}{45}$ (total scored) / (total possible score) x 100 = 35.5%

Reproduced from Fairbank JCT, Couper J, Davies JB, O'Brien JP. The Oswestry Low Back Pain Disability Questionnaire. Physiotherapy 1980;66:272.

APPENDIX D

Exhibit 7.2 Formats of the Numerical Rating (NRS) and Visual Analogue Scales (VAS) as Used by Downie et al.



Reproduced from Downie WW, Leatham PA, Rhind VM, Wright V, Branco JA, Anderson JA. Studies with pain rating scales. Ann Rheum Dis 1978;37:378. Figure 1. With permission.

Ranges of motion:

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

VISIT #

	INITIAL CONSULT.	1	2	3	4	5	6	7	8	9	10
FLEXION	/										
EXTENSION	/										
R. LAT. FLEX.	/										
L. LAT FLEX	/										
ROT. TO R.	/										
ROT. TO L.	/										

PATIENT :

APPENDIX F

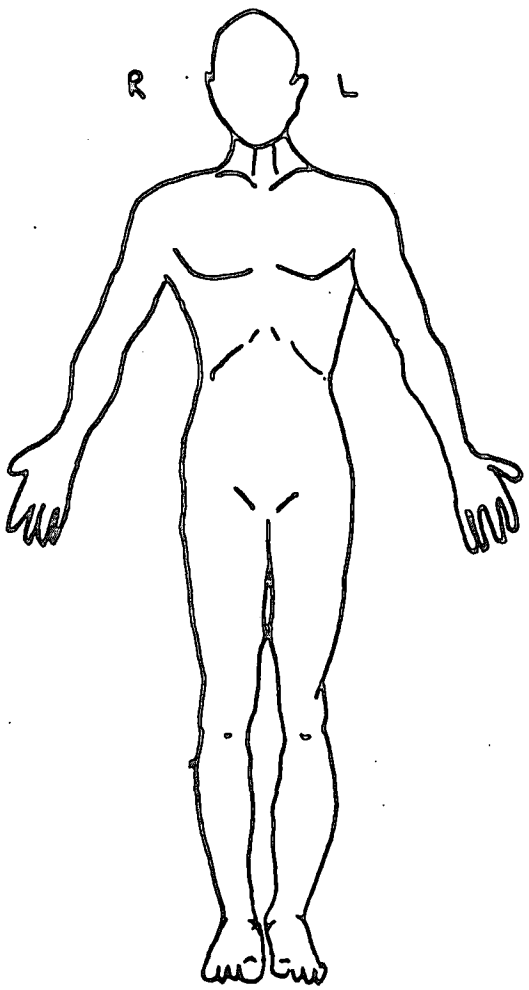
SYMPTOM DIAGRAM

PATIENT NAME: _____ **FILE #:** _____ **DATE:** _____

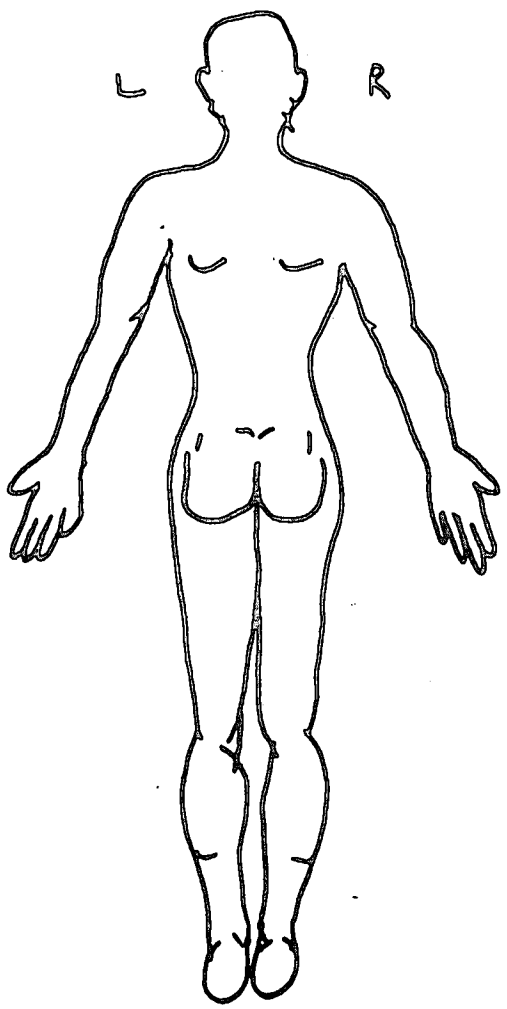
In the diagram provided below, please mark the areas on your body which you feel best represent the pain(s) or sensation(s) you are experiencing. Please include all areas. Use the symbols provided below.

SYMBOLS

numbness	=== ===	pins and needles	....
burning	XXX XXX	stabbing and sharp	//// ////
dull and aching	+++ +++	stiff and tight	ZZZ ZZZ



FRONT



BACK

APPENDIX G

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient:_____ Date # _____

File #:_____

X-ray #:_____

Age: _____ Sex:_____ Occupation: _____

Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: Signature:

Case History:

Examination:
Previous: TN Current: TN
Other Other

X-ray Studies:
Previous: TN Current: TN
Other Other

Clinical path. lab.:
Previous: TN Current: TN
Other Other

Case status:
PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's case history

1. Source of history:

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

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

4. Other complaints:

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

8. Psychosocial history:

   Home situation

   Daily life

   Important experiences

   Religious beliefs

9. Review of systems:

   General

   Skin

   Head

   Eyes

   Ears

   Nose/sinuses

   Mouth/throat

   Neck

   Breasts

   Respiratory

   Cardiac

   Gastro-intestinal

   Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

APPENDIX H

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

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

Patient:_____ File #_____

Last name First name

Clinician:_____ Signature:_____

Intern:_____ Signature:_____

Date:_____

Height:_____ Weight:_____ Temp:_____

Rates: Heart:_____ Pulse:_____ Respiration:_____

Blood pressure: Arms: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

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

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

Flex.

L.Rot. R.Rot.

L.lat flex. R.lat. flex.

Ext.

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

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

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

Chest measurement
- inspiration
- expiration

Visual acuity

Breast examination:

Inspection:
- skin
- size
- contour
- nipples
- arms overhead
- hands against hips
- leaning forward.

Palpation:
- axillary lymph nodes.

SEATED EXAMINATION.

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

	L			R		
	III	IV	VI	III	IV	VI

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

- vessels
- general background
- macula
- vitreous
- lens

Ears:

- auricle
- ear canal
- drum
- auditory acuity
- Weber test
- Rinne test

Nose:

- external
- internal
  - septum
  - turbinates
  - olfaction

Sinuses (frontal & maxillary):

- tenderness
- transillumination

Mouth and pharynx:

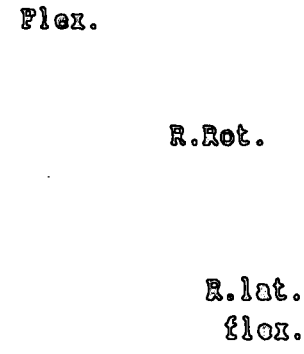
- lips
- buccal mucosa
- gums and teeth
- roof
- tongue
  - inspection
  - movement
  - taste
  - palpation
- pharynx
  - inspection
  - CN X

Neck:

- posture
- size
- swelling
- scars
- discoloration
- hair line

ROM:

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



lymph nodes
trachea
thyroid
carotid arteries (thrills, bruit)

CN V
CN VII
CN VIII (nystagmus)
CN IX
CN XI

TMJ
- Inspection
  - ROM
  - deviation
- Palpation
  - crepitus
  - tenderness

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

Cardiovascular:
auscultation (aortic murmurs)
Allen's test

SUPINE EXAMINATION

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

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

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

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

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

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

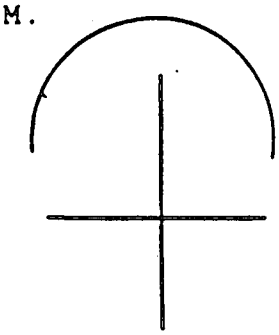
APPENDIX I

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION - LOW BACK

Standing:

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



Flexion 15cm from floor.

Extension 30°

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

/ painless limitation
// painful limitation

Gait:

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

Motion Palpation:

sacro-iliacs (see below for findings)

Sitting:

Posture
Dermatomes:

T12
L1
L2
L3
L4
L5
S1
S2
S3

Reflexes:

patellar
Achilles
medial hamstring

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

tripod
Kemp's

MOTION PALPATION:

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

Supine:

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

leg length:
- actual
- apparent

Patrick FABER
Gaenslen's
gluteus max stretch
hip medial rotation
psoas test
Thomas'test:
- hip joint
- rectus femoris.

Lateral recumbent:
- S-I compression
- Ober's test
- femoral nerve stretch
- myotomes:
  - QL
  - glut.med

Prone:
- gluteal skyline
- skin rolling
- iliac crest compression
- facet joint challenge
- S-I tenderness
- Erichsen's test
- Pheasant's test
- myotomes:
  - glut. max.
- trigger points:
  - QL
  - glut. med
  - glut. max
  - piriformis
  - hamstrings
  - TFL

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