THE EFFECTIVENESS OF THE SIMMONS BEAUTYREST® PILLOW IN THE MANAGEMENT OF CHRONIC NON-SPECIFIC NECK PAIN: A CONTROLLED CLINICAL TRIAL

By

Kathleen Jagarnath

Dissertation submitted in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic, in the Department of Chiropractic and Somatology at the Durban University of Technology.

I, Kathleen Jagarnath, do hereby declare that this dissertation is representative of my own work in both conception and execution (except where acknowledgements indicate to the contrary).

……..... Date: ……

Kathleen Jagarnath

Approved for Final Submission

…….. Date: ……

Dr. L. Wilson
M. Tech. Chiropractic
Supervisor

…….. Date: ……

Dr. J. Shaik
M. Tech. Chiropractic, M. Med. Sci. (SM), MCASA
Co-supervisor

DEDICATION

To my dad, I love you.

'To live in the hearts we leave behind

Is not to die'

~ Thomas Campbell ~

ACKNOWLEDGEMENTS

I would like to thank the following individuals:

- My supervisors, Dr. L. Wilson and Dr. J. Shaik for their guidance, advice and dedication in the planning and execution of this research project.
- My parents and brother, Keith, for their continuous support, encouragement and patience throughout the many years.
- To Shahen, for always believing in me and giving me the strength to continue.
- To Yumna, for your assistance and more importantly kindness throughout this research project.
- To Virosha, Derusha, Kayleigh and Janeene. Thank you for your friendship.
- Mr Ahmed Omar of the Simmons South Africa Company, thank you for your generosity and assistance in making this research project possible.
- The Simmons South Africa Company for their financial assistance and sponsorship of the Simmons Beautyrest® pillows.
- To Tonya Esterhuizen, for her assistance with the statistical analysis.
- To all the participants in the study, for their time and diligence over the study period.

ABSTRACT

Background:

A lack of peaceful sleep and adequate neck support during sleep has been described as a significant contributing factor to the development of chronic non-specific neck pain. Health-care practitioners often prescribe a cervical pillow for the treatment of chronic non-specific neck pain despite the ambivalent findings of several studies. Recently Simmons South Africa introduced the Simmons Beautyrest® pillow which it claims is able to support the cervical spine and promotes a restful sleep. This study, therefore, set out to determine the potential of the Simmons Beautyrest® pillow in alleviating chronic non-specific neck pain.

Objective:

This study aimed to determine the effectiveness of the Simmons Beautyrest® pillow compared to the participant's usual pillow (the control) in terms of objective and subjective findings in the management of chronic non-specific neck pain.

Methods:

Forty individuals, aged 18 to 45 years of age, experiencing chronic non-specific neck pain were recruited via convenience sampling. The study was a single-blinded, cross-over interventional study. All participants underwent a case history, physical and cervical orthopedic examination. Objective (algometer and Cervical Range of Motion measurements) and subjective (Numerical Pain Rating Scale, Neck Disability Index, Sleep and pain diary) outcome measures were obtained at each of the five consultations over a four week period, with the cross-over occurring after two weeks. SPSS version 18.0 was used to analyze the data. Demographic data was analyzed using the Chi square tests and t-tests. The consultations were averaged for each phase of the cross over design to result in a two treatment, two period cross over design. Repeated measures ANOVA testing was used to evaluate the effect of the intervention on subjective and objective measurement according to the method of Dallal (Esterhuizen, 2011). The sleep and pain diary data was analyzed using repeated measures ANOVA and Wald chi square test.

Results:

A significant difference in the perceived comfort levels between the two pillows ($p < 0.001$) was observed with the Simmons Beautyrest® pillow having a higher comfort rating. A significant decrease in NRS scores ($p = 0.018$); NDI scores ($p < 0.001$); and NRS scores on awakening ($p < 0.001$); neck stiffness rating on awakening ($p < 0.00$); headache rating on awakening ($p = 0.043$) was observed in relation to the Simmons Beautyrest® pillow. A significant improvement ($p = 0.001$) in algometer readings was observed when using the Simmons Beautyrest® pillow when compared to participants usual pillow. A significant increase in mean right lateral flexion measurements was observed in both groups when using the Simmons Beautyrest® pillow ($p = 0.001$).

Conclusion:

The Simmons Beautyrest® pillow was effective in improving chronic non-specific neck pain. It was regarded as comfortable and provided relief with regards to the clinical features of non-specific neck pain.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER TWO

CHAPTER THREE

LIST OF FIGURES

CHAPTER TWO

CHAPTER FOUR

LIST OF ABBREVIATIONS

AF	Annulus fibrosus
ALL	Anterior longitudinal ligament
CDC	Chiropractic Day Clinic
CN	Cranial nerve
CROM	Cervical Range of Motion
DISH	Diffuse idiopathic skeletal hyperostosis
DJD	Degenerative joint disease
DUT	Durban University of Technology
e.g.	Example
EOP	External occipital protuberance
FRC	Faculty research committee
i.e.	That is
IVD	Intervertebral disc
IVDs	Intervertebral discs
IVF	Intervertebral foramen
$kPa.m^{-2}$	Kilo Pascal's per meter squared
MFTP	Myofascial trigger point
MFTPs	Myofascial trigger points
MRI	Magnetic resonance image
N/A	Not available
NDI	Neck disability index
NP	Nucleus pulposus
NRS	Numerical Pain Rating Scale

NSAIDs	Non-steroidal anti-inflammatory drugs
PCC	Patient-centered care
PLL	Posterior longitudinal ligament
ROM	Range of motion
SCM	Sternocleidomastoid
SIP	Sickness Impact Profile
SP	Spinous process
TENS	Trans-cutaneous electrical nerve stimulation
TVPs	Transverse processes
US	Ultrasound
VAS	Visual analogue scale
VB	Vertebral body
VBs	Vertebral bodies
viz.	Namely
Yrs	Years

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION TO THE STUDY

Neck pain is the second most common musculoskeletal complaint worldwide (Binder, 2007) with a reported mean lifetime prevalence of 23.1% (Hoy *et al*., 2010). An essential factor in establishing a treatment regime for neck pain is to determine if it is pathological or non-pathological in nature (Dennison and Leal, 2011). Neck pain that is non-pathological is often termed non-specific neck pain or mechanical neck pain (Binder, 2007). The treatment for non-specific neck pain commonly involves manual therapy, electro-modalities, medication or ergonomic support such as cervical pillows (Hurwitz *et al*., 2002; Shields *et al*., 2006).

The recommendation of a cervical pillow to an individual experiencing neck pain is common practice for many health-care practitioners (Hyland, 2003). The proper neck support during sleep may provide the added benefit of relief from neck pain during the day (Lavin *et al*., 1997). The intended use of a cervical pillow is to provide support to the neck and to maintain the cervical lordosis, thereby reducing stress on the anatomical structures (Gordan *et al*., 2010).

Several studies have reported conflicting results on the efficacy of a cervical pillow on neck pain (Shields *et al*., 2006). Positive results were reported by Lavin *et al*. (1997), Erfanian *et al*. (2004), Persson (2006) and Gordan *et al*. (2010). On the other hand, Hyland (2003) and Shields *et al*. (2006) reported that there was insufficient evidence for the use of cervical pillows for relieving neck pain. A lack of methodologically-strong clinical trials supports the argument for investigating the therapeutic value of cervical pillows. Hyland (2003) concluded that recommendations concerning the effectiveness of cervical pillows have often been based on anecdotal evidence.

The pillow selected for investigation in this study was the Simmons Beautyrest® pillow. The manufacturers state that it is a uniquely-designed pillow, with the distinguishing feature being an inner coil system known as the Morpheus spring system. These coils are individually wrapped and embedded within a polyester foam covering. The pillow is described as being soft and comfortable. It is also reported as being able to support the cervical spine, adapt to

any sleeping position and create an ideal micro-climate to promote sleep (Simmons South Africa, 2011). These claims, however, have not been investigated independently. This is the first independent study that will partly address the manufacturer's claims.

Determining the efficacy of a cervical pillow may assist health-care practitioners in devising a complete and more effective management regime for individuals experiencing neck pain (Hyland, 2003). Besides aiding in a good night's sleep, the use of a cervical pillow will enable a home-based treatment approach for the prevention of neck pain. Many patients will enquire from a health-care practitioner e.g. chiropractor on the proper pillow to use for sleep and alleviation of neck pain. It is, therefore, essential that a health-care practitioner is armed with the proper knowledge and is able to advise the patient based on evidence obtained from clinical trials. Therefore, the aim of this study was to determine the effectiveness of the Simmons Beautyrest® pillow in comparison to the participant's usual pillow in the management of chronic non-specific neck pain.

1.2 AIMS AND OBJECTIVES

1.2.1 The aim of this study was:

To determine the effectiveness of the Simmons Beautyrest® pillow in comparison to the participant's standard pillow in the management of chronic non-specific neck pain.

1.2.2 The objectives of the study were:

Objective One:
To determine the effectiveness of the Simmons Beautyrest® pillow in terms of objective and subjective findings in the management of chronic non-specific neck pain.

Objective Two:
To determine the effectiveness of a participant's usual pillow (the control) in terms of objective and subjective findings in the management of chronic non-specific neck pain.

Objective Three:
To compare the results of the Simmons Beautyrest® pillow to the results of the control group.

1.3 THE HYPOTHESES

The Alternate Hypotheses (Ha) were set which stated that:

1. The Simmons Beautyrest® pillow will be effective in reducing chronic non-specific neck pain in terms of subjective and objective clinical findings.
2. The Simmons Beautyrest® pillow will be more effective than the participant's usual pillow in reducing chronic non-specific neck pain.

1.4 SCOPE OF THE STUDY

The results of 40 individuals aged 18-45 years of age, experiencing chronic non-specific neck pain who met the inclusion criteria are reported in this dissertation. The study was a single-blinded cross-over clinical trial over a period of four weeks. Written informed consent was obtained from each participant. A case history, physical examination and cervical spine orthopaedic examination was conducted at the first consultation. The subjective outcome measures were the Neck Disability Index (NDI), Numerical Pain Rating Scale (NRS) and sleep and pain diary while the objective outcome measures were Cervical Range of Motion (CROM) and algometer readings. The subjective and objective assessments were conducted at each consultation.

1.5 LIMITATIONS OF THE STUDY

The labelling of the Simmons Beautyrest® pillow was not removed prior to distributing it to the participants. This was due to each pillow being vacuum-sealed for hygiene purposes. The removal of labels would have required the vacuum seal to be damaged. The participants were, therefore, aware of the pillow branding and may have been influenced by the reputation of the manufacturer of the pillow. This may have influenced the results that they reported. The sample size (n = 40) of the study was relatively small. This was primarily due to financial and human resource constraints. The clinical diagnosis of non-specific neck pain was made by the researcher based on findings of the case history, physical examination and cervical orthopaedic examination. The participants were not radiographed to determine if alternate causes of neck pain were present or the biomechanical changes the pillow may have caused.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

Neck pain has been reported as the second most common musculoskeletal complaint worldwide (Binder, 2007), impacting significantly on an individual's quality of life (Lavin *et al.,* 1997). There has been a steady incline in the amount of attention paid to neck pain primarily due to the associated increase in reimbursement and its disability burden in relation to occupational injuries and motor vehicle accidents (Cote *et al.,* 2003). There are several conservative treatments options available for neck pain such as manipulation, mobilization, electrotherapy, acupuncture and cervical pillows (Hurwitz *et al*., 2002; Persson, 2006). However, discrepancies arise in the literature in the reporting of the optimal treatment modality for neck pain. A cervical pillow is recommended by many health-care professionals to individuals experiencing neck pain. Although there have been several studies investigating the effectiveness of cervical pillows, the results have been ambivalent (Shields *et al*., 2006).

2.2 A SUMMARY OF THE RELEVANT ANATOMY OF THE CERVICAL SPINE

The cervical spine consists of seven vertebrae, located between the skull and the first thoracic vertebra (Moore and Dalley, 1999). These vertebrae are classified as typical (C3-C6) or atypical (C1, C2, and C7) (Collins *et al.*, 2005). The cervical vertebrae are smaller and function less in weight-bearing in comparison to the other vertebrae of the spine (Moore and Dalley, 1999). This section will not present a detailed anatomy of the cervical spine, but only the information relevant to this study.

2.2.1 Typical Cervical Vertebra

Each typical cervical vertebra is made up of a vertebral body (VB) and the following processes (**Figure 2.1**):

- Two oval-shaped pedicles which extend to form the transverse processes (TVPs) and laminae (Collins *et al.*, 2005).
- Two TVPs which are trough-shaped and inclined anteriorly, inferiorly and laterally (Bogduk, 2003).
- The spinous processes are usually short and bifid with two tubercles (Moore and Dalley, 1999). They are formed by the joining of the laminar bilaterally by extending from the pedicle-laminar junction posteriorly and joining medially (Haldeman *et al.,* 2008).
- Four articular processes which form the superior and inferior facet joints. These joints arise from the junction of the pedicle and the laminae. The superior facet joints are directed superoposteriorly and the inferior facet joints directed inferoanteriorly (Collins *et al.*, 2005). The orientation of these joints is approximately 90° to the sagittal plane and 45° to the horizontal plane (Collins *et al.*, 2005).

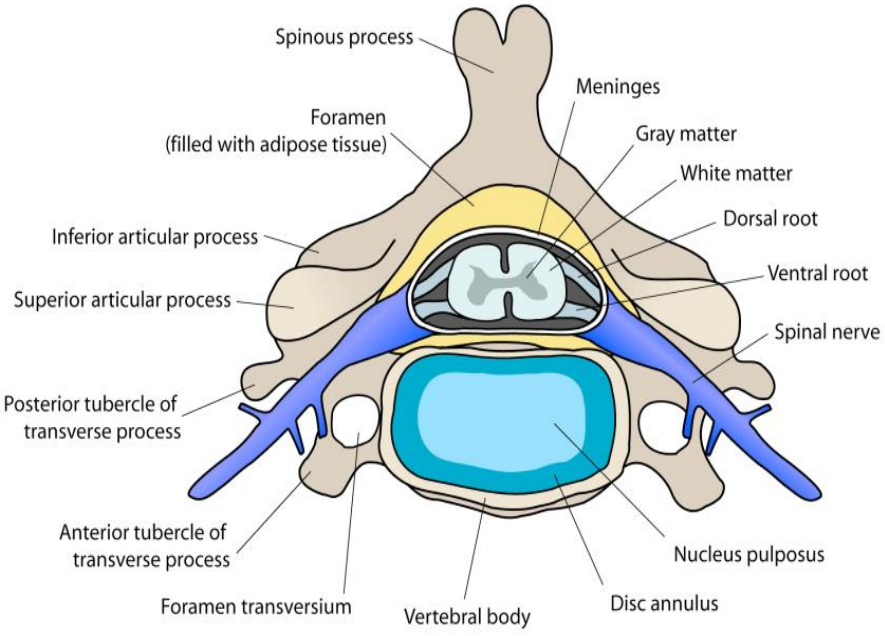


Figure 2.1 A typical cervical vertebra

From www.en.wikipedia.com

Atypical cervical vertebra has two unique features; an uncinate process which is a raised area on the superior border of the VB and an oval foramen located on the transverse process (Bogduk, 2003).

2.2.2 Atypical Vertebrae

a) The Atlas (C1)

The atlas is the widest of the cervical vertebrae, and is deficient in a spinous process and VB; instead an anterior and posterior arch is present, each comprising of a tubercle and lateral mass (Collins *et al.*, 2005). A groove found in the posterior arch is responsible for transmitting the vertebral artery and first cervical nerve (Moore and Dalley, 1999). The atlas consists of bilateral kidney-shaped superior articular processes directed superoposteriorly which function in supporting the occipital condyles. The inferior articular processes are directed inferomedially and articulate with the superior articular processes of the axis (Moore and Dalley, 1999).

b) The Axis (C2)

The axis is the strongest cervical vertebra; it is distinguished by a central and superior projection, the dens or odontoid process. The dens contain facets on the anterior aspect for the attachment of the anterior arch of C1 and a groove for the attachment of the transverse ligament. The axis allows rotation of the atlas around the dens by acting as an axle (Collins *et al.*, 2005).

c) The C7 Vertebra

The C7 spinous process is longer and is usually referred to as vertebra prominens (Moore and Dally, 1999). The C7 transverse foramina, which convey the vertebral veins, are usually smaller or absent in some instances (Moore and Dalley, 1999). The C3 to C7 vertebrae are distinguished by a large vertebral canal which allows for the cervical enlargement of the spinal cord (Collins *et al.*, 2005).

2.2.3 Intervertebral Discs

An intervertebral disc (IVD) is found between each vertebra with the exception of C1 and C2. The intervertebral discs (IVDs) allow for a strong attachment between the vertebrae, shock absorption and the formation of the secondary curvatures of the spine due to their varying shapes (Collins *et al.*, 2005).

The IVD consists of the annulus fibrosus (AF) and the nucleus pulposus (NP). The AF which is found on the periphery of the IVD is made up of fibrocartilage situated as concentric lamellae. The NP is found centrally and is elastic in nature (Nordin and Frankel, 2001). The IVDs in the cervical spine are thicker anteriorly than posteriorly and, therefore, contribute to the cervical lordosis (Nordin and Frankel, 2001).

2.2.4 Cervical Vertebral Joints

The cervical vertebral joints comprise of the craniovertebral joints and the facet joints. There are two craniovertebral joints, the atlanto-occipital joint found between atlas and the occiput and the atlanto-axial joint found between the atlas and axis. The joints between the uncinate processes at the superolateral margins of the vertebral bodies of C3 to C6 are referred to as the uncovertebral joints or joints of von Luschka (Moore and Dalley, 1999). The VB joints are secondary cartilaginous joints; these support weight-bearing, are strong and allow gliding movements to occur between the joints (Collins *et al.*, 2005).

2.2.5 Intervertebral Foramina

The intervertebral foramen (IVF) is formed at the point of connection of the superior and inferior vertebral notches and the IVD. The spinal ganglia are located within the IVF and the spinal nerves with its associated vessels exit through the IVF from the vertebral column (Collins *et al.*, 2005).

2.2.6 Muscles of the Cervical Spine

The muscles of the neck are divided into the superficial or extrinsic group and the deep or intrinsic group. The extrinsic muscles are primarily responsible for movement of the neck (Moore and Dalley, 1999). The extrinsic muscles responsible for movement of the neck include the trapezius and sternocleidomastoid (SCM) muscles. The intrinsic group is largely responsible for the maintenance of posture (Moore and Dalley, 1999). When assessing posture of the cervical spine, the sub-occipital muscles (i.e. semispinalis capitis, semispinalis cervicis, multifidi, rectus capitis posterior major and minor) should be taken into account as they are responsible for maintaining posture. The anatomy of the trapezium, SCM, posterior cervical and sub-occipital muscles is shown in **Table 2.1**.

Table 2.1 Anatomy, innervations and action of the trapezius, sternocleidomastoid, posterior cervical and sub-occipital muscles

Muscle	Anatomy	Innervations	Action
Trapezius	Origin: medial 1/3 of the superior nuchal line and ligamentum flavum. Insertion: the lateral 1/3 of the posterior border of the clavicle.	The 2nd-4th cervical spinal nerves (sensory) and the spinal segment of CN IX (motor).	Elevation of the shoulders. Unilateral: laterally flexes the neck on the same side, neck extension. Bilateral: extends the head and neck against resistance.
Sternocleidomastoid	Origin: the lateral area of the mastoid process and the lateral half of the superior nuchal line. Insertion: anterior surface of the manubrium and along the medial third of the anterior surface of the clavicle.	The spinal portion of CN IX.	Bilateral: flexes the neck forward. Prevention of hyperextension with during upward gazing or forceful extension.
Semispinalis capitis	Origin: the occiput between the superior and inferior nuchal line. Insertion: C3 to C6 and T1 to T6 TVPs.	C1 to C4 or C5 cervical nerves posterior primary division.	Extension combined with lateral flexion.
Semispinalis cervicis	Origin: SP of C2 to C5. Insertion: T1 to T6 TVPs.	C3 to C6 cervical nerves, posterior primary division.	Performs extension, rotation to the opposite side, lateral flexion.
Multifidi	Origin: SP of C2 to C5. Insertion: articular process of C4 to C7.	C3 to C6 cervical nerves, posterior primary division.	General extensors and lateral flexion to the same side, rotation to the opposite side
Rectus capitis posterior minor	Origin: connects C1 and C2 to the occiput bone. Insertion: posterior tubercle of the posterior arch of the atlas.	Sub-occipital nerve, dorsal primary division.	Extensor of the head.
Rectus capitis posterior major	Origin: connects C1 and C2 to the occiput bone. Insertion: SP of the axis.	Sub-occipital nerve, dorsal primary division.	Rotation of the head towards side of movement and extension.
Obliquus capitis superior	Origin: connects C1 and C2 to the occiput bone. Insertion: TVP of C1.	Sub-occipital nerve, dorsal primary division.	Extensor of the head.
Obliquus capitis inferior	Origin: connects C1 to C2. Insertion: SP of C2.	Sub-occipital nerve, dorsal primary division.	Rotation of head towards side of movement.

CN = Cranial nerve; SP = Spinous process; TVP = Transverse process
(Adapted from Moore and Dalley, 1999; Collins *et al.*, 2005)

2.2.7 Innervations of the Cervical Spine

The spinal nerves, a constituent of the peripheral nervous system are formed via the dorsal and ventral rootlets emerging from the spinal cord. These combine to form the dorsal and ventral roots (Moore and Dalley, 1999). The spinal nerve passes superior to the same corresponding vertebra with the exception of C8 which passes below the C7 vertebra (Collins *et al.*, 2005). The spinal nerve divides into the dorsal and ventral rami on exiting the spinal canal with the exception of C1 which has no ventral ramus. The ventral rami form the cervical plexus (C1-C4) and the brachial plexus (C5, C8, and T1). The cervical gray rami comunicantes forms the vertebral nerve which gives rise to the sinuvertebral nerves (Moore and Dalley, 1999). The innervations of structures of the cervical spine are shown in **Table 2.2**.

Table 2.2 Innervations of structures of the cervical spine

Structure	Innervations
Atlanto-occipital joint	C1 ventral ramus, lateral part innervated by C2 ventral ramus. The medial part of the joint and its ligaments are innervated by the sinuvertebral nerve.
Facet joint	C2-C3-By the two branches of the C3 dorsal ramus (third occipital nerve). C3-C4 to C8-T1- By the medial branch of the cervical dorsal rami above and below the joint.
Posterior cervical muscles	Cervical dorsal rami.
IVD	Anteriorly- anterior vertebral plexus formed by the sympathetic trunk. Posteriorly- posterior vertebral plexus formed by the sinuvertebral nerves.

IVD = Intervertebral disc
(Adapted from Bogduk, 2003)

2.2.8 Ligaments of the Cervical Spine

The ligaments of the cervical spine are fibrous bands or sheets of connective tissue (Moore and Dalley, 1999). These act as links between structures. The major function of these ligaments is to provide stability to the cervical spine during rest or movement (Moore and Dalley, 1999). The attachments and function of the ligaments of the cervical spine are shown in **Table 2.3**.

Table 2.3 Anatomy of the relevant ligaments of the cervical spine

Ligament	Attachments	Function
ALL	Superiorly: to the anterior tubercle of the atlas and the occipital bone. Inferiorly: to the sacrum.	Limits extension of the cervical spine and reinforces the front of the AF.
PLL	Attaches firmly to the IVD and loosely to VBs.	Limits flexion of the cervical spine and reinforces the back of the AF.
Ligamentum flavum	The anteroinferior surface of the laminae of the superior vertebra and the posterosuperior surface of the inferior vertebra.	Limits flexion of the cervical spine.
Nuchal ligament	Extends from the EOP to the SP of C7.	Limits flexion of the cervical spine.

ALL= Anterior longitudinal ligament; PLL= Posterior longitudinal ligament; SP = Spinous process; AF = Annulus fibrosus; EOP = External occipital protuberance; VBs = Vertebral bodies
(Adapted from Moore and Dalley, 1999)

2.3 A SUMMARY OF THE BIOMECHANICS OF THE CERVICAL SPINE

a) Curve

The normal curvature of the cervical spine is one that is convex anteriorly and concave posteriorly. Such a curve is called a lordotic curve and it forms intra-uterine, although it becomes most pronounced when an infant starts to lift his/her head around three months of age (Moore and Dalley, 1999). The curvature of the cervical spine develops due to the varying shapes of the IVDs, the ligamentous and muscle attachments and facet joint inclination (Bogduk, 2003).The normal mean cervical lordosis is reported to be 40° (Yochum and Rowe, 2005). However, there are studies that have reported different mean cervical lordotic values. This is due to the differing methodologies used to determine the cervical lordotic angle (Harrison *et al*., 2000). Harrison *et al*. (2000) reported a considerably less mean cervical lordotic angle of 25.8° while McAviney *et al*. (2005) reported an even lower mean cervical lordotic angle of 23.4°. The cervical lordosis may be affected by factors such as gender and race (Christensen and Hartvigsen, 2008). The presence of diseases such as inflammatory conditions (e.g. rheumatoid arthritis) or degeneration of the IVD may also be contributing factors to changes in the cervical lordosis (Collins *et al*., 2005).

b) Range of Motion

The range of motion (ROM) of the cervical spine includes flexion, extension and bilateral lateral flexion and rotation (Moore and Dalley, 1999). The pattern of movement is dependent on the shape and structures of the cervical spine and the interplay between them (Feipel *et*

al., 1999). A summation of movement occurs at the different levels with the exception of C1-C2. The movement at C1-C2 occurs without affecting movement at the other levels (Bogduk and Mercer, 2000). The resting position and the closed-pack position of the cervical spine is extension (Magee, 2005). The primary movements of the atlanto-occipital joint are flexion and extension while the primary movement of the atlanto-axial joint is rotation. The amount of flexion achieved at the atlanto-axial joint is limited by the tension in the posterior cervical muscles and the approximation of the mandibular tissue and the throat (McNair *et al*., 2007).

The orientation of the facet joints allows the remaining cervical vertebrae to achieve flexion and extension, but prevents simple rotation and lateral flexion. The majority of flexion occurs at C5-C6, but a comparable amount also occurs at C4-C5 and C6-C7 levels (Moore and Dalley, 1999). The mean ROM values of the cervical spine of asymptomatic individuals according to age-group are shown in **Table 2.4** (Feipel *et al*., 1999). These values were established by measuring the ROM in individuals of both genders and any race using an electro-goniometer. These results are in accordance with those reported earlier by Trott *et al.* (1996).

A decrease in ROM is frequently linked with an increase in age (Smith *et al*., 2007). This decrease is often associated with myofascial trigger points (MFTPs) of the cervical muscles, degenerative joint disease (DJD) of the cervical spine and in conditions where ankylosis of the spine occurs such as diffuse idiopathic skeletal hyperostosis (DISH) (Yochum and Rowe, 2005). In contrast, an increase in ROM may be observed in inflammatory conditions e.g. rheumatoid arthritis or in congenital disorders such as Marfan's syndrome (Yochum and Rowe, 2005). An analysis of the ROM of the cervical spine allows a clinician to assess for musculoskeletal impairments that may occur and to monitor the effectiveness of therapeutic interventions (Cagnie *et al*., 2007).

Table 2.4 Mean range of motion of asymptomatic individuals according to age group

Motion	14-19 yrs.	20-29 yrs.	30-70 yrs.	Mean ROM (14-70 years)
Flexion	70°	66°	57°	65°
Extension	61°	57°	50°	57°
Lateral flexion (left)	47°	44°	38°	44°
Lateral flexion (right)	48°	45°	39°	44°
Rotation (left)	75°	72°	68°	72°
Rotation (right)	75°	71°	68°	72°

ROM = range of motion
(Adapted from Feipel *et al*., 1999)

2.4 NECK PAIN

2.4.1) The Incidence and Prevalence of Neck Pain

The mean lifetime prevalence of neck pain is reported to be 23.1%, with a large range of 0.4% to 86.8% (Hoy *et al.*, 2010). The reported annual incidence of neck pain in the general population ranges from 12.1% to 71.5% (Haldeman *et al*., 2008). The considerable range in the prevalence and incidence observed in the general population may be due to the varying descriptions and classifications of neck pain in the literature (Dennison and Leal, 2011). The prevalence of neck pain differs among population groups; this may be attributed to cultural, social, economic and health-care variances (Guez, 2006).

The prevalence of neck pain also differs between the different racial groups in the general population. This is linked to the variances found in pain response in the different races. In a study conducted in the United States, the pain response in two racial groups was compared. It was concluded that Black African-Americans experienced higher pain levels than Whites. The difference was credited to health-care utilization, behaviour and psychological responses and the use of pain-reducing activities as well as the use of coping strategies such as prayer (Hastie *et al*., 2005). Similarly, a variation in the prevalence of neck pain has been observed in the population of the greater Durban area in South Africa (**Table 2.5;** unpublished studies). This may be due to genetic or lifestyle differences found between the racial groups (Slabbert, 2010).

The reported mean age of individuals experiencing neck pain ranges from 35 to 49 years of age (Hoy *et al*., 2010). However, a significant range (i.e. 15 to 99 years of age) is reported in the literature (Hoy *et al*., 2010). This is mainly due to lack of homogeneity in research methodologies, genetic and racial differences (Hoy *et al*., 2010). Muchna (2011) observed a mean age of 36.7 years in individuals experiencing neck pain in the Indian population in the greater Durban area. Ndlovu (2006) found a higher prevalence (54.5%) of neck pain in the Black African population aged 31 to 60 years of age when compared to a 21 to 30 (50%) year age group in the greater Durban area. This may be due to degenerative changes that occur in the cervical spine which are associated with increasing age (Puttini *et al*., 2005).

Neck pain is more common in women than men worldwide (Fillingim, 2000; Binder, 2007). A systematic review concluded that the lifetime prevalence of neck pain in females is 27.2% and 17.4% in males (Hoy *et al*., 2010). The factors associated with the higher prevalence of neck pain in females include psychosocial and biological causes. For example, it has been observed that women experience greater pain levels during their menstrual cycle, associating the pain experience with hormonal changes (Fillingim, 2000). Furthermore,

factors such as emotional expressiveness contribute to the higher prevalence in females. Bernardes *et al*. (2008) state that women convey their pain experience with more ease than males. Neck pain is also more common in individuals whose occupations involve repetitive activity or encourage poor posture. These include office and computer work or activities that involve vibration e.g. the use of hand tools (Larsson *et al.,* 2007).

Table 2.5 Reported prevalence of neck pain in the greater Durban area (South Africa)

Reference	Ethnicity	Prevalence (%)
Ndlovu (2006)	Black	50.0
Slabbert (2010)	White	45.0
Muchna (2011)	Indian	36.8

2.4.2 Classification of Neck Pain

There are several classifications of neck pain in the literature. The purpose of a classification is to assist a clinician in determining the most likely diagnosis and effective treatment regimens and enables uniformity in research. A classification also assists in providing sub-groups in relation to clinical data obtained and in determining a patient's prognosis (Childs *et al.,* 2004). Neck pain can be classified according to duration of symptoms although a variation exists in the exact time lines (Dennison and Leal, 2011). Acute neck pain refers to pain of less than four weeks duration while chronic neck pain refers to pain greater than eight weeks duration (Vernon *et al*., 2007). This was the classification used in this study. The variation in time lines prevents homogeneity in diagnosis by different clinicians and produces a lack of standardization in research (Hoy *et al.,* 2010). Alternatively, neck pain can be classified according to pathological and non-pathological causes (Dennison and Leal, 2011; **Table 2.6**). This method of classification provides assistance to the clinician in determining the type of treatment, severity of condition and prognosis. Generally, pathological causes require medical or surgical interventions while non-pathological conditions may be managed conservatively (Guzman *et al*., 2009).

Table 2.6 Classification of neck pain according to pathological and non-pathological causes

	Cause	Example
Pathological	Rheumatic disease	Rheumatoid arthritis
		Ankylosing spondylitis
		DISH
	Trauma	Fracture of vertebra
		Dislocation (e.g. facet dislocation)
	Bone	Osteomalacia
		Paget's disease
		Osteoporosis
		Metastatic tumour
	Neuro-muscular	Meningitis
		Cerebral palsy
Non-pathological	Muscular	Muscle strain
		Myofascial trigger points
	Mechanical (non-specific neck pain)	Degenerative joint disease
		Facet joint dysfunction
		Facet syndrome
		Trauma (e.g. repetitive micro trauma)

DISH = Diffuse idiopathic skeletal hyperostosis

(Adapted from Hoy *et al*., 2010)

A Four-Grade classification for neck pain was recently developed (Haldeman *et al*., 2008). This classification, which is according to clinical features and severity of pathology, is intended to provide a universal classification enabling uniformity in research and diagnosis. The majority of cases seen by conservative health-care practitioners e.g. chiropractors are Grades I and II while medical specialists are more likely to see Grades III and IV (Hurwitz *et al*., 2008). It is important, however, for a chiropractor to be able to recognise the features of Grades III and IV so that appropriate referral is made promptly.

a) Grade I: neck pain not due to major structural pathology; does not interfere with daily functioning

b) Grade II: neck pain not due to major structural pathology; does interfere with daily functioning

c) Grade III: neck pain not due to major structural pathology; neurological signs and symptoms present

d) Grade IV: neck pain due to major structural pathology e.g. neoplasm and myelopathy.

e) (For the purpose of this study, Grades I and II were utilised)

2.5. NON-SPECIFIC NECK PAIN

Neck pain often has a multi-factorial aetiology which makes arriving at a specific diagnosis difficult. The term non-specific neck pain refers to symptoms that cannot be attributed to a specific cause and is not pathological in nature (Hoving *et al*., 2002). Similarly, Dennison and Leal (2011) attribute the term non-specific neck pain to the multi-factorial presentation of neck pain and a lack of clinical means to identify an exact structure that may cause neck pain e.g. facet syndrome or myofascial dysfunction. Many clinicians use the term mechanical neck pain interchangeably with non-specific neck pain (Binder, 2007). Despite the non-pathological nature of non-specific neck pain, the severity of pain and disruption of activities of daily living may be considerable (Dennison and Leal, 2011).

2.6 RISK FACTORS FOR NON-SPECIFIC NECK PAIN

A number of risk factors have been identified for neck pain with the most important being a history of previous neck pain (Guez, 2006). Risk factors are divided into modifiable and non-modifiable factors. Non-modifiable factors include gender, age and genetics. Modifiable risk factors include smoking, contact with environmental pollutants and ergonomics such as furniture (desk, chair) and neck support (pillows, cervical collar) (Haldeman *et al*., 2008).

2.7 AETIOLOGY OF NON-SPECIFIC NECK PAIN

Chronic neck pain is commonly due to numerous inter-related mechanisms acting together, thereby making the cause of neck pain complex and multi-factorial (Guez, 2006). A multi-factorial diagnosis/aetiology should be considered in current decision-making (Dennison and Leal, 2011)

2.7.1 Anatomical and Biomechanical Causes

Since the facet joints, IVDs, muscles and cervical dura mata are innervated, they are all potential causes of neck pain (Bogduk, 2003). Biomechanical causes of neck pain are divided into minor and major injuries. There is no universal definition to differentiate between minor and major injury (Bogduk and Yoganandan, 2001). A minor injury often relates to the low level of trauma experienced or repetitive overuse i.e. microtrauma. Minor injuries are considered injuries that do not involve a fracture; they are commonly soft tissue injuries (no injury to bone) (Bogduk and Yoganandan, 2001). A minor injury includes conditions such as

whiplash where injuries to the cervical muscles, ligaments and facets joints are common. A minor injury often responds to conservative treatment or self-care.

A major injury implies a structural compromise has occurred to the spinal cord or nerve roots resulting in a major neurological deficit (Cusick and Yoganandan, 2002). Major biomechanical injuries include fractures, dislocations and ligamentous compromise where changes in column stiffness occur with resultant major instability. The amount of neurological damage is determined by the localisation and development of injury and the degree of instability (Cusick and Yoganandan, 2002). This type of injury is associated with significant disability and mortality (Persson *et al*., 1997). The long-term consequences of a major or minor injury may be the development of chronic neck pain due to the occurrence of DJD, facet ankylosis or fibrosis in muscles (Haldeman *et al.,* 2008).

a) Facet Dysfunction

The facet joints are a common cause of chronic neck pain (Bogduk, 2003). Pain, temperature, pressure and touch sensations are transmitted to the central nervous system via mechanoreceptors (sensory nerve terminals) located within the joint capsules (Bogduk, 2003). The mechanoreceptors function in stabilizing and protecting the joint in the event of an injury. When the facet joints are unable to function optimally the term joint dysfunction is used. Dysfunction of the cervical facet joints may be due to trauma or degeneration of the facet joints (Kirpalani and Mitra, 2008). Mechanical joint dysfunction or irritation of the nociceptors found in the joint capsule may be a cause of pain (Peterson and Bergman, 2002). The clinical features are synonymous with clinical features of other conditions with a mechanical background and no specific orthopaedic examination is available to diagnose facet dysfunction (Kirpalani and Mitra, 2008). However, motion palpation findings and a positive Kemp's test (localised neck pain and no radicular pain) together with clinical features such as localised neck pain, stiffness and decreased cervical ROM are suggestive of a cervical facet dysfunction or cervical facet syndrome (Peterson and Bergman, 2002; Magee, 2005).

b) Intervertebral Disc Disease

Degenerative changes in the IVD are usually related to advancing age (Puttini *et al*, 2005). A reduction in the water content in the NP results in a decreased cushioning effect. The NP develops gaps and fissures which eventually radiate to the AF. A reduction in the elasticity

of the IVD leads to a decrease in IVD height. The degenerative changes in the IVD causes an increase load on the facet joints contributing to facet dysfunction and degeneration (Puttini *et al.*, 2005). A ruptured IVD may occur due to degenerative processes or an overload of the spine and results in radiculopathy. A ruptured IVD is distinguished from other causes of neck pain due to the severity and distribution of pain and the findings of the orthopaedic examinations in conjunction with a magnetic resonance image (MRI). A MRI is considered more sensitive in diagnosing a ruptured IVD than the use of plain film radiographs (Puttini *et al.,* 2005).

c) Degenerative Joint Disease

Degenerative joint disease is an articular disease that develops gradually resulting in joint pain, stiffness and a reduction in ROM (Puttini *et al.,* 2005). Facet joint and IVD degeneration are often seen with accompanying features of degeneration of the VB. The presence of DJD is more common in the elderly than in young individuals. It is also more common in those who have experienced major trauma or repetitive micro trauma (Puttini *et al*., 2005). The features of DJD may develop as a complication of spinal surgery and this prevents the complete recovery from neck pain. An important and distinguishing radiographic feature is the presence of osteophytes which are bony projections found on the VB. The clinical features are dependent on the location and size of the osteophytes. Posterior osteophytes are more important as they play a role in the development of cervical radiculopathy and myelopathy (Yochum and Rowe, 2005). An individual may present with radicular pain if the osteophyte impinges on a cervical nerve root. The clinical features associated with DJD include neck stiffness, chronic pain, muscle spasm and radiation of pain. The treatment of this condition is often challenging to a clinician because of the associated anatomical and biomechanical changes (Puttini *et al*., 2005).

d) Muscle Spasm

Muscle spindles (sensory nerve endings) are mechanoreceptors which are activated when a muscle is stretched, allowing it to return to its original length, thereby preventing injury and providing protection to the muscle (Bogduk, 2003). In the presence of injury to the muscle or postural deficiency, this mechanism does not function effectively leading to a shortened state in the muscle and muscle spasm (Penas *et al*., 2007). The production of pain in skeletal muscle is due to the excitation of the small diameter, slow conducting afferent nerve fibres. Many of these nerve fibres terminate in free nerve endings and have nociceptive properties

(Bennett, 2007). An accumulation of metabolic waste products is observed in a muscle spasm, initiating an irritation of the nociceptors, leading to pain. A muscle spasm may develop in the extrinsic muscles (**Table 2.1**) due to abnormal movement of the cervical spine. Alternatively, if the extrinsic muscles become affected by a muscle spasm due to causes such as spondylitis, the movement of the cervical spine becomes restricted (Penas *et al*., 2007). When there is spasm of the intrinsic muscles, the cervical lordosis becomes altered leading to either hypo- or hyperlordosis (Penas *et al*., 2007). This affects the associated structures in the area (ligaments, vertebra, and joints). The primary clinical features of cervical muscle spasm are neck pain, stiffness and a reduction in movement of the cervical spine (Simons *et al*., 1999; Bennett, 2007). This discussion is further expanded in **Section 2.8**.

1.7.2 Psychological Causes

Christensen and Knardahl (2010) investigated the relationship between the presence of neck pain and occupation. They reported that even after the removal of biomechanical factors in office workers, neck pain was still prevalent. The neck pain was, therefore, credited to the presence of psychological factors.

Psychological causes encompass factors such as depression, anxiety and mental stress. The attitude, beliefs, coping mechanisms and presence of mental illness such has depression and distress influence the experience and prognosis of neck pain (Pool *et al*., 2010). A higher prevalence of neck pain was observed in occupations that are demanding or where supervisory support is lacking or where a lack of control in occupation is present (Pool *et al*., 2010). The psychological stress leads to the development of muscle spasm, myofascial trigger points (MFTPs), headaches and poor posture (Linton, 2000).

A disturbance in sleep patterns is often associated with psychological stress. The relationship between psychological disorders, sleep disturbances and chronic pain is reciprocal whereby these conditions may initiate, intensify and sustain one another (Linton, 2000; Goral *et al*., 2010). The importance of psychological factors to a clinician is highlighted when acute/sub-acute neck pain progresses to chronic neck pain (Linton, 2000). The inability to recognize the role of psychological factors in the development of neck pain by a clinician may be a reason why patients do not fully respond to treatment (Linton, 2000).

2.8 THE ROLE OF MYOFASCIAL TRIGGER POINTS IN NECK PAIN

Myofascial pain is most commonly due to the presence of hyper-irritable foci found in muscles called MFTPs (Bennett, 2007). Myofascial trigger points are characterized by a tender area found within a taut band in a muscle which restricts ROM, depending on whether the MFTP is active or latent. An active MFTP is characterized by symptoms that may be constantly present while a latent MFTP only produces symptoms when palpated (Simons *et al*., 1999).

2.8.1 Aetiology

Myofascial pain syndrome, which refers to injury to the muscle or repetitive muscle strain, is usually chronic (Huguenin, 2004). In individuals with neck pain, active MFTPs are commonly found in the upper trapezius muscle, the posterior cervical and the sub-occipital muscles (Bennett, 2007). Muscles in this area are usually associated with posture maintenance and, therefore, the MFTPs are activated in postural abnormalities such as short upper limb or due to poor ergonomics (Simons *et al*., 1999). Myofascial trigger points occur due to increased demands on a muscle whereby the muscle adopts an abnormal length and is unable to relax even during periods of rest and sleep. The muscle gradually becomes weakened and is susceptible to ischemia and pain. This causes a further weakening of the muscles leading to a cycle of abnormal muscle position, a weakened state and pain (Vernon and Schneider, 2009).

2.8.2) Common Myofascial Trigger Points in Neck Pain

a) The Trapezius Muscle

For this study, the upper portion of the trapezius muscle was taken into consideration as it is a key area involved in neck movement (Simons *et al*., 1999). There are two common MFTPs in the upper trapezius muscle i.e. MFTP 1 and 2 (**Figure 2.2**). The occurrence of MFTP 1 in the trapezius may contribute to the development of tension-type headaches (Huguenin, 2004).

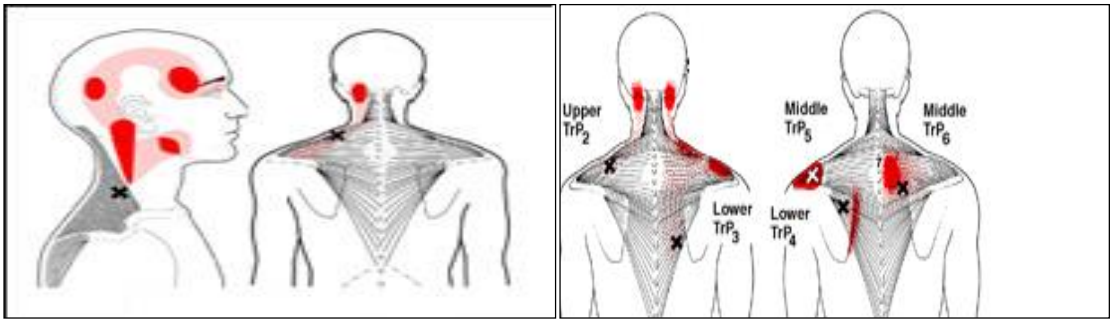


Figure 2.2 MFTPs of the upper trapezius muscle

(From Simons *et al*., 1999)

(The red areas refers to the pain referral pattern of the myofascial trigger points)

a) The Sternocleidomastoid Muscle

The MFTPs in both divisions of the muscle cause pain in the area of its attachment to the cervical spine; it does not refer pain to the neck, but to the facial area and cranium as shown in **Figure 2.3**. Myofascial trigger points in this muscle are recognized for their ability to produce autonomic phenomena and may be diagnosed as tension-type headaches or atypical facial neuralgia.

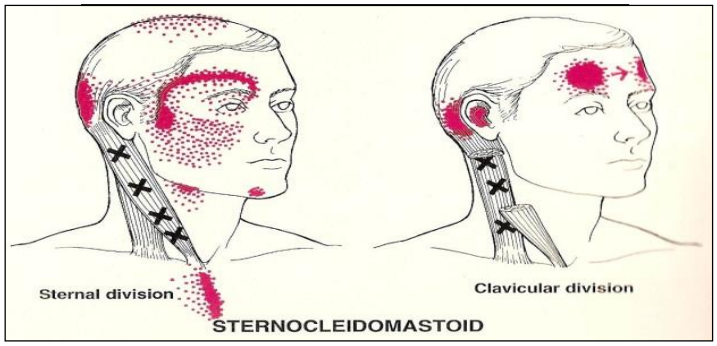


Figure 2.3 MFTPs of the sternocleidomastoid muscle

(From Simons *et al*., 1999)

(The red areas refers to the pain referral pattern of the myofascial trigger points)

c) The Posterior Cervical Muscles

The posterior cervical muscles are sometimes referred to as ‘pain in the neck’ (Moore and Dalley, 1999). If MFTPs in this muscle group (**Figure 2.4**) are present, a person may experience neck pain where they are unable to tolerate the pressure from lying on a pillow, reduced cervical ROM associated with burning, numbness and tingling (Simons *et al*., 1999).

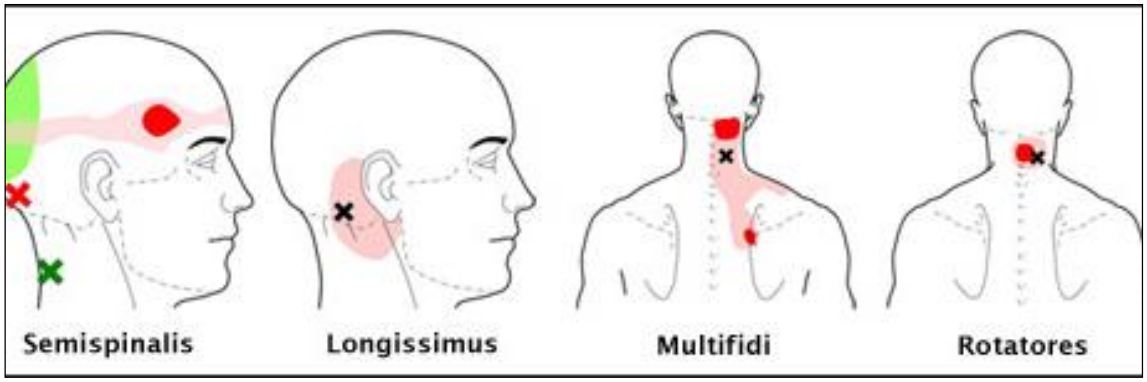


Figure 2.4 MFTPs of the posterior cervical muscle

(From www.abbottcenter.com)

(The red areas refers to the pain referral pattern of the myofascial trigger points)

d) Sub-Occipital Muscles

The symptoms of MFTPs in this muscle group (**Figure 2.5**) are described as "pain that penetrates the skull" and includes neck pain and headaches (Simons *et al*., 1999).

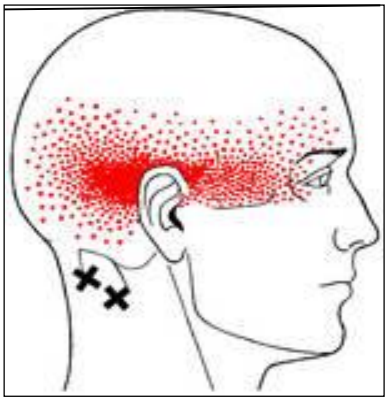


Figure 2.5 MFTPs of the sub-occipital muscle

(From Simons *et al*., 1999)

(The red areas refers to the pain referral pattern of the trigger points)

2.8.3) Clinical Features of Myofascial Trigger Points

Typical features of MFTPs are deep ache and stiffness, and reduced ROM with referral of pain (Simons *et al*., 1999; Huguenin, 2004). If the MFTP remains, it may lead to muscle weakness, fatigue and sleep disturbances. Autonomic phenomena, such as dizziness and hydrosis may occur if the MFTPs are found in the neck and facial muscles (Bennett, 2007). Aggravation of clinical features usually occurs due to activity, psychological stress, exposure to cold, nutritional deficiency and posture abnormalities (Penas *et al*., 2007).

2.8.4) Treatment of Myofascial Trigger Points

There are several treatment options for MFTPs which may be divided into invasive and non-invasive forms **(Table 2.7)**. The treatment options require different skills and training. The most effective invasive method is dry needling while trans-cutaneous electrical nerve stimulation (TENS) has been shown to be an effective short-term non-invasive modality (Rickards, 2006). Many of the treatment methods for MFTPs such as ultrasound or interferential current therapy are practitioner-dependent. The advantage of practitioner-dependent methods lies in a clinician being able to monitor the condition and treatment progress, alter treatment if required and monitor the development of adverse effects. There are also patient-centered care (PCC) treatment methods such as ischemic compression, stretching exercise, TENS and ergonomic support (Blyth *et al*., 2005). This allows for a continuous and affordable treatment to a patient. The disadvantage of this approach is that an individual may not recognize adverse effects that may arise. Patient education is an essential component of the management regimen for MFTPs which encompasses information regarding proper posture and ergonomic support during sleep (Vernon and Schneider, 2009).

Table 2.7 Treatment modalities for MFTPs

Method	Example
Non-invasive	Exercise and stretching therapy
	Electrical modalities e.g. US
	Massage
Invasive	Dry needling
	Injection therapy (e.g. injection of a local anaesthetic)

US = Ultrasound
(Adapted from Huguenin, 2004)

2.9 ASSOCIATED FEATURES OF NON-SPECIFIC NECK PAIN

Neck pain is regarded as a clinical symptom with pain or discomfort in the neck region and a possible reduction in ROM (Guez, 2006). The clinical features of neck pain are not always unique to individual causes, but may be synonymous with the various aetiologies. Non-specific neck pain may present with stiffness in the cervical spine (Hoving *et al*., 2002) as well as tension-type headaches which are often associated with muscle spasm (Persson, 2006). Pain in the shoulders, upper thoracic spine and jaw usually accompany neck pain

(Guez, 2006). Despite the absence of nerve root irritation or compression, referred pain to the chest and posterior spinal areas may also present as clinical features (Guez, 2006). Autonomic phenomena such has lacrimation, dizziness and ptosis are sometimes observed in conjunction with cervical MFTPs (Simons *et al*., 1999). In an epidemiological investigation of the South African White population, it was concluded that approximately a quarter (28%) of participant's found their sleep to be affected followed by concentration (16%) and work (15%) due to neck pain. Headaches and shoulder pain were most commonly associated with neck pain (Slabbert, 2010). The variations in sleeping position can often lead to pain with sleeping in a prone position being an important cause. This may be due to the cervical muscles and joints being placed in an abnormal position, causing increase stress on these structures, leading to neck pain (Schmidt and Richardson, 2003).

2.10 TREATMENT OF NECK PAIN

Although there are several treatment options available to manage neck pain, there is little consensus on the proper management protocols. Invasive and non-invasive methods should be taken into consideration when deciding on a treatment option for neck pain (**Table 2.8**).

Often, there is difficulty in deciding on the appropriate treatment due to non-specific neck pain encompassing a considerable number of conditions. The vagueness and broad clinical spectrum compounds the problem. The presence of concomitant conditions such as DJD, repetitive micro trauma or macro trauma intensifies the difficulties in treating non-specific neck pain (Hoy *et al*., 2010). Treatments for non-specific neck pain range from cervical manipulation, exercise therapy, ergonomic advice to surgical intervention (Taimela *et al*., 2000). The implementation of manual therapy, supervised exercise, acupuncture, analgesics and low level therapy are considered as effective methods of providing relief in Grade I/II neck pain while exercise instruction, TENS and ultrasound have been considered unhelpful in providing relief (Hurwitz *et al*., 2008).

The considerable number of treatment modalities and methods pose an additional difficulty to clinicians during decision-making. A clinician is, therefore, conflicted with the choice of modality and the criteria of use of the respective modalities. The usefulness of several of the modalities remains ambivalent and may be confusing to the clinician in deciding the proper treatment (Hurwitz *et al*., 2008).

A clinician needs to account for the development of adverse effects from the various treatments prior to decision making (Partridge and Kitchen, 1999). The use of invasive

methods such as needling requires caution, although it is known to produce relief of symptoms due to MFTPs and associated neck pain (Simons *et al*., 1999, www.cdc.gov). One of the primary adverse-effects, however, is post-needling soreness. Other limitations include its contra-indication to its use on muscles where blood vessels course (e.g. SCM). There is also a small, but important risk of needle stick injuries to practitioner and patient. It is also imperative that the proper disposal measures of needles are adhered to (www.cdc.gov).

The use of electro-modalities requires caution and should be used judiciously in the treatment of neck pain (Partridge and Kitchen, 1999). One needs to consider the many contra-indications associated with the various modalities such as avoiding the use of ultrasound over the region of the carotid bodies or interferential current therapy in those with cardiac pace-makers (Partridge and Kitchen, 1999).

Diagnosis and treatment does not necessarily occur under the guidance of a health-care practitioner. Many individuals opt for self-care which also has therapeutic merit. The choice between obtaining treatment or self-care is dependent on the severity of pain and personal circumstance e.g. the presence or type of health-care system (Guzman *et al*., 2009). Barlow *et al*. (2002) define self-management as an 'individual's ability to manage the symptoms, treatment, physical and psychological consequences and lifestyle changes in living with a chronic condition'. Self-management strategies are categorized by passive and active methods (**Table 2.9**). An active method is one that involves those activities, instigated by an individual experiencing pain, to manage their pain. A passive method is one where an individual received an intervention to relieve pain, but played a passive role (Du *et al*., 2011).

Despite the common use of either self-care or practitioner centered-care, a more effective treatment approach is PCC. Here, a clinician plays an important role in instigating a patient's self-care routine. It is defined by a customized regime for each patient, whereby the patient's ideals and inclinations are taken into consideration. Patient-centered care, also promotes the implementation of a symbiotic relationship between alternate or complementary care giver (e.g. chiropractor) and the conventional health-care system (e.g. medical doctors). The benefits of PCC include a higher satisfaction rate amongst patients, a reduction in the use of health-care and associated costs, and improved outcomes for the patient and practitioner (Maizes *et al*., 2009). An example of PCC is the use of cervical pillows to manage neck pain.

Table 2.8 Treatment options for neck pain according to invasive and non-invasive methods

Method	Treatment	Example
Invasive	Surgery	Fusion of vertebral segments, laminectomy
	Injection	Corticosteroids in to facet joint capsule
	Dry needling	Treatment of MFTPs
	Acupuncture	
Non invasive	Drug	NSAIDs, corticosteroids
	Manual	Spinal manipulation, spinal mobilization
	Psychological	Cognitive behavioural therapy
	Exercise	Stretching, muscle strengthening
	Electro modalities	Laser, TENS, US
	Ergonomics	Cervical collar, cervical pillow, furniture

MFTPs = Myofascial trigger points; NSAIDs = Non-steroidal anti-inflammatory drugs; TENS = Trans-cutaneous electrical nerve stimulation; US = Ultrasound (Adapted from Rickards, 2006)

Table 2.9 Self-management strategies for neck pain

Type of self-management strategy	Example
Active	Exercise
	Correcting posture
	Relaxation techniques
Passive	Hot or cold packs
	TENS
	Medication e.g. NSAIDs

TENS = Trans-cutaneous nerve electrical stimulation; NSAIDs = Non-steroidal anti-inflammatory drugs (Adapted from Blyth *et al*., 2005)

2.11 CERVICAL PILLOWS

The definition of a cervical pillow is one that is specifically designed to correct the head and neck positioning while laying on any surface e.g. a bed (Persson, 2006). A restful and healthy sleep is essential for the optimal functioning of the body. A pillow that is able to provide the correct support of the cervical spine and comfort is invaluable (Bogdanovic *et al*., 2011). Often neck pain that is worse in the mornings may be due to improper or decreased neck support while sleeping (Lavin *et al*., 1997). This is supported by Borenstein (2007) who reported that difficulty in remaining asleep is found in people with neck pain and that neck support during sleep is an important factor for relieving neck pain. In addition, chronic neck pain and unconscious muscle tension often produces tension-type headaches that may affect an individual's quality of sleep and difficulty in finding a proper sleeping position (Persson, 2006).

The aim of a cervical pillow is to maintain the cervical lordosis whilst supporting the cervical joints and allowing the neck muscles to relax (Ambrogio *et al*., 1998). A pillow should support the head and neck in a neutral position (i.e. normal lordotic angle) in order to prevent

excessive biomechanical stress on the pain-sensitive structures of the neck (Gordan *et al*., 2010). This may contribute to relief of neck pain that is non-specific in nature (Ambrogio *et al*., 1998). An ideal pillow is described as one that is flexible, sensitive to temperature changes of the environment and ensures proper joint support, thereby allowing the anatomical structures of the cervical spine to relax (Bogdanovic *et al*., 2011). The proper neck support while sleeping may have a continuing effect of reducing pain during the day (Lavin *et al*., 1997; Borenstein, 2007).

There have been several investigations on cervical pillows with varying results (**Table 2.10**). It is difficult to make a direct comparison between these studies due to differences in methodologies and patient characteristics. The use of a semi-customised foam pillow in individuals experiencing neck pain is supported by Erfanian *et al*. (2004). In contrast, Gordan *et al.* (2009) did not observe an improvement when a foam or semi-customised foam pillow was investigated and concluded that these pillows were uncomfortable. Gordan *et al*. (2009) advocated the use of a rubber pillow in individuals experiencing neck pain while Lavin *et al*. (1997) and Persson (2006) recommend a variety of pillow types (**Table 2.10**).

In previous studies an absence of a wash-out period may have influenced the results (Lavin *et al*., 1997; Persson, 2006). A carry-over effect of the varying pillows may have occurred. It is, therefore, difficult to attribute a specific pillow to the results observed. The trial period of the studies varied with Gordan *et al.* (2009) implementing a trial period of one week for each pillow, while Lavin *et al* (1997) used a period of 14 days and Erfanian *et al*. (2004) used a period of 4 weeks. Anecdotal evidence suggests that an individual may require a prolonged period to become accustomed to a new pillow (Erfanian *et al*., 1998).

Gordan *et al.* (2009) included participants that slept in a lateral recumbent position while the other studies did not report on the sleeping positions of the participants. Sleeping position may be a contributing or relieving factor to neck pain (Schmidt and Richardson, 2003). The prone position may lead to an increase stress on the muscles and joints, due to the cervical spine being placed in an altered position (Schmidt and Richardson, 2003). The introduction of a new pillow may also lead to an altered sleeping position which may account for the initial discomfort experienced by the user.

The blinding of participants to the pillow occurred in the studies conducted by Persson (2006) and Gordan *et al*. (2009). Furthermore, these studies only collected subjective data. The use of subjective assessment methods relies on participant observation and honesty. The remaining studies (**Table 2.10**), did not consider the lack of blinding as a limitation, nor did they account for the Hawthorne Effect during the discussion of the results. These factors could have added a component of bias to the observed results.

Cervical pillows are often recommended by health-care practitioners, although the majority of the information regarding the efficacy of cervical pillows is based on anecdotal evidence (Hyland, 2003). In a systematic review on cervical pillows and neck pain it was concluded that there is insufficient research regarding cervical pillows to determine their effectiveness in reducing neck pain (Shields *et al*., 2006). This was largely due to the questionable quality of studies available. The use of standardization of objective and subjective measurements and case definition will assist in deciding on an effective pillow.

Table 2.10 A summary of the studies reporting on the effectiveness of cervical pillows

Reference	Sample size	Age range	Neck pain duration	Type of pillow used	Outcome measures	Results
Lavin *et al.* (1997)	*n* = 46	26 –76 yrs	1 month-25 years	Water-based pillow Roll pillow Usual pillow	VAS Sleep questionnaire SIP	The water based pillow performed the best in terms of reducing pain and patient satisfaction. The roll pillow was considered uncomfortable. Awakening scores ($p < 0.01$). Participant satisfaction ($p < 0.001$).
Erfanian *et al*. (1998)	*n = 23*	N/A	Asymptomatic participants	Semi-customized foam pillow	Sleep diary	The experimental pillow did not produce any adverse effects.
Erfanian *et al*. (2004)	*n* = 36	N/A	≥ 3 months	Standard pillow Semi-customized foam pillow of varying height ×2	NDI NRS Sleep diary	An improvement was noted when using the semi-customized foam pillow with regards to NDI ($p < 0.005$) and awakening NRS ($p < 0.05$) scores.
Persson (2006)	*n* = 52	18-82 yrs	≥ 3 months	Fibre-filled pillow Polyurethane pillow Cold-cured pillow Standard pillow	VAS Sleep diary	The pillow containing the fibre filling performed the best.
Gordan *et al.* (2009)	*n* = 106	20 –81 yrs	≥ 3 months	Polyester pillow Foam contour pillow Feather pillow Rubber pillow	Sleep diary	The foam pillow and contour foam pillow did not produce any benefit in comparison to the normal pillow. The rubber pillow was considered the best pillow.
Gordan *et al.* (2010)	*n* = 106	20 –81 yrs	Asymptomatic participants	Latex pillow Feather pillow Foam contour pillow Foam regular pillow Usual pillow	Sleep diary	The authors recommended the latex pillow and not the feather pillow.

VAS = Visual Analogue Scale; SIP = Sickness impact profile; NDI = Neck Disability Index; NRS = Numerical Pain Rating Scale; N/A = Not available

2.11.1 Adverse Effects of Cervical Pillows

The adverse effects of cervical pillows have not been adequately investigated. However, a study did examine the adverse effects of a semi-customized pillow on asymptomatic individuals (**Table 2.10**) (Erfanian *et al*., 1998). A sleep and pain diary was used to determine if the participants experienced neck pain, headache or decreased quality of sleep during the course of the study. The study did not yield statistically significant results although it was

concluded that the semi-customized pillow did not produce any adverse effects. Anecdotal evidence indicates that an individual may find a cervical pillow uncomfortable at the beginning, but will find an improvement with continuous use (Erfanian *et al*., 1998; Hyland, 2003). The use of a cervical pillow may also lead to alterations in sleeping positions which may involve adhering to a prolonged time to adapt to the pillow (Shields *et al*., 2006).

2.12 THE SIMMONS BEAUTYREST® POCKETED COIL PILLOW

The following information was provided by Simmons South Africa Company via email (simmonssales@iafrica.com, Omar, 2010). The details provided below are the marketing information the company uses to promote its pillow**.**

The Simmons Beautyrest® pocketed coil pillow is a uniquely-designed pillow, consisting of an inner coils system known as the Morpheus spring system surrounded a polyester fibre filling. Each coil is wrapped independently and capable of adapting to individual movement. Proper neck support is, therefore, provided regardless of sleeping position. This pillow contains approximately 12 litres of air which enables the pillow to create an ideal microclimate by releasing warm air and allowing fresh air to flow in with changes in pressure. The pillow is reported to be comfortable and soft and will adapt to any shape, weight or movement by the user. The pillow also has a non-flattening characteristic, which makes it permanently plump, yet soft. Each pillow is individually wrapped and vacuum-sealed to maintain hygiene. To date there has been no formal investigation into the effectiveness of the Simmons Beautyrest® pocketed coil pillow in reducing or alleviating chronic neck pain.

Figure 2.6 The Simmons Beautyrest® pillow in cross section
(From www.simmons.co.za)

The above pillow was chosen for this study due to the features it encompasses (as motivated by the company) and, therefore, its potential in reducing non-specific neck pain. There was no further information available regarding the Simmons Beautyrest® pillow due to proprietary interest.

2.13 THE HAWTHORNE EFFECT

The Hawthorne Effect refers to the concept of altered performance or behaviour due to awareness of being in an experimental environment (Campbell *et al*., 1995; Coombs, 2003). A tendency to improve productivity, thereby producing improved results, is a hallmark of the Hawthorne Effect (Macefield, 2007). The Hawthorne Effect has been a factor in numerous clinical studies (McCarney *et al*., 2007). However, there has been much critique into its validity or its place in research (Macefield, 2007). It has been argued that the positive effect observed in studies may be due to various reasons other than altered behaviour or the need to gratify the researcher. For example, the results observed in the original Hawthorne study may have been due to a feedback mechanism. The workers being investigated in the original Hawthorne study received feedback regarding their performance. This led to the critique that the worker's performance improved due to knowledge they received from the feedback and because they were encouraged by the researchers to perform better. Another factor is that the participants in the Hawthorne study were individuals who were regarded as 'experts' in performing the specific task. The generalizability of the Hawthorne Effect to all clinical research is, therefore, considered flawed. However, many argue that the Hawthorne Effect has become so entrenched in the research environment that it is difficult to ignore, regardless of whether it has any significance (Macefield, 2007).

The Hawthorne Effect does not require the direct observation nor does it require feedback to influence experimental subjects (Campbell *et al*., 1995). If the Hawthorne Effect is taken into consideration, the following factors should be considered:

- The participants' need to please the researcher as a result of been chosen or singled out to participate in the trial.
- Any form of perceived compensation by the researcher to the participants.
- An altered response by the participants due to branded products.

2.14 CONCLUSION

Non-specific neck pain has a diverse clinical presentation that requires an equally diverse range of treatment methods. The difficulty concerning non-specific neck pain lies in an inability to identify the most appropriate or effective treatment approach. Treatments such as manipulation, dry needling or electro-modalities, often require the skill of a health-care practitioner. Alternatively, patients may opt for self-care. Self-care options include hot or cold therapy, stretching or ergonomic support such as cervical pillows. The advantage of self-care is that it is usually cost-effective, can be continuous and gives an individual a sense of control and empowerment (Blyth *et al*., 2005).

Health-care professionals have been providing advice on cervical pillows and recommendations to patients based primarily on an anecdotal basis (Gordan *et al*., 2009). Several studies have been conducted to determine the effectiveness of cervical pillows in reducing neck pain with ambivalent results (**Table 2.10**). It is difficult to directly compare the results of these studies due to the differences in the pillows used, methodologies and patient characteristics. One is, therefore, unable to conclude on which is the most effective cervical pillow.

The Simmons South African company has recently introduced the Simmons Beautyrest® pillow. They claim that the pillow is a uniquely-designed pillow that is able to provide support and comfort to the head and neck in any sleeping position. However, there have been no independent studies to determine whether the pillow is effective is alleviating chronic non-specific neck pain. Therefore, this study aimed to determine the effectiveness of the Simmons Beautyrest® pillow compared to the participant's conventional pillow in reducing non-specific chronic neck pain.

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY DESIGN

This study was designed as a quantitative, single-blinded, cross-over trial conducted at the Durban University of Technology's (DUT) Chiropractic Day Clinic (CDC). Approval to conduct the study was obtained from the Faculty of Health Sciences Research Committee (FRC) **(Ethics Certificate Clearance Number: 033/11[Appendix J]).**

3.2 PATIENT RECRUITMENT

Participants were recruited via advertisements (**Appendix B**), pamphlets and word of mouth. Advertisements were placed on notice boards at the DUT, local health shops and libraries with permission from the respective authorities. Prospective participants were invited to telephone the researcher at the CDC if they were interested in participating in the study.

3.3 STUDY POPULATION

Residents of the eThekwini province of Kwazulu Natal.

a) Inclusion Criteria

1. The participants had to be between the ages of 18 and 45 years. This was done to minimize the entry of participants with advanced degenerative changes in the spine (Friedenberg and Miller, 2010).
2. The participants had to be diagnosed with non-specific neck pain. These conditions were diagnosed through the examination process according to the following criteria:
   a) Active MFTPs were diagnosed via palpation of the cervical muscles and the pain referral patterns (**Figure 2.1 – 2.4**).
   b) Cervical facet syndrome through the use of cervical orthopaedic tests (e.g. Kemp's test) and motion palpation of the cervical spine (Magee, 2005).
3. The participant had to experience neck pain that was chronic in nature i.e. eight weeks or more in duration (Vernon *et al.*, 2007).

4. The intensity of neck pain had to be mild to moderate, ranging between 30 and 80 on the NRS.
5. The participants were allowed to use any pillow except the Simmons Beautyrest® pillow or another cervical/orthopaedic pillow.

b) Exclusion Criteria

1. Neck pain that was due to pathological causes (e.g. tumors) or chronic inflammatory diseases (e.g. systemic arthropathies). This was determined on the basis of the case history, physical examination and cervical orthopaedic examination findings.
2. Participants' that used more than one pillow for sleeping.
3. Participants' that were receiving any current treatment for non-specific neck pain (e.g. cervical spine manipulation or medication).

3.4 SAMPLING

A non-probability convenience sampling method was utilised (Teddlie and Yu, 2007). The sample size (*n* = 40) was determined after consultation with a statistician (Esterhuizen, 2010) and after reviewing the samples sizes of previous studies (**Table 2.10**). Financial and time constraints also played a role in determining the final sample size.

3.5 Measurement tools for assessing neck pain

3.5.1) Subjective Measurements

a) Numerical pain rating scales

Pain rating scales are one of the most common methods of evaluating neck pain subjectively (Vernon, 2008). The Numerical Pain Rating Scale (NRS) has shown to be a valid and reliable tool and detects small changes in pain when compared to other pain rating scales (Williams *et al*., 2009). The NRS (**Appendix D**) was used to determine the severity of neck pain that the participants were experiencing during the study. This scale consists of numbers zero to a hundred. The participant was asked to rate their pain with a rating of zero being no pain and a hundred been the most severe pain experienced (Williams *et al.,* 2008). This value was documented as the raw score on **Appendix D** at each consultation.

b) Neck disability index

The neck disability index (NDI) is utilised primarily to determine the impact of neck pain on an individual's activities and function (Ackelman and Lindgren, 2002). The NDI is frequently used in research and clinical settings due its reliability (Vernon, 2008). The NDI questionnaire comprised of ten questions, each with six responses (**Appendix F**). The participant was asked to choose only one option from each question. Each option is allocated a specific number from zero to five which was added to achieve a total score out of fifty (Vernon, 2008). This score was added and documented as a number out of fifty on **Appendix F**.

c) Sleep and pain diary

A sleep and pain diary is used to monitor changes in sleep and pain by documenting results of neck pain and its effect on sleep daily, thereby allowing a clinician to detect patterns in these areas. The sleep and pain diary is frequently used in clinical research regarding pillow use (Gordan *et al*., 2009). A disadvantage of subjective methods is the reliance on the truthfulness of the participants' responses. The sleep and pain diary (**Appendix E**) consisted of questions pertaining to pillow comfort, sleep quality and neck pain. It was used to monitor changes in these aspects and the presence of any symptoms (e.g. neck stiffness) related to the pillow use and neck pain. The diary was adapted from a study conducted by Gordan *et al*. (2009). The questions required varying responses and were documented on **Appendix E** as follows:

- Question one – The participants were required to document a rating of their neck pain prior to sleeping using a scale of zero to ten with zero representing no pain and ten representing the worse pain ever. This score was documented as a value out of ten on **Appendix E**.
- Question two – The participants were required to rate their neck pain on awakening using a scale of zero to ten with zero representing no pain and ten representing the worse pain ever. This score was then recorded as a value out of ten on **Appendix E**.
- Question three – The participants were required to rate the comfort level of the pillow that they were using. They were given four options; each option was allocated a number from one to four: very comfortable (1), somewhat comfortable (2), very uncomfortable (3), and somewhat uncomfortable (4). The participants chose the most appropriate option along with the allocated number. The allocated number was then

placed in the excel spreadsheet used for data analysis along with a key for interpretation of the numbers.

- Question four – The participant was required to indicate the presence of 1) neck pain, 2) neck stiffness and 3) a headache on awakening using a 'yes' or 'no' response. The 'yes' option was allocated the number one and 'no' was allocated the number two.
- Question five – The participant was required to indicate if neck pain had an effect on their performance in daily activities by responding with either 'yes' or 'no' with 'yes' being allocated the number one and 'no' the number two.

3.5.2) Objective Measurements

a) Pain pressure thresholds

An algometer pressure device is used to evaluate muscle tenderness or soft tissue tenderness (Wagner Instruments, Greenwich; Vanderweeen *et al*., 1996). It is regarded as a reliable and valid tool (Livingson *et al*., 1998). There are two variants of the algometer pressure device available viz. an analogue and a digital algometer device. A clinician is able to use the algometer on subsequent readings to detect changes in pain threshold. The analogue algometer requires calibration to maintain device quality and relies on correct reading of measurements by the operator. The analogue algometer device was used in this study.

The following procedure was used when taking these measurements, this process was adhered to ensuring reliability of data obtained (Livingson *et al*., 1998):

1. The algometer was first calibrated and zeroed before proceeding with the measurements.
2. The procedure was then explained to the participant.
3. The participant was seated with the neck and upper back area exposed.
4. The four most tended areas were located via palpation and recorded as value in mmHg on **Appendix C**.
5. The algometer tip was placed on the tender areas previously identified, pressure was then applied with the participant been asked to respond to the onset of pain.
6. The MFTP that revealed the lowest reading was recorded on **Appendix C** in mmHg and stained with henna to allow for accurate measurements to be obtained at each consultation.
7. This MFTP stained with henna was measured as per the above protocol on subsequent visits to obtain a reading in mmHg. The reading in mmHg was recorded on **Appendix C** at each visit.

b) Cervical range of motion

Range of motion measurements are frequently used in clinical research to test the efficacy of various treatments (Williams *et al*., 2009). The cervical range of motion (CROM) device, goniometer and inclinometer are considered valid and reliable due to significant results being reported in inter-examiner reliability studies (Williams *et al*., 2009). The CROM has been studied more extensively than its counter-parts and is, therefore, recommended for clinical use (Jordan, 2000). The inclinometer is reliable and valid for assessing ROM, but has not been researched as extensively as the CROM (Williams *et al*., 2009).

In this study the cervical ROM was assessed using a CROM device [Performance Attained Associates Model, Greenwich]. The CROM readings were obtained by following the guidelines as outlined in the manual. This procedure was adhered to at subsequent visits ensuring reliability of data obtained.

1. The CROM device was placed on the participants' nose bridge and ears. This was then fastened at the back of the head while the participant was in a seated position.
2. The participants were asked to sit upright with their back resting against the back of the chair, arms hanging freely at their side and feet flat and together.
3. The researcher ensured the dial was zeroed prior to taking measurements.
4. The following process was followed for the individual ROM measurements:
5. Flexion-the participants were asked to bend their head forward as much as possible
6. Extension-the participants were asked to extend their head in a backward direction or look at the ceiling
7. Lateral flexion-the participants were asked to bring their ear towards their shoulder or bend their head sideward, this was done bilaterally
8. Rotation-the participants were instructed to look over their shoulder, this was done bilaterally
9. These measurements in degrees were then recorded for each movement on **Appendix C**

3.6 RESEARCH PROCEDURE

a) The prospective participants were contacted telephonically by the researcher to assess their suitability to participate in the study. Permission to ask the prospective participants questions were obtained from the FRC and the following questions were asked:

1. Are you between the ages of 18 and 45 years?

2. Have you had treatment for neck pain within the last three months?
3. Do you have any chronic disease (e.g. rheumatoid arthritis of the neck)?
4. What kind of pillow are you using currently?
5. How long have you had neck pain?
6. How many pillows are you currently using?

The required period an individual needed to experience neck pain was eight weeks or more. If the prospective participant answered 'yes' to Question One, 'no' to Question Two and Three and was not using a Simmons® Beautyrest pillow or more than one pillow, they were preliminarily accepted. An appointment was thereafter made at the CDC.

b) At **Consultation One**, the following process occurred:
1. The study was explained to the participants and they were given an opportunity to ask questions regarding the study.

2. If the participants agreed to participate in the study they were given a letter of information and informed consent form (**Appendix A**) to sign.

3. A case history (**Appendix G**) was obtained followed by a physical examination (**Appendix H**) and cervical orthopaedic examination (**Appendix I**).

The participants were then allocated to a group using a random allocation chart (Teddlie and Yu, 2007). The random allocation chart was formulated by a biostatistician (Esterhuizen, 2011), whereby the participants' (n = 40) were assigned to either Group A (n = 20) or Group B (n = 20). The independent variable was the Simmons Beautyrest® pillow. The study period was four weeks. A cross-over design was used where participants in Group A were given the Simmons Beautyrest® pillow for the first two weeks, followed by them using their usual (the one they normally slept with) pillow for the remaining two weeks. Participants in Group B where told to continue using their usual pillow for the first two weeks followed by the Simmons Beautyrest® pillow for the remaining two weeks.

3.7 BLINDING

A research assistant used the random allocation chart to issue the pillows to the participants in order to keep the researcher unaware of the group designation of the participants. This was done to remove any bias that the researcher may have had to a particular group. The research assistant issued the pillows at the end of Consultation One or Three, depending on

the group allocation of the participant. The participants' were told not to inform the researcher of their group allocation at any stage of the study.

3.8 CONSULTATIONS

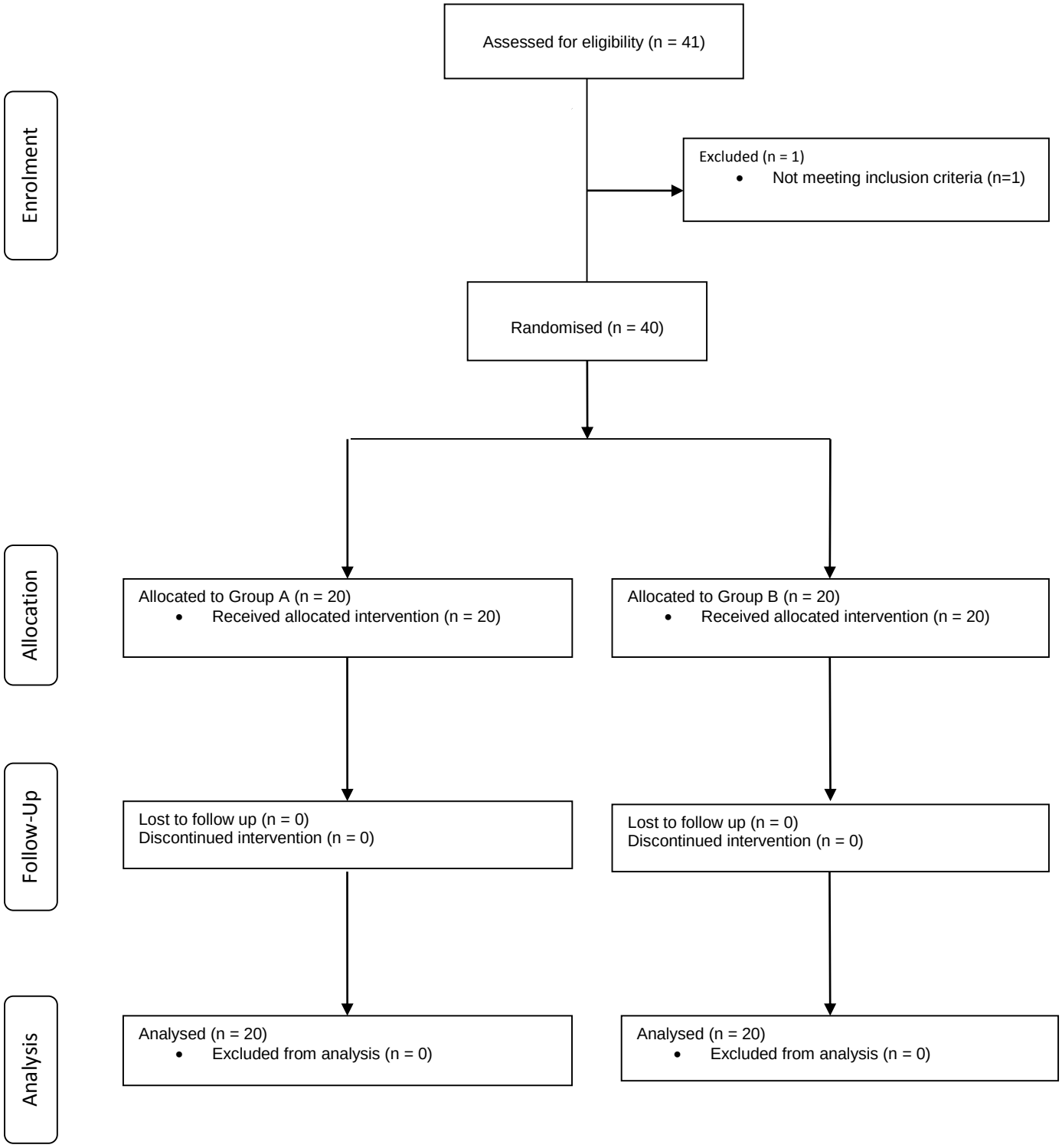
3.8.1) Consultation One

After the case history, physical and cervical spine regional examinations were completed; the subjective and objective measurements were taken. The participant was instructed to complete the pain and sleep diary on a daily basis and a follow-up consultation was made within a week. The researcher then left the consulting room and the research assistant then informed the participants to which group they were allocated and then either issued them a Simmons Beautyrest® pillow or informed them to continue using their normal pillow. If the participant was issued a Simmons Beautyrest® pillow they were then advised to follow the instructions located within the pillow packaging. These instructions contained directions on how to prepare the pillow for use as the pillow was vacuum-sealed and needed 5-6 hours to self-inflate and obtain its proper size. The procedures for the remainder of the consultations are outlined in **Table 3.1**.

Table 3.1 The procedure according to consultations

Consultation	Day	Procedures/examination	Comments
Two	7	Subjective and objective measurements	The participant was instructed to continue using the pillow from consultation.
Three	14	Objective and subjective measurements	The participant was instructed by the research assistant on pillow use depending on grouping.
Four	21	Objective and subjective measurements	The participant was instructed to continue using the pillow from the previous consultation.
Five	28	Objective and subjective measurements	The sleep and pain diary was collected.

3.9 OUTLINE OF RESEARCH PROCEDURE:



3.10 STATISTICAL ANALYSES

The raw data was transferred from the data collection sheets into an excel spread sheet for statistical analysis. The data was checked for normality of distribution before analysis began and was found to be approximately normally distributed, therefore parametric tests were used. Data collection took place at five consultations; the consultations were averaged for each phase of the cross over design to result in a two treatment, two period crossover designs for ease of analysis and interpretation. The first three consultations make up period one and the last two consultations make up period two. The statistical package SPSS version 18 was used to analyze the data. A *p*-value of <0.05 indicated statistical significance (Esterhuizen, 2011). In order to ensure that the groups were similar in terms of demographic data Chi square tests were used for categorical variables (e.g. gender and race) and t-test were used for continuous variables (e.g. age). Baseline subjective and objective measurements (excluding the sleep and pain diary) were analyzed using Student's t-tests to compare the groups. Repeated measures ANOVA testing was used to evaluate the effect of the intervention on subjective and objective measurement in this cross-over design according to the method of Dallal (Esterhuizen, 2011).

The sleep and pain diary data was measured at 28 time points, the first 14 constituting period one and the second fourteen constituting period two. The data was therefore arranged by period. For the sleep and pain diary (**Appendix E**), Question One, Two and Three were analyzed using repeated measures ANOVA. Question Four and Five (**Appendix E**) was analyzed using the Wald chi square test, the total number of cases (neck pain, neck stiffness, headaches or where neck pain affected an individual's daily activities) documented over the 28-day period were added together according to group and period and were then analyzed.

CHAPTER FOUR

RESULTS

4.1 DEMOGRAPHIC DATA OF THE PARTICIPANTS

4.1.1 Age

The mean age for group A was 29.9 (± SD 8.9) and group B was 27.6 (± SD 8.6), resulting in a mean age difference of 2.3 years. There was no statistically significant difference observed in the mean age of the groups (p = 0.412). The ages ranged from 18 years to 45 years with the overall mean (± SD) age being 28.75 (± 8.75) years of age.

4.1.2 Race, Gender and Occupation

The race and gender distribution are depicted graphically in **Figure 4.1**. There was no significant difference in the distribution of race (p = 0.443) nor in the distribution of gender (p = 0.705) between the groups. There were no Coloured participants in the study. In terms of occupation of the participants students made up 42.5% of the sample (group A 35% and group B 50%) with other occupations including housewife's, professionals, managers, a domestic worker and artisan (**Appendix K**).

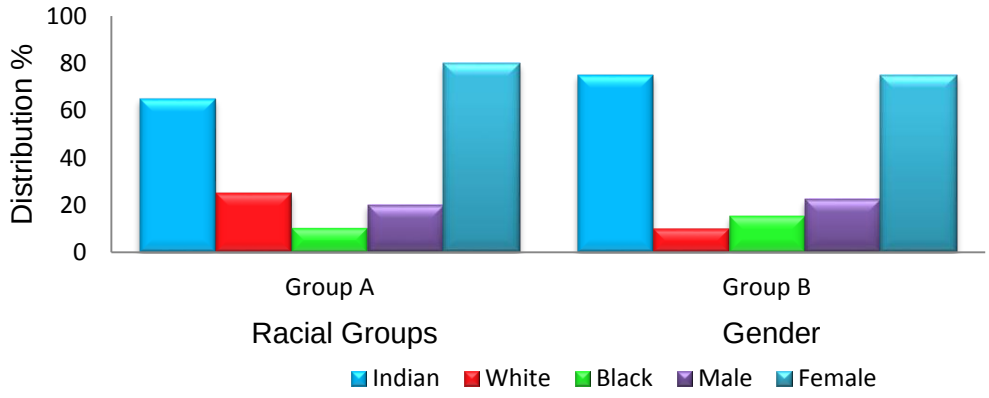


Figure 4.1 The distribution (%) of the respective racial groups and gender

4.2 OBJECTIVE OUTCOME MEASURES

4.2.1 Pain pressure threshold

The pain pressure threshold readings (estimated marginal means) according to time trends and the effects of the intervention are represented in **Figures 4.3** and **4.4** respectively. A significant improvement in the mean pain pressure threshold scores was observed in both groups when the participants used the Simmons Beautyrest® pillow compared to the participants' usual pillow (p = 0.001; **Figure 4.4**). The period effect was significant, indicating that the algometer readings increased generally over time (p ‹ 0.001) however the carryover effect was not statistically significant (p = 0.960).

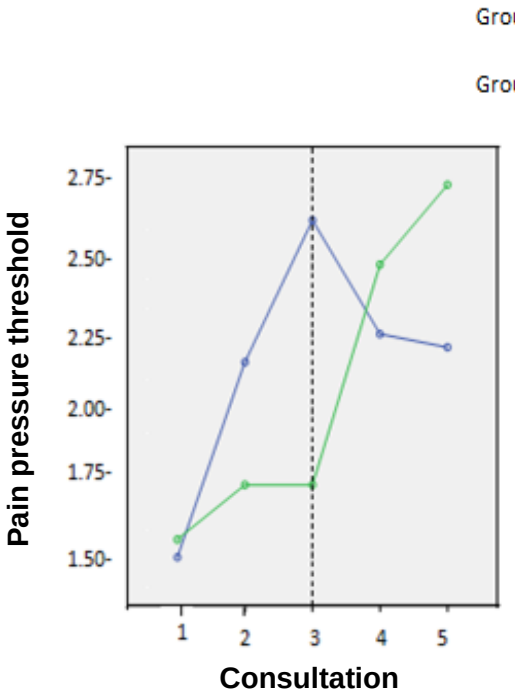


Figure 4.3 The pain pressure threshold (kPa.m^{-2}) readings of the respective groups according to time trends

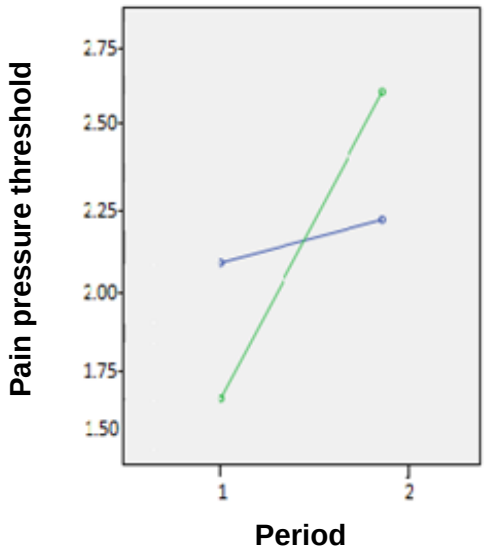


Figure 4.4 The pain pressure threshold (kPa.m^{-2}) readings of the respective groups according to the intervention

4.2.2 Cervical Range of Motion

The results from the CROM for extension, left and right rotation and left lateral flexion were not statistically significant. Flexion range of motion had a significant period effect (p = 0.001) however there was no significant effect observed in the ROM when participants were using the Simmons Beautyrest® pillow (p = 0.370), indicating that both groups had flexion range of motion improvements at the same rate. A significant increase in the mean right lateral flexion measurements was observed when using the Simmons Beautyrest® pillow in both groups (p = 0.001) as represented in **Figures 4.5** and **4.6** respectively.

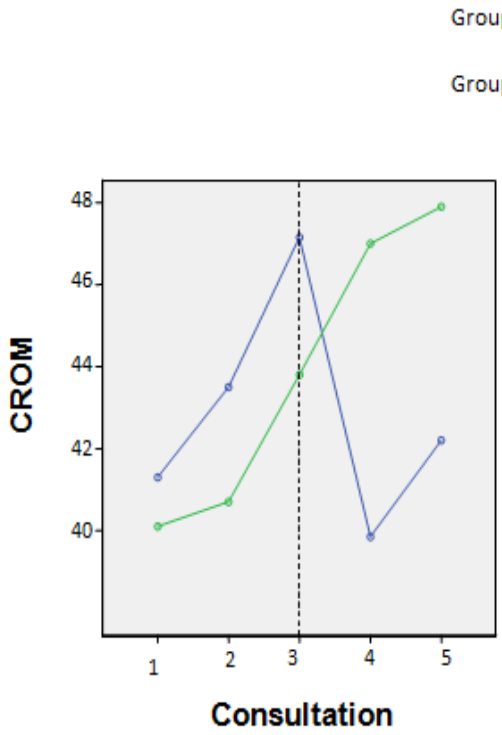


Figure 4.5 The trends of mean right lateral flexion ROM measurements of the respective groups.

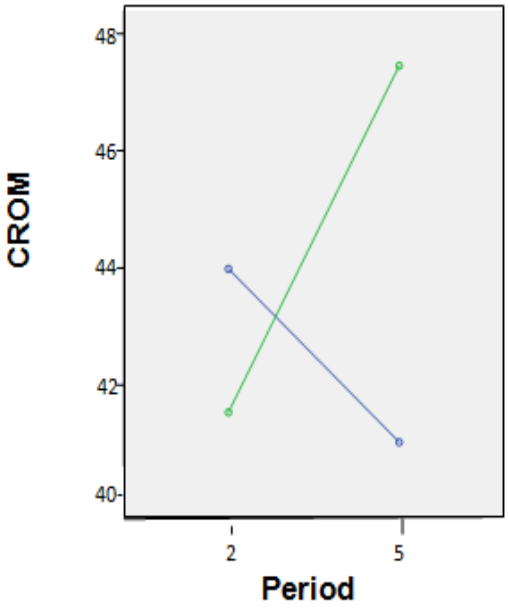


Figure 4.6 The mean right lateral flexion ROM measurements of the respective groups according to the intervention

4.3 SUBJECTIVE OUTCOME MEASUREMENTS

4.3.1 Numerical Pain Rating Scale

The pain scores (estimated marginal means) are represented graphically in **Figures 4.7** and **4.8** respectively. The participants were required to rate their neck pain using a scale of zero to a hundred. There was a significant decrease in the mean pain scores in both groups when using the Simmons Beautyrest® pillow (p = 0.018). Furthermore the carry-over effect was not significant (p = 0.125).

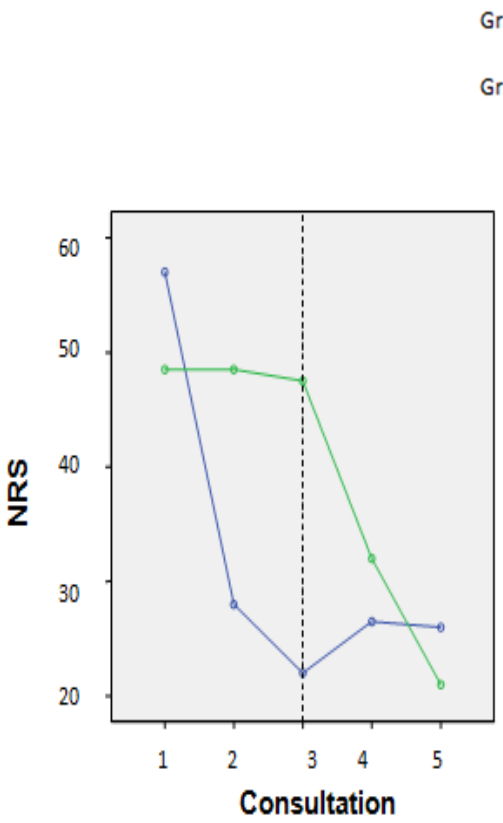


Figure 4.7 The mean pain scores of the respective groups according to time trends

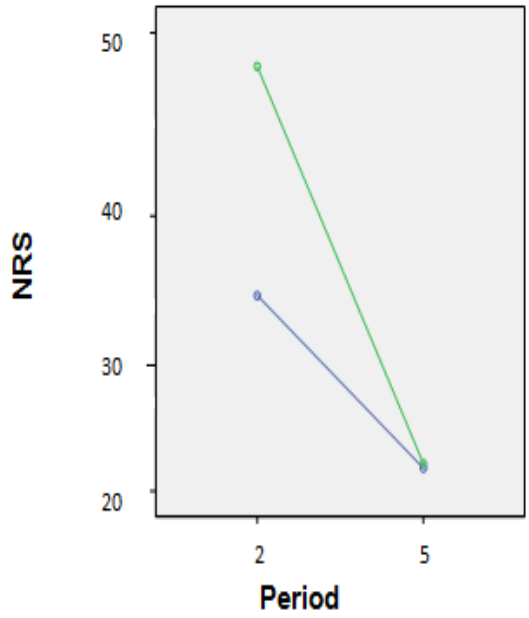


Figure 4.8 The mean pain scores of the respective groups according to the intervention

4.3.2 Neck Disability Index (NDI)

The NDI scores (estimated marginal means) according to time trends and the effect of the intervention are shown in **Figures 4.9** and **4.10** respectively. At each consultation, the participant was required to complete a NDI questionnaire. A total score out of fifty was obtained for each NDI questionnaire. This value was recorded as a raw value for statistical analysis. A significant decrease in NDI scores ($p < 0.001$) was observed in both groups when using the Simmons Beautyrest® pillow. A greater improvement was seen in Group B when compared to Group A while using the Simmons Beautyrest® pillow (**Figure 4.10**). The carry-over was not statistically significant ($p = 0.567$)

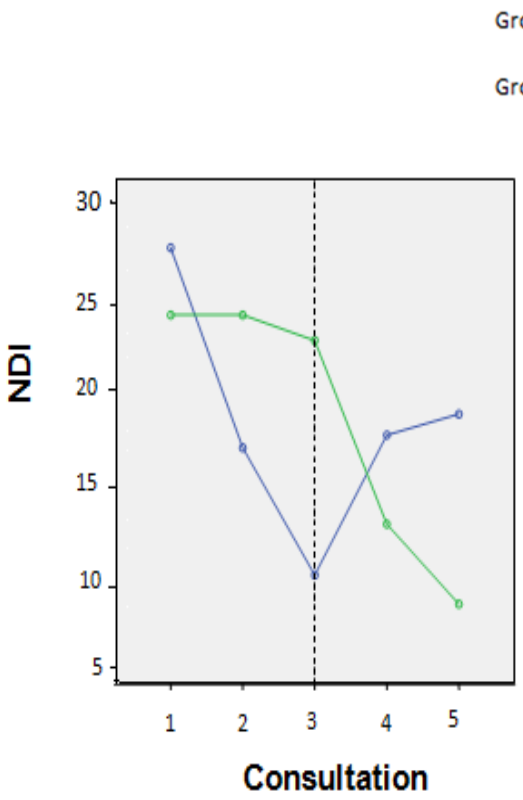


Figure 4.9 The mean NDI measurements of the respective groups according to time trends

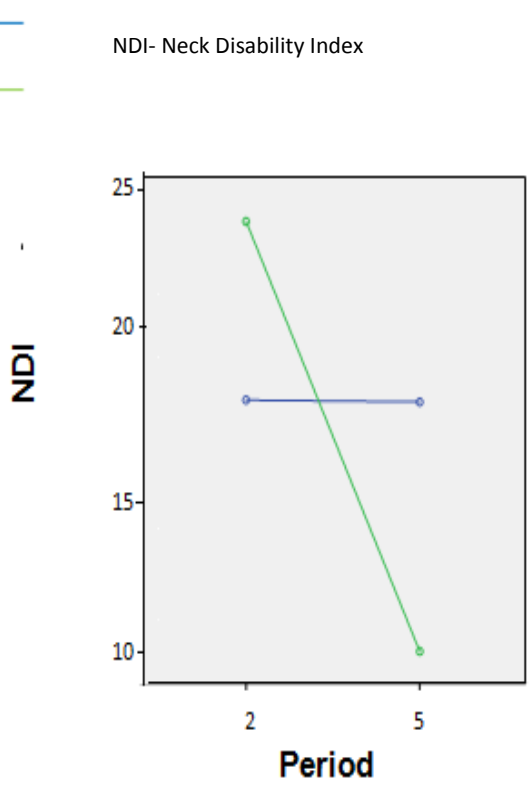


Figure 4.10 The mean NDI measurements of the respective groups according to the intervention

4.3.3 Sleep and Pain Diary

4.3.3.1 Question 1: Rating of neck pain rating prior to falling asleep

The rating of neck pain prior to falling asleep (estimated marginal means) according to time trends and the effect of the intervention, using a scale of zero to ten, are shown in **Figures 4.11** and **4.12** respectively. A significant reduction in neck pain was noted in both groups when using the Simmons Beautyrest® pillow ($p < 0.001$), the carry-over effect was not statistically significant ($p = 0.333$).

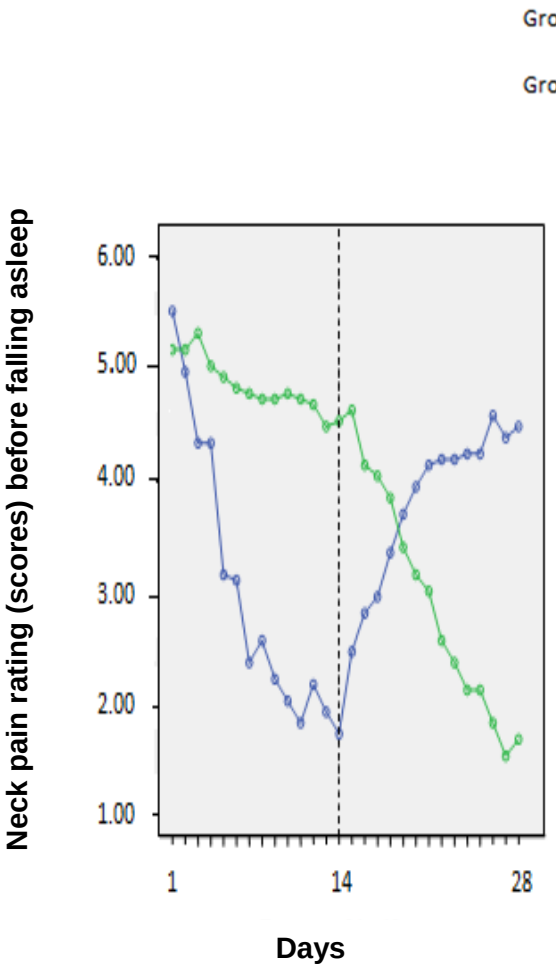


Figure 4.11 The neck pain rating (mean values) prior to falling asleep of the respective groups according to time trends

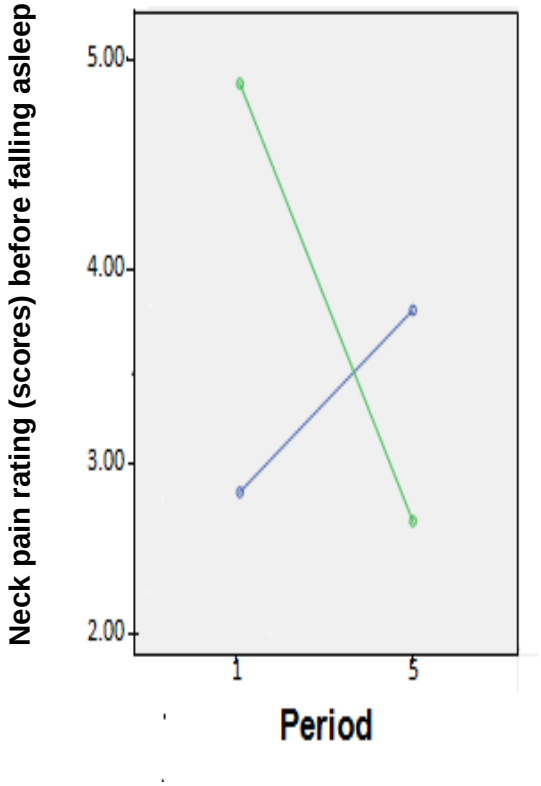


Figure 4.12 The neck pain rating (mean values) prior to falling asleep of the respective groups according to the intervention

4.3.3.2 Question 2: Rating of neck pain on awakening

The rating of neck pain on awakening (estimated marginal means) according to time trends and the effect of the intervention are represented graphically in **Figures 4.13** and **4.14** respectively. A scale of zero to ten was used to rate neck pain on awakening. A significant reduction in neck pain on awakening was noted in both groups when using the Simmons Beautyrest® pillow ($p < 0.001$). The carry-over effect was not significant ($p = 0.241$).

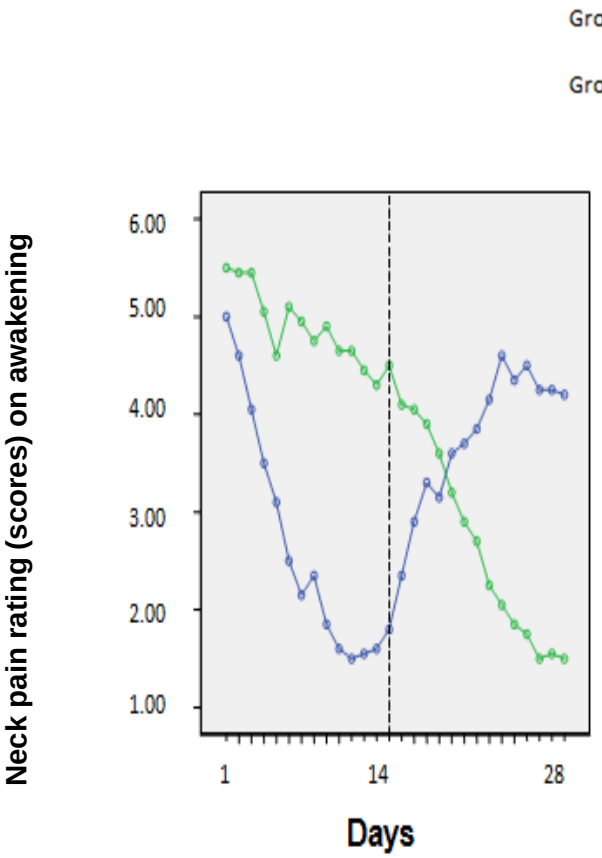


Figure 4.13 The mean neck pain ratings on awakening of the respective groups according to time trends

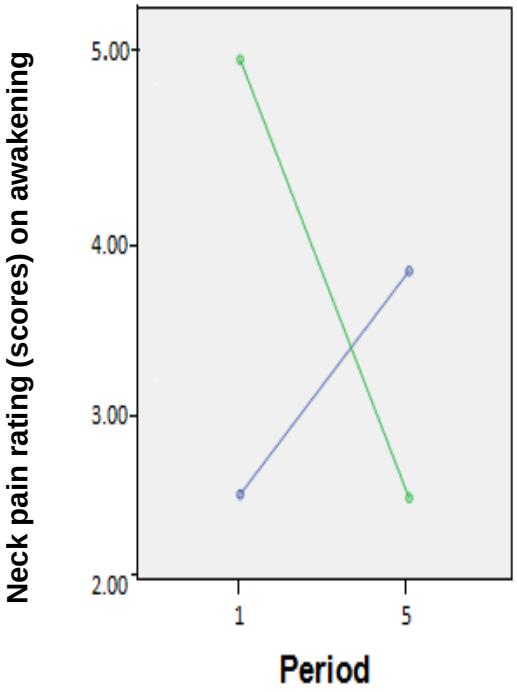


Figure 4.14 The mean neck pain rating on awakening of the respective groups according to the intervention

4.3.3.3 Question 3: Rating of the comfort levels of both pillows

The rating of the comfort of both the pillows (estimated marginal means) according to time trends and the effect of the intervention are depicted graphically in **Figures 4.15** and **4.16** respectively. The rating of comfort was assessed using ranked data. The participant was required to indicate if the pillow was very comfortable (1), somewhat comfortable (2), very uncomfortable (3) or somewhat uncomfortable (4). These options were assigned numbers one to four (**Appendix E**). There was a significant difference in the perceived comfort levels between the two pillows ($p < 0.001$) with the Simmons Beautyrest® pillow having a higher comfort rating in both groups when compared to the participant's usual pillow (**Figure 4.15 and 4.16**). The mean comfort rating score according to the period effect is shown in **Figure 4.16**. The carry-over effect was considered non-significant ($p = 0.485$).

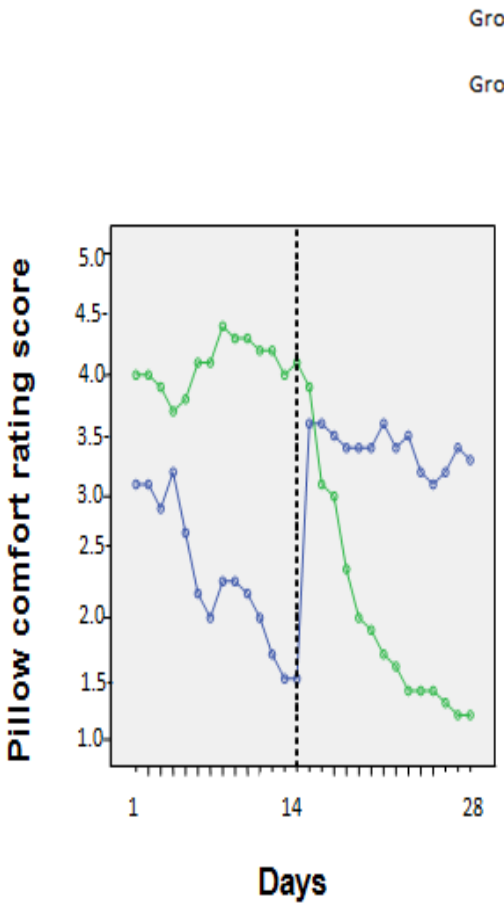


Figure 4.15 The mean comfort rating of the pillow of the respective groups according to time trends

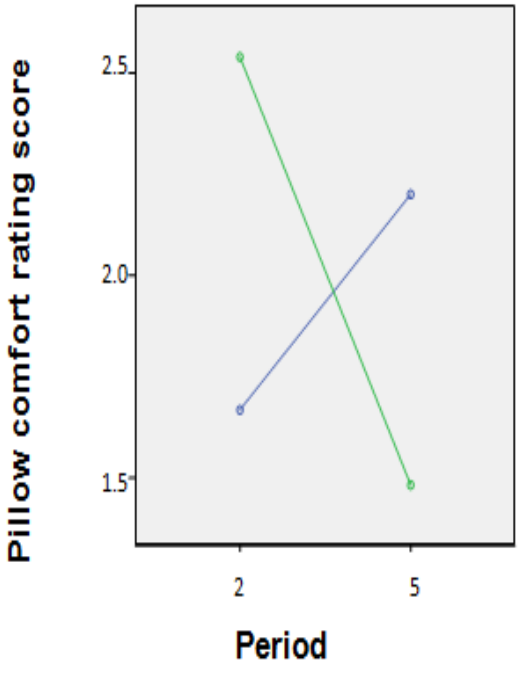


Figure 4.16 The mean comfort rating of the pillow of the respective groups according to the intervention

4.3.3.4 Question 4.1: The presence or absence of neck pain on awakening

The total count of neck pain cases on awakening are shown in **Figure 4.17**. The information was determined by the participant indicating a 'yes' or 'no' response to the presence of neck pain. The episodes of neck pain that each person reported over the 28-day period was summed for each group to provide the total number of neck pain cases on awakening. The Simmons Beautyrest® group showed a significant decrease in the presence of neck pain on awakening in both groups ($p < 0.001$) however the carry-over effect was significant ($p = 0.048$).

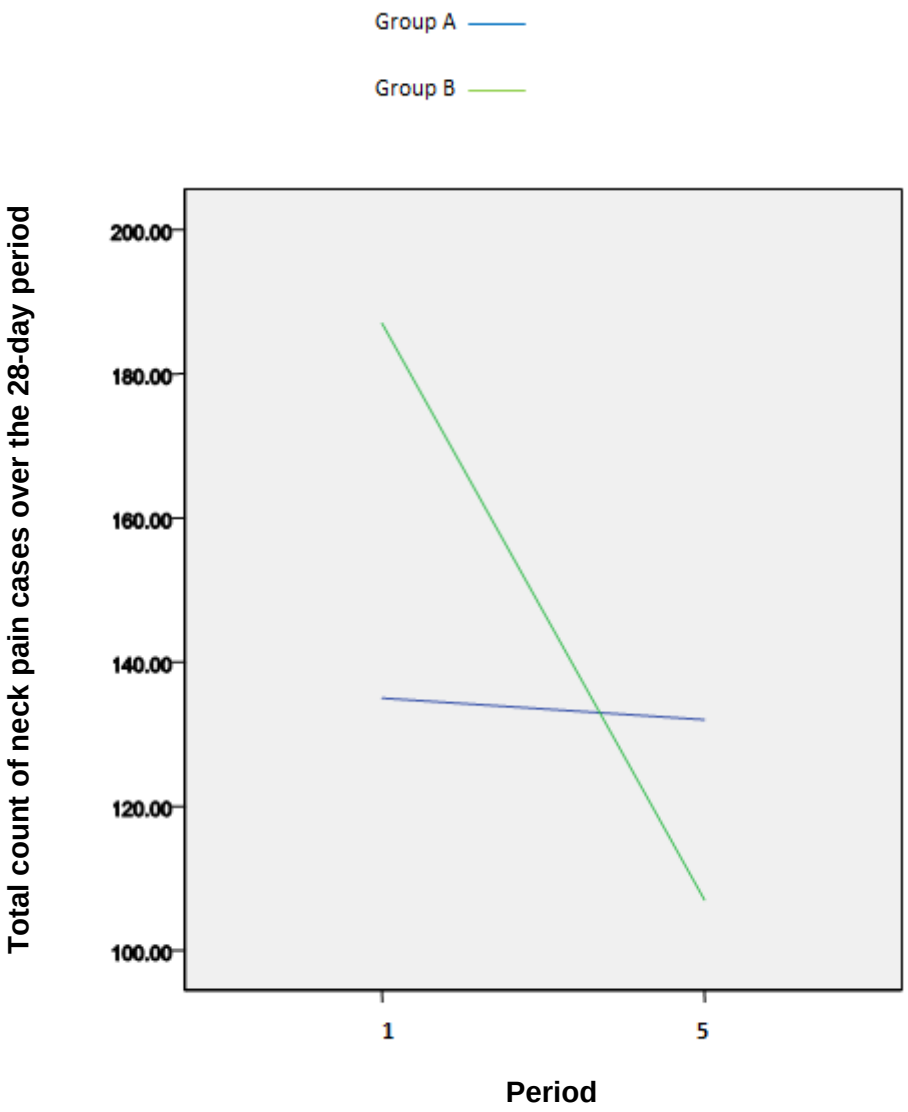


Figure 4.17 The total cases of participants presenting with neck pain over the 28-day period of the respective groups according to the intervention

4.3.3.5 Question 4.2: The presence or absence of neck stiffness on awakening

The total count of neck stiffness cases on awakening are represented in **Figure 4.18**. This data was gathered by a participant indicating 'yes' or 'no' to the presence of neck stiffness on awakening. The summation of episodes of neck stiffness that each person reported per group over the 28-day period provided the total number of neck stiffness cases on awakening. The Simmons Beautyrest® pillow showed a highly significant ($p < 0.001$) benefit with regards to reducing neck stiffness in both groups. The carry-over effect was not statistically significant ($p = 0.280$).

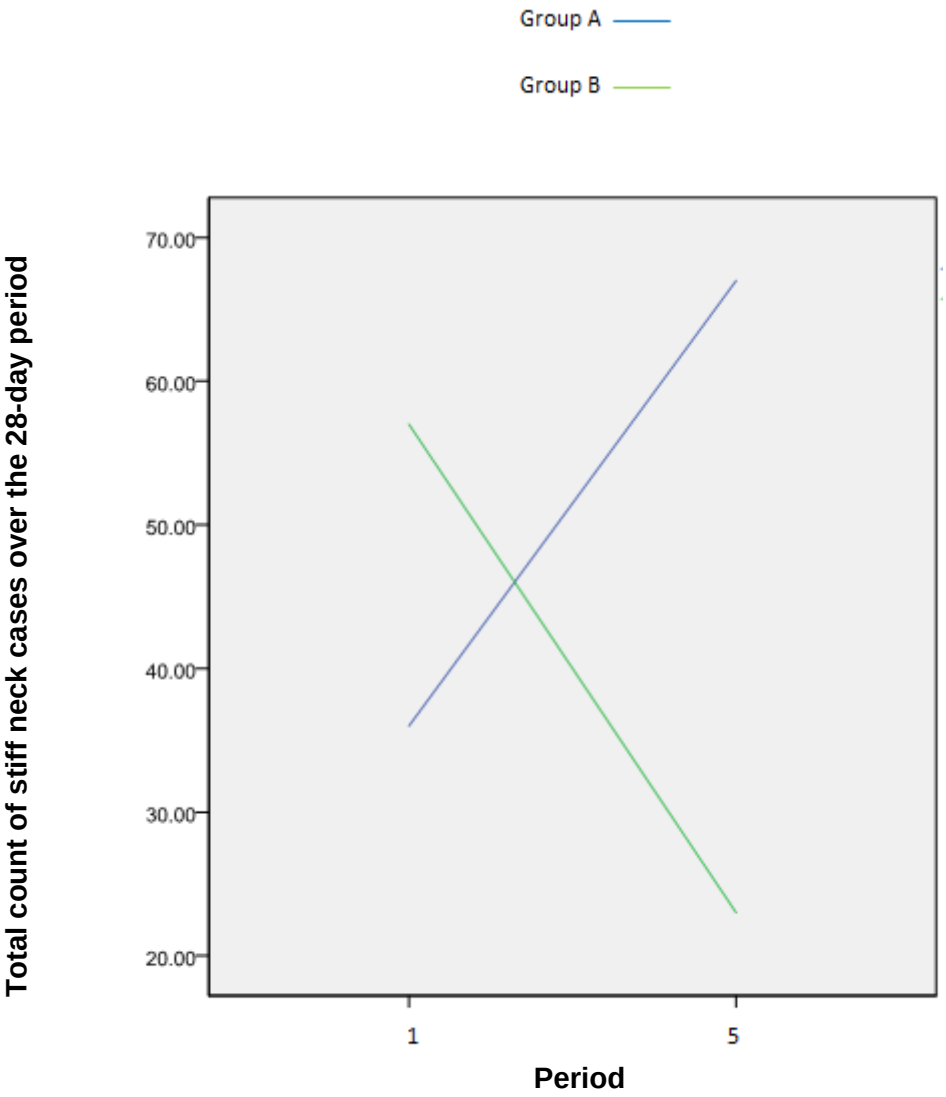


Figure 4.18 The total count of participants presenting with neck stiffness over the 28-day period of the respective groups according to the intervention.

4.3.3.6 Question 4.3: The presence or absence of headache on awakening

The total number of participants experiencing a headache on awakening is shown in **Figure 4.19**. The participants were required to answer 'yes' or 'no' to the presence of headache on awakening. The episodes of a headache that each person reported over the 28-day period were summed per group to provide the total number of headache cases on awakening. The Simmons Beautyrest® group showed a reduction in the presence of headaches on awakening in both groups (p = 0.043) with the carry-over effect being non-significant (p = 0.713).

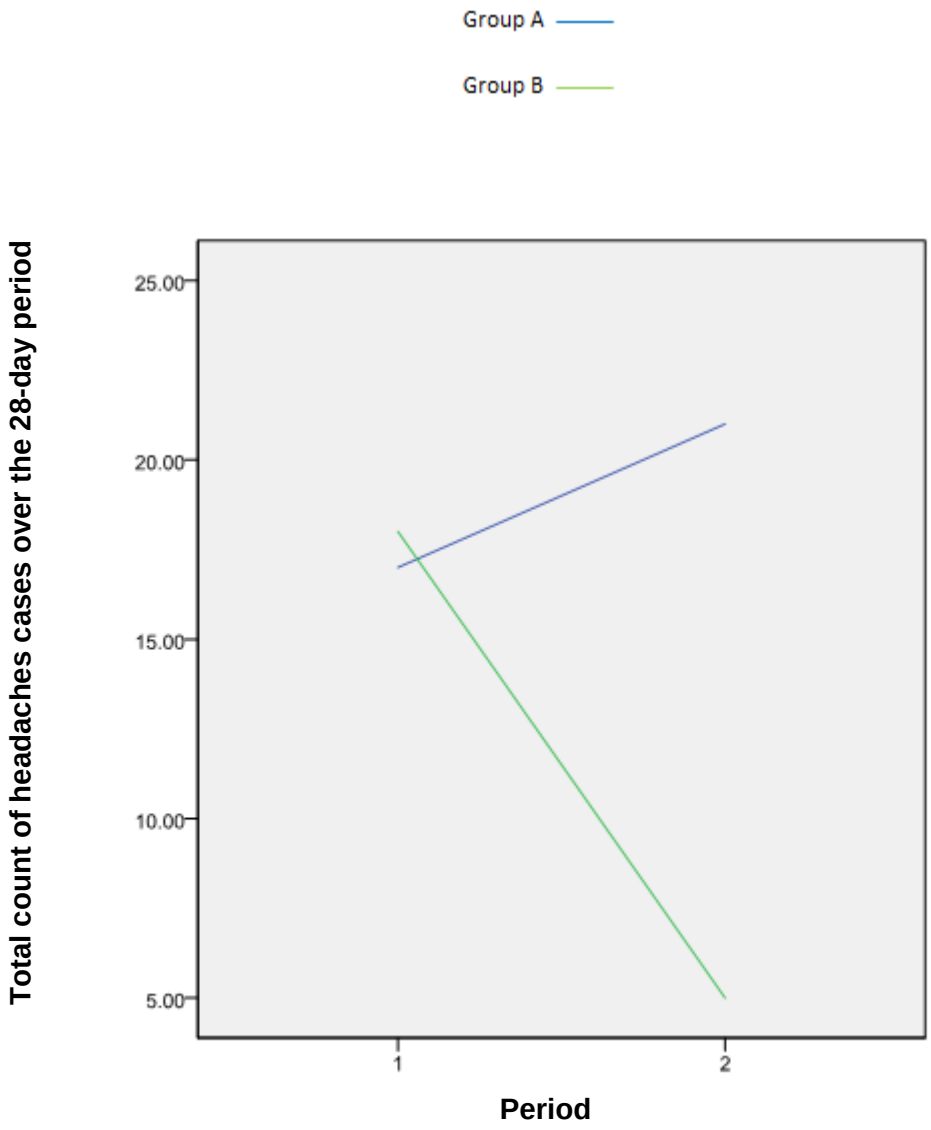


Figure 4.19 The total count of participants presenting with a headache over the 28-day period in the respective groups according to the intervention.

4.3.3.7 Question 5: The effect of neck pain on activities of daily living

The total number of participants whose neck pain affected their daily activities is represented in **Figure 4.20**. The participants were asked to indicate if neck pain effected their activities of daily living by using a 'yes' or 'no' answer. The instances were neck pain affected an individual's activities of daily living over the 28-day period was summed per group to provide the total number of cases. It was observed that neck pain affected activities less when using the Simmons Beautyrest® pillow compared to when the participants used their normal pillow ($p < 0.001$). The carry-over effect was not statistically significant ($p = 0.594$)

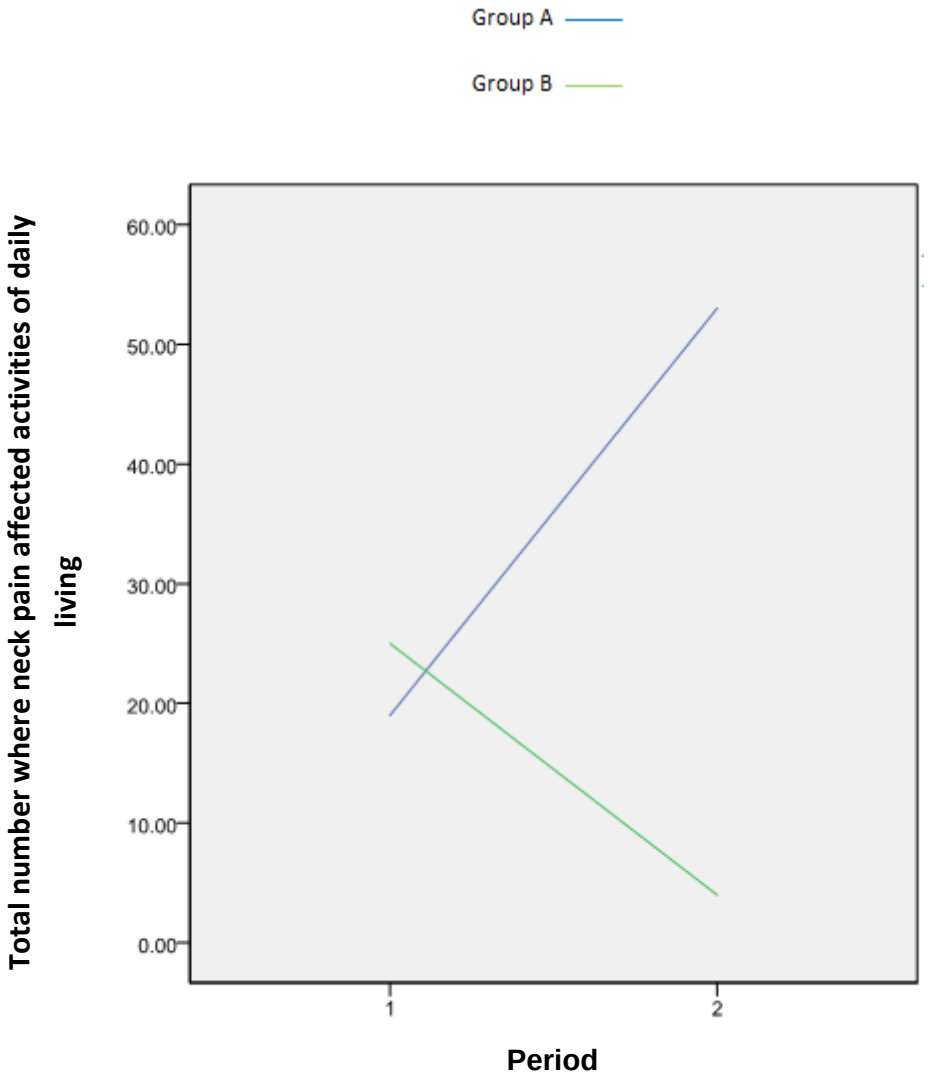


Figure 4.20 The total number of participants whose neck pain affected their activities of daily living.

CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 SUMMARY OF FINDINGS

The Simmons Beautyrest® pillow when compared to the participant usual pillow resulted in statistically significant improvements in the following measures:

- Pain pressure thresholds of the involved MFTP
- Right lateral flexion range of motion of the cervical spine
- Non-specific neck pain
- Disability as a result of neck pain
- Variables measured by the sleep and pain diary

Each measurement cannot, however, be linked to a specific feature of the Simmons Beautyrest® pillow; rather an inter-play exists between the different features of the pillow and the mechanism of disease for each variable tested.

The benefit of a cervical pillow is appreciated when an individual finds comfort in the pillow and experiences a relief in neck pain. The Simmons Beautyrest® pillow met both these criteria as it was regarded as comfortable and was beneficial in reducing non-specific neck pain.

5.2 DEMOGRAPHIC DATA OF PARTICIPANTS

a) Age

There was no significant difference in the mean age between the groups. This allowed for the results of the two groups to be comparable. Age was a controlled variable in this study, only those participants between the age of 18 and 45 years of age were included. This minimized the inclusion of participants with conditions such has degenerative joint disease (DJD) of the cervical spine and excluded minors. This also allowed for a narrow age range unlike those of previous studies which investigated cervical pillows (**Table 2.10**).

b) Gender

There was no statistical difference (p = 0.705) in gender between the groups allowing for comparability. The majority of the participants in both groups were female (**Figure 4.1**), this is consistent with the literature on neck pain (Cote *et al* 2003; Binder, 2007; Hurwitz *et al*, 2008). The proposed reasons for female preponderance for neck pain vary from biochemical to psychological factors. These include factors such as hormonal changes and emotional expressiveness in females (Fillingim, 2000; Bernardes *et al*, 2008).

c) Race

There was no statistical difference (p = 0.443, **Figure 4.1**) in racial distribution between the groups. Indians were the highest racial profile in both groups (**Figure 4.1**). This may be due to approximately 80% of the Indian population in KwaZulu Natal residing in the greater Durban area (www.statssa.gov.za).There were no Coloured participants, possibly due to the Coloureds representing 3% of the population in KwaZulu Natal (www.statssa.gov.za).

d) Occupation

The majority of the participants were students. This may be attributed to the location of the study being on the DUT campus. It is not unexpected that neck pain was observed in individuals with different occupations. Nearly all of the occupations of the participants involve repetitive activity (e.g. typing) or are prone to incorrect posture (e.g. students who study). These factors have been identified as risk factors for non-specific neck pain (Binder, 2007; Larsson *et al*., 2007; Hoy *et al*, 2010).

5.3 DISCUSSION OF RESULTS

a) Physiological factors

Many of the causes of non-specific neck pain have a physiological basis. When the cause is due to a lack of proper support, the presenting clinical features are neck pain, neck stiffness, the presence of MFTPs and possible headaches (Simons *et al*., 1999; Bennett, 2007). A difficulty in maintaining adequate sleep patterns may also be observed (Bennett, 2007).

Firstly, the Simmons Beautyrest® pillow was assessed for reducing neck pain at each of the consultations. In addition, the participants documented a rating of their neck pain prior to falling asleep and awakening on a daily basis in the sleep and pain dairy. Pain was a controlled variable in the study as participants had to have pain between three and eight on the NRS; this excluded those with excruciating pain and those with minimal pain. When the participants used the Simmons Beautyrest® pillow a significant reduction in neck pain was found in all instances (**Figures 4.7, 4.8, 4.11 - 4.14**). Lavin *et al*. (1997) and Erfanian *et al*. (2004) observed a significant improvement in pain scores on awakening (**Table 2.10**). However, in these studies the NRS scores found prior to falling asleep were not significant. It can, therefore, be concluded that the Simmons Beautyrest® pillow appears to provide a reduction in neck pain that was sustainable throughout the day.

The improvement in pain ratings may be linked to a change in the dynamics of the cervical facet joints, muscles and ligaments as these are all potential sources of pain (Bogduk, 2003). For example, the mechanoreceptors found within the facet joints may become activated as a result of biomechanical stress due to improper support of the cervical spine while sleeping (Bogduk, 2003). This may eventually lead to facet joint dysfunction, which is a common cause of neck pain (Kirpalani and Mitra, 2008). The proper support of the cervical lordosis may improve cervical posture reducing stress on the facet joints, thereby preventing the irritation of the mechanoreceptors (Bogdanovic *et al*, 2011). A resultant decrease in pain would occur as supported by the NRS scores (**Figures 4.7** and **4.8**) and pain pressure (algometer) readings (**Figure 4.3** and **4.4**) observed in this study. These factors may have also contributed to the decrease in neck pain on awakening (**Figure 4.17**), as a lack of comfort and/or sub-standard neck support whilst sleeping often presents with neck pain on awakening (Lavin *et al*., 1997).

b) Anatomo - physiological changes

A decrease in neck pain is closely associated with an improvement in MFTPs (Vernon and Schneider, 2009). A significant (p = 0.001) improvement in pain measurements was found in both groups when using the Simmons Beautyrest® pillow compared to the participants' usual pillow (**Figures 4.4** and **4.5**). This indicates that the participants were able to withstand higher pain pressure thresholds which may be as a result of an improvement in the MFTPs. Previous investigations into the efficacy of cervical pillows (**Table 2.10**) did not use the algometer as an outcome measure and as such the algometer results cannot be compared to previous studies.

The changes in pain pressure thresholds are further supported by the NRS results observed in this study. Myofascial trigger points are areas of hyper-irritability found within a muscle.

They may occur due to changes in the cervical lordosis resulting in altered posture which leads to abnormal loading on the cervical muscles (Simons *et al*., 1999). The result could either be prolonged muscle contraction or muscle tension (Bennett, 2007). These changes are associated with a decrease in the blood supply to the muscle, and increased production and accumulation of metabolic waste products within the muscles (Simons *et al*., 1999; Bennett, 2007). This in turn causes the nociceptors to become activated with a resultant tenderness in the muscle and pain (Bennett, 2007). The muscles fail to relax during periods of rest or sleep and often improper neck support while sleeping may actually exacerbate this condition (Bogdanovic *et al*, 2011).

Bogdanovic *et al*. (2011) describes an ideal pillow as one that has flexibility, and provides support to the cervical spine. This allows the cervical muscles to relax, dampening nociceptive activity and contributing to a reduction in pain. A decrease in neck stiffness was reported by participants when using the Simmons Beautyrest® pillow (**Figure 4.18**). The presence of neck stiffness is commonly associated with cervical facet syndrome and cervical MFTPs. In addition, a decrease in headaches was reported by participants when using the Simmons Beautyrest® pillow (**Figure 4.19**). Cranio-cervical muscle tension is often associated with the development of tension-type headaches (Hyland, 2003). The relaxation of the cervical muscles may have contributed to a decrease in headache because of the support provided by the Simmons Beautyrest® pillow.

A significant improvement was also observed in the NDI scores (**Figure 4.9** and **4.10**), indicating that an individual was more adept in performing his/her daily tasks. This improvement is important to individuals experiencing neck pain as the presence of neck pain has a negative impact on performing daily activities (Denison *et al*., 2004). An attributing factor to this is the psychological and physical detriments such as fear-avoidance behaviour that are associated with chronic neck pain (Denison *et al*., 2004). The results of the NDI scores in this study are in accordance with those observed by Erfanian *et al*. (2004) (**Table 2.10**).

c) Biomechanical factors

In terms of CROM a significant improvement (p = 0.001, ANOVA) was found in right lateral flexion measurements in both groups when using the Simmons Beautyrest® pillow **(Figures 4.6** and **Figure 4.7)**. However, there was no significant improvement in left lateral flexion, left and right rotation, flexion, and extension results. In order to be included in the study the participants were diagnosed with non-specific neck pain and needed to have at least one cervical spine fixation. Cervical spine fixations are normally associated with a decreased in range of motion (Cassidy and Cote, 2008), however in this study the baseline CROM

measurements were in keeping with the normal range of motion values reported in the literature (**Table 2.4**). Range of motion assessments of the cervical spine were not conducted in the previous studies **(Table 2.10)** and a comparison of the results could, therefore, not be made.

It can be concluded that the Simmons Beautyrest® pillow did not have a significant impact on cervical ROM. The primary purpose of a cervical pillow is to maintain the cervical spine in a neutral position and prevent end-range of motions thereby reducing biomechanical stress on the cervical spine (Gordan *et al*., 2010). This is not a surprising finding as improvement in cervical ROM is seen in interventions directed mainly at releasing cervical facet joint restrictions such as spinal mobilization and manipulation (Hurwitz *et al*., 2002; Vernon *et al*., 2005, Cassidy and Cote, 2008).

d) Comfort

Firstly, an essential factor in determining what comprises an effective cervical pillow is that the pillow is required to provide a certain level of comfort which promotes a restful and healthy sleep. The Simmons Beautyrest® pillow was considered comfortable (**Figures 4.15** and **4.16**) by the participants. However, on analysis of **Figures 4.15** and **4.16**, it is observed that the comfort rating levels of the Simmons Beautyrest® pillow varied with an improvement observed over time. This may be due to an individual requiring a prolonged period to become accustomed to a pillow (Erfanian *et al*., 1998). The perceived comfort levels of the Simmons Beautyrest® pillow may have been the initiating event in producing the positive results observed, as comfort is an essential characteristic of a pillow. It can, therefore, be concluded that the Simmons Beautyrest® pillow provided a level of comfort that facilitated healthy sleep.

e) Hawthorne effect

The Simmons brand is well known to the South African community due to brand marketing Participants may have been aware of the retail value of the pillow which is considerably more than the average pillow. This may have influenced the participants to record greater improvements in their subjective measurements. The retail value, as well as the brand of a product is often associated with improved client satisfaction in comparison to inexpensive or not well-known products of the same quality (Dodds *et al*., 1991; Lichtenstein *et al*., 1993). Furthermore, due to the participants being included in the research study, they may felt a need to please the researcher. The participants were also informed that they were to keep the Simmons Beautyrest® pillow after the trial was over, they may have construed this as a form of compensation which may have influenced their responses.

The presence of the Hawthorne Effect is difficult to evade and was, therefore, considered as a contributing factor to the positive results. However, the findings of the objective outcomes, lends credence to the argument that not all the positive results were due to the Hawthorne Effect.

f) Hypotheses

The alternate hypotheses were accepted. The Simmons Beautyrest® pillow was effective in reducing chronic non-specific neck pain in terms of subjective and objective clinical findings and the Simmons Beautyrest® pillow was more effective than the participant's usual pillow in reducing chronic non-specific neck pain.

5.4) CONCLUSION

The researcher is of the view that the Simmons Beautyrest® pillow can form an integral part of a PCC approach to the management of non-specific neck pain. The findings of this study provide health-care practitioners with the knowledge to make recommendations to patients with regards to the appropriate cervical pillow for non-specific chronic neck pain. Therefore, in addition to treatment options for non-specific neck pain provided in-house by health-care providers, practitioners can advise their patients to use the Simmons Beautyrest® pillow as part of a global or holistic management programme. The benefits to the patient of such an approach include:

- Supplementation of in-house intervention or treatment regimens.
- Adequate support of cervical lordosis and cervical musculature.
- Relief of MFTPs of the cervical musculature.
- Reduction in neck stiffness on awakening.
- Reduction in the frequency of headaches.
- Attaining a restful sleep.
- An improvement in the psychological status and a sense of empowerment.
- An improvement in the performance of daily tasks.
- A cost-effective approach in the management of non-specific neck pain as the patient may reduce medical or chiropractic consultations in seeking to alleviate neck pain.

The trends observed in this study partly support the claims of the manufacturer of the pillow. The Simmons Beautyrest® pillow was effective in providing support to the cervical spine as well as comfort. Furthermore, the Simmons Beautyrest® pillow was more effective in

reducing the symptoms of chronic non-specific neck pain in comparison to the participant's usual pillow.

This study did not, however, investigate the level of support provided by the pillow nor its effect on maintaining the cervical lordosis over a period of time. Although positive trends were observed, caution must be exercised in over-generalizing the findings of this study because of the small sample size. A similar study needs to be conducted with a larger sample size to verify the findings of this study.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

It can be concluded that the Simmons Beautyrest® pillow was effective in reducing non-specific neck pain in the study participants. The pillow was regarded as comfortable; it provided pain relief and improved pain pressure thresholds. This may have occurred due to the pillow altering or preventing the causative agents (e.g. MFTPs, facet syndrome) of non-specific neck pain. Cervical pillows that are comfortable and decreases neck pain are valuable to individuals experiencing neck pain, and to practitioners who recommend these types of pillows to patients.

The use of Simmons Beautyrest® pillow allows for the implementation of a home-based treatment option to individuals experiencing non-specific neck pain. For the practitioner, it allows for the recommendation of a cervical pillow based on evidence and for the provision of a complete management programme for non-specific neck pain.

6.2 LIMITATIONS

The following limitation were considered:

The sample size (n = 40) used was relatively small therefore limiting the external validity of the study results.

The long-term effects of the pillow were not investigated and are therefore unknown.

The biomechanical effect of the Simmons Beautyrest® pillow on the cervical lordosis was not investigated therefore the effects of the pillow on the anatomical and biomechanical structures are unknown.

The results of the study may have also been influenced by the participants being aware of the branding and retail value of the pillow. These effects may have occurred through the Hawthorne Effect.

6.3 RECOMMENDATIONS

The recommendations arising from this study are the following:

- A similar study should be conducted with a larger sample size which should be more representative of the South African population. This will allow for the results of the study to be more generalizable.
- A study should be conducted comparing the Simmons Beautyrest® to pillows of other brands to objectively assess the biomechanical parameters such as cervical lordosis, and degree of neck support during the recumbent position. This will likely provide more objective data to support the subjective findings of this study.

REFERENCES

Ackelman, B. and Lindgren, U. 2002. Validity and reliability of a modified version of the neck disability index. *Journal of Rehabilitative Medicine*, 34: 284–287.

Ambrogio, N., Cuttiford, J., Lineker, S.L. and Li, L. 1998. A comparison of three types of neck support in fibromyalgia patients. *Arthritis Care and Research*, 5: 405-410.

Barlow, J., Wright, C., Sheasby, J., Turner, A. and Hansworth, J. 2002. Self- management approaches for people with chronic conditions: A review. *Patient Education and Counseling*, 48: 177-187.

Bennett, R. 2007. Myofascial pain syndromes & their evaluation*. Best Practice & Clinical Research Rheumatology*, 21: 427-445.

Bernardes, S.F., Keogh, E. and Lima, M.L. 2008. Bridging the gap between pain and gender research: A selective literature review. *European Journal of Pain*, 12: 427-440.

Binder, A. 2007. Cervical spondylosis and neck pain. *British Medical Journal*, 334: 527-531.

Blyth, F.M., March, L.M., Nicholas, M.K. and Cousins, M.J. 2005. Self-management of chronic pain: A population-based study. *Pain,* 113: 285-292*.*

Bogdanovic, Z., Markovic, Z. and Petkovic, D.T. 2011. The pillow comfortableness and kiphotic posture. *Acta Kinesiologica*, 5: 21-24.

Bogduk, N. 2003. The anatomy and pathophysiology of neck pain. *Physical Medicine and Rehabilitation Clinics of North America*, 14: 455-472.

Bogduk, N. and Mercer, S. 2000. Biomechanics of the cervical spine, Part I: Normal kinematics. *Clinical Biomechanics*, 15: 638-344.

Bogduk, N. and Yoganandan, N. 2001. Biomechanics of the cervical spine, Part 3: Minor injuries. *Clinical Biomechanics*, 16: 267-275.

Borenstein, D.G. 2007. Chronic neck pain: How to approach treatment. *Current Pain and Headache Reports*, 11: 436-439.

Borghouts, J., Janssen, H., Koes, B. and Muris, J., Metsemakers, J. and Bouter, L. 1999. Management of chronic neck pain in general practice. *Scandinavian Journal of Primary Health Care*, 17: 215-220.

Cagnie, B., Cools, A., Loose, V., Cambier, D. and Danneels, L. 2007. Reliability and normative database of the zebris cervical range-of-motion system in healthy controls with preliminary validation in a group of patients with neck pain. *Journal of Manipulative and Physiological Therapeutics*, 30: 450-455.

Campbell, J.P., Maxey, V.A. and Watson, W.A. 1995. Hawthorne Effect: Implications for prehospital research. *Annals of Emergency Medicine*, 26: 590-594.

Cassidy, J.D. and Cote, P. 2008. Is it time for a population health approach to neck pain. *Journal of Manipulative and Physiological Therapeutics*, 31: 442-446.

Childs, M.J., Fritz, J.M., Piva, S.R. and Whitman, J.M. 2004. Proposal of a classification system for patients with neck pain. *Journal of Orthopaedics & Sports Physical Therapy*, 34: 686-700.

Christensen, S. T. and Hartvigsen, J. 2008. A systematic critical review of the epidemiological literature dealing with associations between sagittal spinal curves and health. *Journal of Manipulative and Physiological Therapeutics*, 31: 690-714.

Christensen, J.O. and Knardahl, S. 2010. Work and neck pain: A prospective study of psychological, social and mechanical risk factors. *Pain*, 151:162-173.

Collins, P., Wigley, C.B., Newell, R.L.M. 2005. Head and neck. In Standring, S. ed. *Gray's Anatomy*. 39th ed. Spain: Elsevier Churchill Livingstone, 397 - 763.

Coombs, S.J., 2003. The Hawthorne Effect: Is it a help or hindrance in social science research? *Transformation in Education,* 6: 97-111.

Cote, P., Cassidy, D. and Carroll, L. 2003. The epidemiology of neck pain: what we have learned from our population-based studies. *Journal of Canadian Chiropractic Association*, 47: 284-289.

Cusick, J.F. and Yoganandan, N. 2002. Biomechanics of the cervical spine Part 4: Major injuries. *Clinical Biomechanics*, 7: 1-20.

Denison, E., Asenlof, P. and Lindberg, P. 2004. Self-efficacy, fear avoidance, and pain intensity as predictors of disability and chronic musculoskeletal pain in patients in primary health care. *Pain,* 111: 245 – 252.

Dennison, S.B. and Leal, M.H. 2011. Mechanical neck pain. In de las Penas, C.F., Cleland, J.A. and Huijbregts, P. ed. *Neck and arm pain syndromes: Evidence informed screening, diagnosis and management*. China: Elsevier Ltd, Churchill Livingstone, 94-111.

Dodds, W.B., Monroe, K.B. and Grewal, D. 1991. Effects of price, brand, and store information on buyers' product evaluations. *Journal of Marketing- Research*, 28: 307-319.

Du, S., Yuan, C., Xiao, X., Chu, J., Qiu, Y. and Qian, H. 2011. Self-management programs for chronic musculoskeletal pain conditions: A systematic review and meta-analysis. *Patient Education and Counselling*, 85: e299-e310.

Erfanian, P., Hagino, C. and Guerriero, R.C. 1998. A preliminary study assessing adverse effects of a semi-customized cervical pillow on asymptomatic adults. *Journal of Canadian Chiropractic Association*, 42: 156-162.

Erfanian, P., Tenzif, S. and Guerriero, R. 2004.Assessing effects of a semi-customized experimental cervical pillow on symptomatic adults with chronic neck pain with and without headache. *Journal of Canadian Chiropractic Association*, 48: 22-28.

Esterhuizen, T (esterhuizent@ukzn.ac.za), 30 May 2010. Statistical Analysis. E mailed to K Jagarnath (kathleenjag@yahoo.com). Accessed 30 May 2010.

Esterhuizen, T (esterhuizent@ukzn.ac.za), 01 July 2011. Statistical Analysis. E mailed to K Jagarnath (kathleenjag@yahoo.com). Accessed 01 July 2011.

Feipel, V., Rondelet, B., Pallec, J.P. and Rooze, M. 1999. Normal global motion of the cervical spine: an electrogoniometric study. *Clinical Biomechanics*, 14: 462-470.

Fillingim, R.B. 2000. Sex, gender and pain: Men and women really are different. *Current Review of Pain*, 4: 24-30.

Friedenberg, Z.B. and Miller, W.T. 2010. Degenerative disc disease of the cervical spine: A comparative study of the asymptomatic and symptomatic patients. *American Journal of Bone and Joint Surgery,* 45: 1171-1178.

Goral, A., Lipsitzb, J.D. and Grossa, R. 2010. The relationship of chronic pain with and without comorbid psychiatric disorder to sleep disturbance and health care utilization: Results from the Israel National Health Survey. *Journal of Psychosomatic Research*, 69: 449-457

Gordan, S.K., Grimmer-Somers, G. and Trott, P.H. 2009. Pillow use: The behavior of cervical pain, sleep quality and pillow comfort in side sleepers. *Manual therapy*, 14: 671-678.

Gordan, S.K., Grimmer-Somers, G. and Trott, P.H. 2010. Pillow use: the behavior of cervical stiffness, headaches and scapular arm pain. *Journal of Pain Research*, 3: 137-145.

Guez, M. 2006. Chronic Neck Pain. An epidemiological, psychological and SPECT study with emphasis on whiplash-associated disorders. *Acta Orthopaedica*, 77:1-36.

Guzman, J., Haldeman, S., Caroll, L.J., Carragee, E.J., Peloso, P., Nordin, M., Cassidy, J.D., Holm, L.W., Cote, P., Velde, G. and Hogg-Johnson, S. 2009. Clinical practice implications of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain. *Journal of Manipulative and Physiological Therapeutics,* 32: S227-S243*.*

Haldeman, S., Caroll, L., Cassidy, D., Schubert, J. and Nygren, A. 2008.The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and its associated disorders. Executive Summary. *Spine*, 33: S5-S7.

Harrison, D. E., Harrison, D. D., Calliet, R., Troyanovich, J. S., Janik, J. T. and Holland, B. 2000. Cobb Method or Harrison Posterior Tangent Method: Which to choose for lateral cervical radiograph analysis? *Spine*, 25: 2072-2078.

Hastie, B.A., Riley, J.L. and Fillingim, R.B. 2005. Ethnic differences and responses to pain in healthy young adults. *Pain Medicine*, 6: 61-71.

Hoving, J.L., Koes, B, W.,Van Der Windht, D., Mameran, H., Deville, W., Scholten, R. and Bouter, L. 2002. Manual therapy, physical therapy or continued care by a general practitioner for patients with neck pain. *Annals of Internal Medicine*; 136: 713-722.

Hoy, D.G., Protani, M. and Buchbinder, R. 2010. The epidemiology of neck pain. *Best Practice & Research Clinical Rheumatology*, 24:783-792.

Huguenin, L.K., 2004. Myofascial trigger points: the current evidence*. Physical Therapy in Sport*; 5: 2-12.

Hurwitz, E., Morgenstern, H., Harber, P., Kominski, G., Yu, F. and Adams, A. 2002. A randomised trial of chiropractic manipulation and mobilization for patients with neck pain: clinical outcomes from the UCLA Neck Pain Study. *American Journal of Public Health*, 92: 1634-1641.

Hurwitz, E.L., Carragee, E.J., Velde, G., Carroll, L.G., Nordin, M., Guzman, J., Peloso, P.M., Holm, W., Cote, P., Hogg-Johnson, S., Cassidy, J.D. and Haldeman, S. 2008. Treatment of neck pain: noninvasive interventions. Results of the Bone and Joint Decade 2000–2010 Task

Force on Neck Pain and Its Associated Disorders. *Journal of Manipulative and Physiological Therapeutics*, 32: S141-S175.

Hyland, J.K. 2003. Cervical support pillows: useless or helpful? *Foot Levelers, Inc*., 1-6.

Jordan, K. 2000. Assessment of published reliability studies for cervical range of motion measurement tools. *Journal of Manipulative and Physiological Therapeutics,* 23: 180-195.

Kirpalani, D. and Mitra, R. 2008. Cervical facet joint dysfunction: A review. *Archives of Physical Medicine and Rehabilitation*, 89:770-774.

Larsson, B., Soggard, K. and Rosendal, L. 2007. Work-related neck shoulder pain: On magnitude, risk factors, biochemical characteristics, clinical picture and preventative interventions. *Best Practice & Research Clinical Rheumatology*, 21: 447-463.

Lavin, R., Pappagallo, M. andKuhlemeier, K. 1997. Cervical pain: A comparison of three pillows. *Archives of Physical Medicine and Rehabilitation*, 78:193-198.

Lichtenstein, D.R., Ridgway, N.M. and Netemeyer, R.G. 1993.Price perceptions and consumer shopping behavior: a field study. *Journal of Marketing Research*, 30: 234-245.

Linton, S.J. 2000. A review of psychological risk factors in back and neck pain. *Spine*, 25:1148-1156

Livingson, T., Bernadi, D. and Carroll, M. 1998. *Algometer™ Commander & Digitrack™ Commander: User's Manual.* J Tech Medical Industries.

Macefield, R. 2007. Usability studies and the Hawthorne Effect. *Journal of Usability Studies*, 2: 145-154.

Magee, D.J. 2005.*Orthopaedic Physical Assessment*. 4th ed. Missouri: Saunders Elsevier.133 - 452.

Maizes, V., Rakel, D. and Niemiec, C. 2009. Integrative medicine and patient-centered care. *Explore*, 5: 277-289.

McAviney, J., Schulz, D., Bock, R., Harrison, D.E. and Holland, B. 2005. Determining relationship between cervical lordosis and neck complaints. *Journal of Manipulative and Physiological Therapeutics*, 28: 187-193.

McCarney, R., Warner, S., Haselen, R., Griffin, M. and Fisher, P. 2007. The Hawthorne Effect: A randomized, controlled trial. *BMC Medical Research Methodology*, 7: 1-8.

McNair, P.J., Portero, P., Chiquet, C., Mawston, G. and Lavast. M. 2007. Acute neck pain: Cervical spine range of motion and position sense prior to and after joint mobilization. *Manual Therapy*, 12: 390-394.

Moore, L.K. and Dalley, F.A. 1999. *Clinically Oriented Anatomy. 4th ed*. Baltimore. Lippincott Williams & Wilkins, 446 - 982.

Muchna. J.M. 2011. An epidemiological investigation into the risk factors associated with neck pain in the Indian population in the greater Durban area. M. Tech. Thesis, Durban University of Technology.

Myofascial Trigger Points [Online]. 2011. Available from http://www.abbottcenter.com. Accessed [13 March 2011].

Ndlovu.P.Z. 2006. A case-control study investigating factors associated with neck pain in the indigenous African population in the greater Durban area. M. Tech. Thesis, Durban Institute of Technology.

Nordin, M. and Frankel, H. 2001. *Basic Biomechanics of the Musculoskeletal System. 3rd ed.* Baltimore: Lippincott Williams & Wilkins, 133 – 215.

Omar, A (simmonssaleas@iafrica.com), 3 June 2010. Simmons Beautyrest® pillow features. E mailed to Jagarnath, K (kathleenjag@yahoo.com) Accessed on 3 June 2012.

Partridge, C.J. and Kitchen, S.S. 1999. Adverse effects of electrotherapy used by physiotherapists. *Physiotherapy*, 85: 298-303.

Penas, C.F., Blanco, A.C. and Miangolarra, J.C. 2007. Myofascial trigger points in subjects presenting with mechanical neck pain: A blinded, controlled study. *Manual Therapy*, 12, 29-33.

Persson, L. 2006. Neck pain and pillows – A blinded study of the effects of pillows on non-specific neck pain, headache and sleep. *Advances in Physiotherapy*, 8: 122-127.

Persson, L., Axel, C.C. and Carlsson, J. 1997. Long-lasting cervical radicular pain managed with surgery, physiotherapy, or a cervical collar: A prospective, randomized study. *Spine*, 22: 751-758.

Peterson, D.H. and Bergman, T.F. 2002. *Chiropractic Technique: Principles and Procedures*. Missouri: Mosby.11, 33, 47, 146.

Pool, J.J.M., Ostelo, R.W.J.G., Knol, D., Bouter, L.M and Henrica, C.W. 2010. Are psychological factors prognostic indicators of outcome in patients with sub-acute neck pain? *Manual Therapy*, 15: 111-116.

Puttini, S.P., Atzeni, F., Fumagilli, M., Capsone, F. and Carraba, M. 2005. Osteoarthritis of the spine. *Seminars in Arthritis and Rheumatism*, 38-43.

Rickards, L.D. 2006. The effectiveness of non-invasive treatments for active myofascial trigger point pain: A systematic review of the literature. *International Journal of Osteopathic Medicine,* 9:120-136.

Schmidt, T.A. and Richardson, S.J. 2003. Prevalence of sleep disturbance and its relationship to pain in adults with chronic pain. *American Society of Pain Management Nurses*, 4:124-133.

Shields, N., Capper, J., Polak, T. and Taylor, N. 2006. Are cervical pillows effective in reducing neck pain? *New Zealand Journal of Physiotherapy,* 34: 3-9.

Simmons South Africa [online]. 2011. Available online from: http://www.simmons.co.za. Accessed [12 January, 2011].

Simons, D.G., Travell, J.G. and Simons, L.S. 1999. *Travell and Simons Myofascial Pain and Dysfunction: The Trigger Point Manual*. *Vol. 1, Upper half of the body*. Baltimore: Williams and Wilkins, 21 – 178.

Slabbert, W.N. 2010. An epidemiological investigation of neck pain in the White population in the greater Durban area. M. Tech. Thesis, Durban University of Technology.

Smith, K., Hall, T. and Robinson, K. 2007. The influence of age, gender, lifestyle factors and sub-clinical neck pain on the cervical flexion-rotation test and cervical range of motion. *Manual Therapy*, 13: 552-559.

Statistical Release P0302.[Online].Available from http://www.statssa.gov.za. Accessed [13 February 2011].

Syringe disposal 2005. [Online]. Available from http://www.cdc.gov/idu/facts. Accessed [4 June 2012].

Taimela, S., Takala, E.P., Tom Asklo, T., Seppa, K. and Parviainen, S. 2000. Active treatment of chronic neck pain a prospective randomized intervention. *Spine*, 28: 1021-1027.

Teddlie, C. and Yu, F. 2007. Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research,* 1: 77-100.

Trott, P.H., Pearcy, M.J., Ruston, S.A., Fulton, I. and Brien, C. 1996. Three dimensional analysis of active cervical motion. The effect of age and gender. *Clinical Biomechanics*, 11: 201-206.

Typical cervical vertebrae [Online]. 2007. Available from http://en.wikipedia.org/wiki/File:Cervical_vertebra_english.png. [Accessed on 2 March 2012].

Vanderweeen, L., Oostendorp, R. A. B., Vaes, P. and Duquet, W. 1996. Pressure algometry in manual therapy. *Manual Therapy*, 15: 258-265.

Vernon, H. 2008. The neck disability index: state-of-the-art. *Journal of Manipulative and Physiological Therapeutics*, 31: 491-502.

Vernon, H., Humphreys, B. K. and Hagino, C. 2007. Chronic mechanical neck pain in adults treated by manual therapy: a systematic review of change scores in randomized controlled trials of a single session. *Journal of Manual and Manipulative Therapy,* 16: 215-227.

Vernon, H. and Schneider, M. 2009. Chiropractic management of myofascial trigger points and myofascial pain syndrome: A systematic review of the literature. *Journal of Manual and Manipulative Therapy,* 32: 14-24.

Williams, M.A., McCarthy, C.J., Chorti, A., Cooke, M.W. and Gates, S.M. 2009. A systematic review of reliability and validity studies of methods for measuring active and passive cervical range of motion. *Journal of Manipulative and Physiological Therapeutics*, 33: 139-155.

Yochum, T.R. and Rowe, L.J. 2005. *Essentials of Skeletal Radiology. Vol. 3rd ed*. Philadelphia: Lippinkott Williams & Wilkins, 209-969.

Youdas, J., Carey, J. and Garret, T. 1991. Reliability of measurements of cervical range of motion- a comparison of three methods, *Journal of Manipulative and Physiological Therapeutics*, 24: 552-555.

APPENDIX A

LETTER OF INFORMATION AND CONSENT

Title of Research Study: **The effectiveness of the Simmons Beautyrest® pillow in the management of non-specific chronic neck pain: A controlled clinical trial**

Researcher: Kathleen Jagarnath

Supervisor: Dr L. Wilson (M.Tech: Chiropractic)

Dr J. Shaik (M. Tech: Chiropractic, M. Med. Sci. (SM), MCASA)

Brief introduction and purpose of the study:

Welcome to this research study. Neck pain is a common condition that affects many people. Previous studies indicate that proper neck support whilst sleeping may help to reduce neck pain. It has also been shown that certain types of pillow may be effective in reducing neck pain. This clinical trial aims to determine the effectives of the Simmons Beautyrest® pillow on chronic neck pain compared to the pillow that you are currently using.

Research procedure:

The following requirements will be needed to be met in order to participate in the research:

- You must agree to sign the consent form.
- You must be between the ages of 18 and 45.
- You must be experiencing neck pain that is mild to moderate in nature which is present for two months or more.

If the following are present you will not be able to participate in the research:

- If you have any chronic disease.
- If you have severe neck pain.
- If you are taking medication for neck pain or medication that may contribute to a relief in neck pain unless you agree to stop and have a wash out period of 3 days.
- If you are already using a Simmons Beautyrest® pillow.

The study will be conducted at the Durban University of Technology, Chiropractic Day Clinic (CDC). The study will take place over a four week period. On the first consultation a case history, physical examination and neck examination will be conducted to determine if you are suitable to participate in the research. As a research participant, you will be required to sleep with your usual pillow for a 2 week period and with the Simons Beautyrest® pillow for 2 weeks. The order of this may vary according to your group allocation. During the 4 week study period you will need to attend the CDC once a week to gather information regarding pain, disability in relation to neck pain and neck range of motion. You are also required to fill in a sleep and pain diary on a daily basis for the duration of the study.

Risks or Discomfort to the Subjects:

There may be a period of discomfort when changing your pillow however this should be temporary.

Benefits:

As a participant in this study you will be allowed to keep the Simmons Beautyrest® pillow once the study has been completed.

Reasons why the subject may withdraw from the study:

You are free to withdraw from the study without it influencing further treatment you wish to receive at the CDC. You will be excluded from the study if you miss a consultation or if you develop a condition which will influence the results of the study such as a whiplash injury.

Cost of the Study:

The will be no cost to you for your participation in this study.

Confidentiality:

All information of the participants will be kept confidential and only be available to the researcher and supervisor. Information that is included in the thesis will not contain any personal information of the participants.

Research related Injury: Transient increase in neck pain may occur as a result of changing your pillow however should anything more than that occur please report it to the researcher.

Persons to contact in the Event of Any Problems or Queries:

Please contact myself, Miss K. Jagarnath on 031 373 2205 or my supervisor, Dr L Wilson on 031 373 2923. Alternatively please contact the research co-ordinator Faculty of Health Sciences, Durban University of Technology on 031 373 2701.

Statement of agreement to participate in the research:

I.....,....., have read this document in its entirety and understand its contents. Where I have had any queries, these have been explained to me by.....to my satisfaction. Furthermore, I fully understand that I may withdraw from this study at any stage without any adverse consequences and my future health care will not be compromised. I therefore, voluntarily agree to participate in this research.

Subjects Name (print).....

Subjects Signature.....Date:.....

Researchers Name (print).....

Researchers Signature..... Date:.....

Witness name (print).....

Witness Signature..... Date:.....

APPENDIX B

DO YOU SUFFER FROM NECK PAIN?

HAVE YOU HAD IT FOR MORE THAN 2 MONTHS?

ARE YOU BETWEEN THE AGES OF 18 AND 45?

RESEARCH IS CURRENTLY BEEN CONDUCTED AT THE DURBAN UNIVERSITY OF TECHNOLOGY'S CHIROPRACTIC DAY CLINIC

TO SEE IF YOU QUALIFY TO PARTICIPATE IN THIS RESEARCH

CONTACT KATHLEEN ON (031) 3732205

APPENDIX C

DATA SHEET

Name: .....

File Number: ……...

Algometer Readings

Con 1:

Location of Trigger Points	LEFT	RIGHT

Date	TP
Consult 2	
Consult 3	
Consult 4	
Consult 5	

Cervical Range of Motion

Date	Flex	Ext	R rot	L rot	R lat flex	L lat flex

APPENDIX D

NUMERICAL PAIN RATING SCALE 101

Patient Name:____

File No:_____________ Visit No:_________________

Date______________________

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience when it is at its worse. A zero (0) would mean “no pain at all”, and one hundred (100) would mean “the worse pain ever”.

Please write only one number____________________________________

Date______________________

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience when it is at its worse. A zero (0) would mean “no pain at all”, and one hundred (100) would mean “the worse pain ever”.

Please write only one number____________________________________

Date______________________

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience when it is at its worse. A zero (0) would mean “no pain at all”, and one hundred (100) would mean “the worse pain ever”.

Please write only one number____________________________________

Date______________________

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience when it is at its worse. A zero (0) would mean “no pain at all”, and one hundred (100) would mean “the worse pain ever”.

Please write only one number____________________________________

Date______________________

Please indicate on the line below, the number between 0 and 100 that best describes the pain you experience when it is at its worse. A zero (0) would mean “no pain at all”, and one hundred (100) would mean “the worse pain ever”.

Please write only one number____________________________________

APPENDIX E

SLEEP AND PAIN DIARY

NAME:_____**DATE:**_____ **FILE NO. :**_____

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Prior to falling asleep, rate your neck pain on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate your neck pain when you woke up this morning on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate the comfort of your pillow using the following scale 1-very comfortable 2-somewhat comfortable 3-somewhat uncomfortable 4-somewhat uncomfortable							
Did you have any of the following symptoms this morning 1-neck pain 2-stiff neck 3-headache							
Did your neck pain affect your activities today 0-No effect 1-minimal effect 2-interfered with work and leisure 3-absent from work/school							

APPENDIX E

SLEEP AND PAIN DIARY

NAME:_____ **DATE:**_____ **FILE NO. :**_____

	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
Prior to falling asleep, rate your neck pain on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate your neck pain when you woke up this morning on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate the comfort of your pillow using the following scale 1-very comfortable 2-somewhat comfortable 3-somewhat uncomfortable 4-somewhat uncomfortable							
Did you have any of the following symptoms this morning 1-neck pain 2-stiff neck 3-headache							
Did your neck pain affect your activities today 0-No effect 1-minimal effect 2-interfered with work and leisure 3-absent from work/school							

APPENDIX E

SLEEP AND PAIN DIARY

NAME:_____ **DATE:**_____ **FILE NO. :**_____

	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21
Prior to falling asleep, rate your neck pain on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate your neck pain when you woke up this morning on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate the comfort of your pillow using the following scale 1-very comfortable 2-somewhat comfortable 3-somewhat uncomfortable 4-somewhat uncomfortable							
Did you have any of the following symptoms this morning 1-neck pain 2-stiff neck 3-headache							
Did your neck pain affect your activities today 0-No effect 1-minimal effect 2-interfered with work and leisure 3-absent from work/school							

APPENDIX E

SLEEP AND PAIN DIARY

NAME:_____ DATE:_____ FILE NO. :_____

	Day 22	Day 23	Day 24	Day 25	Day 26	Day 27	Day 28
Prior to falling asleep, rate your neck pain on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate your neck pain when you woke up this morning on a scale of 0 to 10 with 0 being no pain and 10 being the worst pain experience							
Rate the comfort of your pillow using the following scale 1-very comfortable 2-somewhat comfortable 3-somewhat uncomfortable 4-somewhat uncomfortable							
Did you have any of the following symptoms this morning 1-neck pain 2-stiff neck 3-headache							
Did your neck pain affect your activities today 0-No effect 1-minimal effect 2-interfered with work and leisure 3-absent from work/school							

APPENDIX F

NECK DISABILITY INDEX

NAME: _____ _____ **DATE:** _____ **FILE NO.** _____

Please answer every section and mark in each section only the ONE answer 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 answer which most closely describes your problem.

Section 1 – Pain intensity

A. I have no pain at the moment.
B. The pain is very mild at the moment.
C. The pain is moderate at the moment.
D. The pain is fairly severe at the moment.
E. The pain is very severe at the moment.
F. The pain is the worst imaginable at the moment.

Section 2 – Personal care (washing, dressing)

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

Section 3 – Lifting

A. I can lift heavy weights without extra pain.
B. I can lift heavy weights but it gives extra pain.
C. Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.
D. Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
E. I can lift very light weights.
F. I cannot lift or carry anything at all.

Section 4 – Reading

A. I can read as much as I want to with no pain in my neck.
B. I can read as much as I want to with slight pain in my neck.
C. I can read as much as I want with moderate pain in my neck.
D. I cannot read as much as I want because of moderate pain in my neck.
E. I can hardly read at all because of severe pain in my neck.
F. I cannot read at all.

Section 5 – Headaches

A. I have no headaches at all.
B. I have slight headaches which come infrequently.
C. I have moderate headaches which come infrequently.
D. I have moderate headaches which come frequently.
E. I have severe headaches which come frequently
F. I have headaches almost all the time.

Section 6 – Concentration

A. I can concentrate fully when I want to with no difficulty.
B. I can concentrate fully when I want to with slight difficulty.
C. I have a fair degree of difficulty in concentrating when I want to.
D. I have a lot of difficulty in concentrating when I want to.
E. I have a great deal of difficulty in concentrating when I want to.
F. I cannot concentrate at all.

Section 7 – Work

A. I can do as much work as I want to.
B. I can only do my usual work, but no more.
C. I can do most of my usual work, but no more.
D. I cannot do my usual work.
E. I can hardly do any work at all.
F. I cannot do any work at all.

Section 8 – Driving

A. I can drive my car without any neck pain.
B. I can drive my car as long as I want with slight pain in my neck.
C. I can drive my car as long as I want with moderate pain in my neck.
D. I cannot drive my car as long as I want because of moderate pain in my neck.
E. I can hardly drive at all because of severe pain in my neck.
F. I cannot drive my car at all.

Section 9 – Sleeping

I have no trouble sleeping.

A. My sleep is slightly disturbed (less than 1 hr sleepless).
B. My sleep is mildly disturbed (1-2 hrs sleepless).
C. My sleep is moderately disturbed (2-3 hrs sleepless).
D. My sleep is greatly disturbed (3-5 hrs sleepless).
E. My sleep is completely disturbed (5-7 hrs sleepless).

Section 10 – Recreation

A. I am able to engage in all my recreation activities with no neck pain at all.
B. I am able to engage in all my recreation activities, with some pain in my neck.
C. I am able to engage in most, but not all of my usual recreation activities because of pain in my neck.
D. I am able to engage in a few of my usual recreation activities because of pain in my neck.
E. I can hardly do any recreation activities because of pain in my neck.
F. I cannot do any recreation activities at all.

APPENDIX G

DURBAN UNIVERSITY OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: _____ Date: _____

File #: _____ Age: _____

Sex: _____ Occupation: _____

Intern : _____ Signature: _____

FOR CLINICIANS USE ONLY:

Initial visit
Clinician: Signature:

Case History:

Examination:

Previous:
Current:

X-Ray Studies:

Previous:
Current:

Clinical Path.lab:

Previous:
Current:

CASE STATUS:

PTT:	Signature:	Date:

CONDITIONAL:
Reason for Conditional:

Signature: Date:

Conditions met in Visit No: Signed into PTT: Date:

Case Summary signed off: Date:

Intern's Case History:

1. **Source of History:**

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

3. Present Illness:

	Complaint 1	Complaint 2
< Location		
< Onset : Initial:		
Recent:		
< Cause:		
< Duration		
< Frequency		
< Pain (Character)		
< Progression		
< Aggravating Factors		
< Relieving Factors		
< Associated S & S		
< Previous Occurrences		
< Past Treatment		
< Outcome:		

4. Other Complaints:

5. Past Medical History:

< General Health Status

< Childhood Illnesses

< Adult Illnesses

< Psychiatric Illnesses

< Accidents/Injuries

< Surgery

< Hospitalizations

6. Current health status and life-style:

< Allergies

< Immunizations

< Screening Tests incl. x-rays

< Environmental Hazards (Home, School, Work)

< Exercise and Leisure

< Sleep Patterns

< Diet

< Current Medication

Analgesics/week:

< Tobacco

< Alcohol

< Social Drugs

7. Immediate Family Medical History:

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

8. Psychosocial history:

< Home Situation and daily life
< Important experiences
< Religious Beliefs

9. Review of Systems:

< General

< Skin

< Head

< Eyes

< Ears

< Nose/Sinuses

< Mouth/Throat

< Neck

< Breasts

< Respiratory

< Cardiac

< Gastro-intestinal

< Urinary

< Genital

< Vascular

< Musculoskeletal

< Neurologic

< Haematologic

< Endocrine

< Psychiatric

APPENDIX H

DURBAN UNIVERSITY OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
PHYSICAL EXAMINATION

Patient:_____File#:_____Date:_____

Clinician: _____Signature:_____

Student:_____Signature:_____

1. VITALS

Pulse rate:
Respiratory rate:
Blood pressure: R L
Medication if hypertensive:
Temperature:
Height:
Weight: Any change Y/N If Yes: how much gain/loss

Over what period

2. GENERAL EXAMINATION

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

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

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

Inspection - Scars

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

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

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

Percussion:
- borders of heart

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

4. RESPIRATORY EXAMINATION

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

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

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

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

Auscultation
- Normal breath sounds bilat.:

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

5. ABDOMINAL EXAMINATION

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

Inspection - Shape:
- Scars:
- Hernias:

Palpation - Superficial:
- Deep = Organomegally:
- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
- Ascites:
- Masses:

Auscultation - Bowel sounds:
- Arteries (aortic, renal, iliac, femoral, hepatic)

Rectal Examination - Perianal skin:
- Sphincter tone & S4 Dermatome:
- Obvious masses:
- Prostate:
- Appendix:

6. G.U.T EXAMINATION

External genitalia**:**
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

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

Higher Mental Function - Information and Vocabulary:
- Calculating ability:
- Abstract Thinking:

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

Evidence of head trauma:

Evidence of Meningism: - Neck mobility and Brudzinski's sign:
- Kernigs sign:

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

II External examination of eye: - Visual Acuity:
- Visual fields by confrontation:
- Pupillary light reflexes = Direct:
= Consensual:
- Fundoscopy findings:

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

V a. Sensory - Ophthalmic:
- Maxillary:
- Mandibular:

b. Motor - Masseter:
- Jaw lateral movement:

c. Reflexes - Corneal reflex
- Jaw jerk

VI Lateral movement of eyes

VII

a. Motor - Raise eyebrows:
- Frown:
- Close eyes against resistance:
- Show teeth:
- Blow out cheeks:

b. Taste - Anterior two-thirds of tongue:

VIII General Hearing:

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

IX & X Gag reflex:
Uvula deviation:
Speech quality:

XI Shoulder lift:
S.C.M. strength:
XII Inspection of tongue (deviation):

Motor System:

a. Power
- Shoulder = Abduction & Adduction:
= Flexion & Extension:
- Elbow =Flexion &Extension
- Wrist = Flexion & Extension:
- Forearm = Supination & Pronation:
- Fingers = Extension (Interphalangeals & M.C.P's):
- Thumb = Opposition:
- Hip = Flexion & Extension:
= Adduction & Abduction:
- Knee = Flexion & Extension:
- Foot = Dorsiflexion & Plantar flexion:
= Inversion & Eversion:
= Toe (Plantarflexion & Dorsiflexion):

b. Tone
- Shoulder:
- Elbow:
- Wrist:
- Lower limb - Int. & Ext. rotation:
- Knee clonus:
- Ankle clonus:

c. Reflexes
- Biceps:
- Triceps:
- Supinator:
- Knee:
- Ankle:
- Abdominal:
- Plantar:

Sensory System:

a. Dermatomes
- Light touch:
- Crude touch:
- Pain:
- Temperature:
- Two point discrimination:

b. Joint position sense - Finger:
- Toe:
- Big toe:

c. Vibration:
- Tibial tuberosity:
- ASIS:
- Interphalangeal Joint:
- Sternum:

Cerebellar function:

Obvious signs of cerebellar dysfunction:
= Intention Tremor:
= Nystagmus:
= Truncal Ataxia:

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

8. <u>SPINAL EXAMINATION:</u> (See Regional examination)

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

9. <u>BREAST EXAMINATION:</u>

Summon female chaperon.

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

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

APPENDIX I

DURBAN UNIVERSITY OF TECHNOLOGY
REGIONAL EXAMINATION - CERVICAL SPINE

Patient: ..... File No: .....

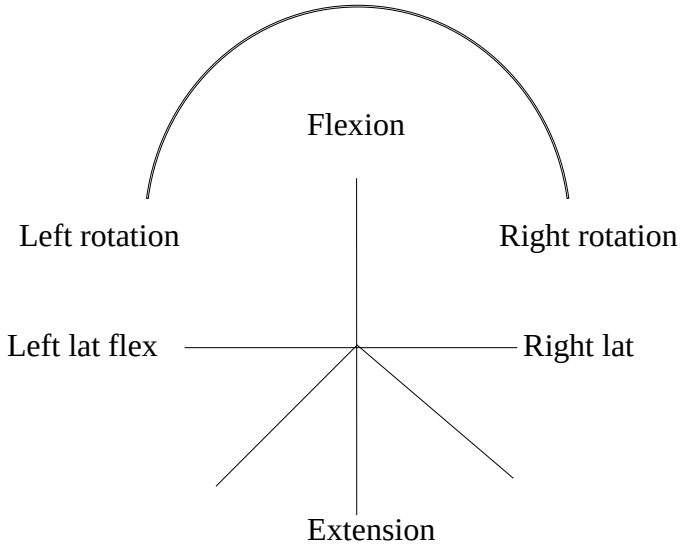
Date: ..... Student: .....

Clinician:..... Sign: .....

OBSERVATION:
Posture
Swellings
Scars, discolouration
Hair line
Body and soft tissue contours

Shoulder position
Left :
Right :
Shoulder dominance (hand):
Facial expression:

RANGE OF MOTION:
Extension (70º):
L/R Rotation (70º):
L/R Latflex (45º):
flex
Flexion (45º):



PALPATION:
Lymph nodes
Thyroid Gland
Trachea

ORTHOPAEDIC EXAMINATION:

Tenderness		Right	Left
Trigger Points:	SCM		
	Scalenii		
	Post Cervicals		
	Trapezius		
	Lev scapular		

	Right	Left		Right	Left
Doorbell sign			Cervical compression		
Kemp's test			Lateral compression		
Cervical distraction			Adson's test		
Halstead's test			Costoclavicular test		
Hyper-abduction test			Eden's test		
Shoulder abduction test			Shoulder compression test		
Dizziness rotation test			Lhermitte's sign		
Brachial plexus test					

NEUROLOGICAL EXAMINATION:

Dermatones	**Left**	**Right**	**Myotomes**	**Left**	**Right**	**Reflexes**	**Left**	**Right**
C2			C1			C5		
C3			C2			C6		
C4			C3			C7		
C5			C4					
C6			C5					
C7			C6					
C8			C7					
T1			C8					
			T1					
Cerebellar tests:		Left		Right				
Disdiadochokinesis								

VASCULAR:	**Left**	**Right**		**Left**	**Right**
Blood pressure			Subclavian arts.		
Carotid arts.			Wallenberg's test		

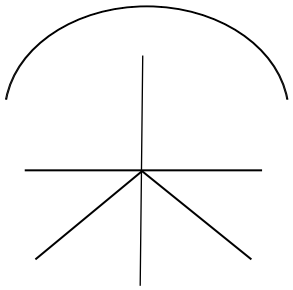
MOTION PALPATION & JOINT PLAY:
Left: Motion Palpation:
Joint Play:
Right: Motion Palpation:
Joint Play:

BASIC EXAM: SHOULDER:
Case History:

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

BASIC EXAM: THORACIC SPINE:
Case History:

ROM:



Extension

Motion Palpation:	
Orthopaedic:	
Neuro:	
Vascular:	
Observ/Palpation:	
Joint Play:	

APPENDIX J

DURBAN UNIVERSITY of TECHNOLOGY

Faculty of Health Sciences

ETHICS CLEARANCE CERTIFICATE

Student Name	Kathleen Jagarnath	**Student No**	20429940
Ethics Reference Number	FHSREC 003/11	**Date of FRC Approval**	14/02/11
Qualification	M.Tech: Chiropractic		
Research Title:	The effectiveness of the Simmons Beautyrest pillow in the management of non-specific chronic neck pain: A controlled clinical trial		

In terms of the ethical considerations for the conduct of research in the Faculty of Health Sciences, Durban University of Technology, this proposal meets with Institutional requirements and confirms the following ethical obligations:

1. The researcher has read and understood the research ethics policy and procedures as endorsed by the Durban University of Technology, has sufficiently answered all questions pertaining to ethics in the DUT 186 and agrees to comply with them.
2. The researcher will report any serious adverse events pertaining to the research to the Faculty of Health Sciences Research Ethics Committee.
3. The researcher will submit any major additions or changes to the research proposal after approval has been granted to the Faculty of Health Sciences Research Committee for consideration.
4. The researcher, with the supervisor and co-researchers will take full responsibility in ensuring that the protocol is adhered to.
5. ***The following section must be completed if the research involves human participants:***

	YES	NO	N/A
❖ Provision has been made to obtain informed consent of the participants	×		
❖ Potential psychological and physical risks have been considered and minimised	×		
❖ Provision has been made to avoid undue intrusion with regard to participants and community	×		
❖ Rights of participants will be safe-guarded in relation to: - Measures for the protection of anonymity and the maintenance of Confidentiality.	×		
- Access to research information and findings.	×		
- Termination of involvement without compromise	×		
- Misleading promises regarding benefits of the research	×		

[redacted] — 28-02-11

SIGNATURE OF STUDENT/RESEARCHER — DATE

[redacted] — 28-02-11 / 07/03/2011

SIGNATURE OF SUPERVISOR/S — DATE

[redacted] — 10/3/2011

SIGNATURE OF HEAD OF DEPARTMENT — DATE

SIGNATURE: CHAIRPERSON OF RESEARCH ETHICS COMMITTEE — DATE

[redacted] Chairperson: DTRC subcommittee — 18/3/2011

APPENDIX K

Occupation		Group A	Group B	Total
Health-care professional	*N*	2	2	4
	% within group	10.0%	10.0%	10.0%
Domestic worker	*N*	1	0	1
	% within group	5.0%	0.0%	2.5%
Professional	*N*	2	2	4
	% within group	10.0%	10.0%	10.0%
Artisan	*N*	0	1	1
	% within group	0.0%	5.0%	2.5%
Housewife	*N*	5	3	8
	% within group	25.0%	15.0%	20.0%
Manager	*N*	3	2	5
	% within group	15.0%	10.0%	12.5%
Student	*N*	7	10	17
	% within group	35.0%	50.0%	42.5%
	Total *n*	**20**	**20**	**20**
	Total % in group	**100%**	**100%**	**100%**