The prevalence of musculoskeletal disorders among dentists in KwaZulu-Natal

By

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Summary

Introduction

Occupational hazards are common among many professions and dentistry is no exception. Occupational hazards include percutaneous injuries, inhalation of noxious chemicals, noise and musculoskeletal disorders (MSD). Despite the fact that MSD have been documented to be very prevalent among dentists in various countries, there is a paucity of literature from South Africa.

Aim

The aim of the present study was to determine the prevalence of musculoskeletal disorders among the dentists in KwaZulu-Natal (KZN), South Africa and to identify risk factors associated with it. The study was a cross-sectional, descriptive one and questionnaires were used to elicit information regarding socio-demographic details, medical history, work history and work-related posture information from dentists based in KwaZulu-Natal. A convenience sample of all qualified dentists in this region who were registered members of the South African Dental Association (SADA) was used.

Results

One hundred and nine dentists responded to the questionnaire. The response rate was 31%. The majority were male; a third aged between 30 – 39 years and the ratio of females to males was 1:3. Almost all the dentists reported pain in the neck, lower back and shoulder. Less than a quarter of the dentists in KZN reported hand pain, numbness in the hands and a tingling sensation in the hands. More than three quarters reported that they had no negative effects when performing restorative work and scaling and polishing, but 3.1% reported having extreme levels of pain. The most common working position reported was the 2 o' clock position. Nearly three quarters rotated their necks while performing clinical dentistry and a third tilted their shoulders towards their dominant hand.

There was no relationship between Body Mass Index (BMI) and whether respondents treated patients while seated or standing and neither was there a relationship between pain in the lower back and BMI. There was a strong association between pain in the neck while performing clinical work and the number of years in practice confounded by age. When compared to other countries the prevalence of MSD is very high. The highest occurrence was for neck, back and shoulder pain.

Avoiding these injuries is critical and self-recognition is important in either preventing further injuries or in increasing severity of the condition. The findings of this study suggests that it may be valuable to include ergonomic work practice in the training of dentists and dentists should be involved in a proper exercise routine which should include stretching and weight training to prevent injuries. Regular breaks should be taken to perform stretching exercises in-between the management of patients in order to reduce the risk of MSD.

DECLARATION

I, Rajeshree Moodley, the undersigned, hereby declare that the work contained in this dissertation, the prevalence of musculoskeletal disorders among dentists in KwaZulu-Natal, is my original work and that it has not been previously in its entirety or in part submitted at any university for a degree. I also declare that all sources I have used are appropriately referenced.

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Rajeshree Moodley Date

DEDICATION

This thesis is lovingly dedicated to

To my dear husband Sagren Moodley and my sons Shailin and Keyur, for giving me constant love, total support and encouragement.

My mum and my dad for always inspiring me, being a pillar of strength and assisting me in this Master's experience. Your sustained love has supported me throughout my life.

My siblings for their unconditional love and support.

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Love and light to you all!

LIST OF ABBREVIATIONS

ADA	American Dental Association
CTS	Carpal tunnel syndrome
HPCSA	Health Professions Council of South Africa
MSD	Musculoskeletal disorder
NSAID	Non-steroidal anti-inflammatory drugs
PD	Proprioceptive Derivation
PSP	Prolonged Static Postures
RCI	Rotator cuff impingement
SADA	South African Dental Association
WHO	World Health Organisation
WRMSD	Work related musculoskeletal disorder

CHAPTER 1: INTRODUCTION

Occupational Health is defined by the World Health Organisation (WHO) as a multidisciplinary activity that promotes and protects the health of workers. Occupational health seeks to control accidents and diseases by reducing risks in the workplace. Musculoskeletal disorders (MSD) are health problems of the locomotor apparatus that includes muscles, tendons, skeleton, cartilage ligaments and nerves (WHO, 2011). Back problems are the most common ailment faced by people globally and are one of the ailments that are self-inflicted.

The risk factors of MSD in dentistry can be divided into biomechanical, ergonomic and work factors (Diaz-Caballero et al. 2010). The risk factors at work that could predispose workers to develop MSD include the lifting or carrying heavy loads, whole body vibration, having a static posture for a long time and frequent bending and twisting (Pargali and Jowkar, 2010). Biomechanical models suggest that awkward postures lead to MSD (Saunders and Turcotte, 2002). Dentists complain of the highest incidence of back pain, neck pain and shoulder pain, more than any other occupational group and this may be related to inadequate working patterns, poor posture and the work environment (Tandon et al. 2010). These impacts on the quality of care a dentist can offer his or her patient. By making changes in work posture, work conditions and maintaining an active lifestyle, a dentist can reduce the risk of MSD (Tandon et al. 2010).

Working postures among dentists have changed over the past 30 years, from a standing posture to a seated one, in the hope of reducing muscle fatigue and MSD (Ellapen et al. 2011). Occasional pain is not a major cause for concern, but regular pain or discomfort cannot be ignored as the cumulative effect can lead to injury or disability (Tandon et al. 2010). Dental operators cannot usually avoid prolonged static postures (PSP) and even when seated for a long period, the muscles are in a contracted position with little or no vertebral movement this may cause physiological changes that can lead to MSD (Valachi and Valachi, 2003).

MSD has been reported to be very prevalent among dentists in various countries, but there is a paucity of data from South Africa.

CHAPTER 2: LITERATURE REVIEW

2.1. Background

Musculoskeletal disorders (MSD) are health problems of the locomotor apparatus (WHO, 2011) that includes muscles, tendons, the skeleton, cartilage, ligaments and nerves. They can either be minor disorders or irreversible disabling injuries and are often caused or exacerbated by work. There are two types of MSD injuries - one is acute and painful and the other is chronic and lingering. The acute state is caused by lifting or carrying a strong, short-term, heavy load leading to sudden failure in the structure and function of muscles, while the chronic state is due to permanent overloading leading to continuous pain and dysfunction. Chronic pain results from long-term loading that is often ignored by the worker. In industrialized countries about one third of all health related absenteeism from work are due to MSD. The highest proportion (about 60%) of absenteeism is due to back injury, followed by injuries of the neck and upper extremities, and injuries of the knee and hips (WHO, 2011).

MSD have been recognized for hundreds of years in relation to work activities. Bernardini Ramazzini, an Italian physician in the eighteenth century and father of occupational medicine was the first to describe MSD as diseases *"... that arise from three causes: first constant sitting, the perpetual motion of the hand in the same manner, and thirdly the attention and the application of the mind ..."* (Sluiter, Rest and Frings, 2001). Each member of the dental team is predisposed to pain or injury in slightly different areas of the body, depending on his or her tasks and positioning in relation to the patient (Velachi and Velachi, 2003).

Dentistry is a demanding profession that requires concentration and precision. The work area - the oral cavity - is small and narrow, and performance of the dental work often results in inflexible work postures (Finson, Christensen and Bakke, 1998). Many occupational health problems still persist in modern dentistry despite the numerous technical advances in the recent years. These include percutaneous exposure incidents and exposure to infectious diseases, radiation, noise, allergy to dental materials, musculoskeletal disorders, eye injuries, vibration induced neuropathy and psychological conditions (Leggat et al. 2007). Other occupational health problems include contact dermatitis, hearing loss and toxicity from the materials used (Samat, 2011).

MSDs commonly occur in certain industries and occupations. High risk sectors include nursing, air transportation services, mining, food processing, leather tanning and heavy and

light manufacturing. Upper extremity MSD is prevalent in clerical workers, cleaners, postal service workers and commercial packers. Back and lower limb disorders occur among nurses, nurse aids, airplane baggage handlers, construction workers, crane operators and other patient care workers (Punnet and Wegman, 2004).

Musculoskeletal disorders are a work related (health) issue that affects muscles, joints, tendons, ligaments and nerves. The back, neck, shoulders, upper and lower limbs are usually affected. Factors that predispose dentists to MSD are a stressful work environment and poor ergonomics of the dental practice. When compared with other health workers, dental health workers have been known to report the highest prevalence of MSD. Dentists work under both psychological stress and a great deal of physical demand and this exacerbates the occurrence of MSD (Lindfors, Thiele and Lindberg, 2006).

Dentists need a high level of precision and control when they work. They work in a confined space for prolonged periods of time with precision tools (Samat, 2011). They need good vision, psychomotor skills, manual dexterity and the ability to maintain "occupational postures" for extended periods. The abnormal positions and awkward postures have a great impact on the body. Failure to adapt to correct work postures predisposes the dentist to develop back pain (Samat, 2011). Work Related Musculoskeletal disorders (WRMSD) that result from repetitive motions have various names including cumulative trauma disorders and repetitive strain injury (Panagos et al. 2007).

2.2. Risk Factors

Diaz-Caballero et al. (2010) have classified the possible risk factors of MSD as biomechanical, ergonomic and work factors (psychosocial risk factors due to job stress). The ergonomic factors are the physical condition of the environment, adequate equipment design, and avoidance of unhealthy postures. Biomechanical factors include work forced postures, equipment that vibrates, forceful grips, static postures and rotary devices that operate at high frequency (Diaz-Caballero, Gomez-Palentia and Diaz-Gadenas, 2010).

Dentists, dental therapists and oral hygienists are at risk for muscular skeletal injuries due to the repetitive type of work that they perform. A dental team member experiences pain in different areas of the body depending on the tasks they perform as well as the position of the patient (Velachi and Velachi, 2003). The risk factors for MSD are torso twist (twisting the upper torso too much to the left or right while seated), tipped shoulders, dominant elbow

rising during operation, operating light away from work field, working in the 7 to 8.30 and the 3.30 to 5 o'clock position. Eliminating or avoiding these positions will minimize risks of MSDs (Rucker and Sunell 2002).

When a dentist works with a dental assistant there is distinct advantage. Both four and six handed dentistry allows the musculoskeletal system and nervous system to rest. The muscles of the back, the neck and lower extremities are allowed to rest. Unfortunately some dentists work without an assistant and this places them at increased risk. Rest breaks are essential in a long day of work. Physical activity increases efficiency of the musculoskeletal system. It increases muscle strength and flexibility and reduces symptoms of MSD. Dentists that do not have active lifestyles are more prone to MSD (Szymanska, 2002).

Prolonged sitting in a poorly designed chair, inadequate equipment, improper workplace design and inadequate work organization are occupational risk factors. Psychosocial risk factors at work similar to high pressure on time and workload, low job control, job dissatisfaction, monotonous work, poor support from co-workers and poor support from management can lead to back pain. Other risk factors include cold temperatures, vibration, extrinsic stress, and repetitive movements (Samat et al. 2010; Lindfors et al. 2006).

Musculoskeletal symptoms were found to increase with use of certain positions around the patient's chair. The 7.30 to 8.30 and 3.30 to 5 o' clock seated positions are related to torso twisting and elbow raising. Clinicians that raise the dominant elbow while working are likely to experience musculoskeletal symptoms throughout the body. Dentists who adopt this position have more than a 50% chance of experiencing hand, shoulder, neck and upper back pain. Tipped shoulders and operating with the hands close to face are considered risk factors (Rucker and Sunell, 2002). A static posture is a further risk factor. Operator positions are maintained for thirty to fifty minutes depending on the appointment times and even at low static loads for a long duration there will be muscle fatigue leading to chronic neck and shoulder pain. Fatigue may be caused by compromised microcirculation, increased pressure within the muscles and insufficient removal of lactic acid (Sanders and Turcotte, 2002).

2.3. Prevalence

MSDs are the cause of common complaints in both the general and working population. In 1990, 15% of the entire working population in the USA suffered from one or more types of chronic MSD (Treaster and Burr, 2004). The high prevalence of MSD pain among dentists is

well documented and MSDs particularly back pain have been found to be a major health problem for dental practitioners (Leggat and Smith, 2006).

Ellapen et al. (2011) reported in the only study carried out in South Africa (on dentists from Durban and Verulam) that the frequency of pain and discomfort was 49.3 % in the vertebral area, 18.7% in the wrist, 16.6% in the shoulder and 12.5%in the lower leg. The most prevalent being the vertebrae, probably due to the seated work position adopted by dentists. Wrist pain was the next most prevalent symptom. Nearly half (46%) of the dentists did not experience work-related musculoskeletal pain and it was surmised that this was due to the fact that they were involved in an exercise routine including running, strength training and flexibility (Ellapen et al. 2011).

The reported prevalence of back pain among dental personnel (dental technicians, dental staff nurses and dentists) in Malaysia was 45%. Dentists reported the least prevalence of back pain (28%) and technicians the highest (52%). These were thought to be due to the fact that dentists were trained for longer periods and were more aware of ergonomic hazards (Samat et al. 2011).

Moradia and Patel (2011) reported that 63.6% of dentists in Surat City in Gujarat, India had at least one kind of occupational pain either in the neck, back or shoulder or a combination of it. The back, neck and shoulder were the most common sites reported by 75%, 42.9% and 22.5% by dentists respectively. Nearly 96 % of dentists reported that the pain began when they started dentistry. Five dentists stated that they had symptoms that lasted for the entire day, while almost 90% had intermittent pain that was precipitated or aggravated by certain factors - prolonged sitting was the most common factor (95.9%) (Moradia and Patel, 2011).

Mild pain (did not demand a change in work position) was reported by 40.8%, moderate pain (made them change position) by 44.9% and 12.2% had severe pain which compelled them to take a rest in-between patients (Moradia and Patel, 2011). Certain factors helped relieve the pain: correct posture (49.9%), pause for few minutes (32.7%), muscle relaxing exercise (24.5%), analgesic drugs (10.2%) and a complete rest for the day (4.1%) (Moradia and Patel, 2011).

A Spanish study carried out among dentists and students at the University of Barcelona to determine intensity and location of musculoskeletal symptoms among dentists reported that 79.8% of participants experienced MSD in the past 6 months. The neck region was the most

frequently affected (58%), followed by pain in the lumbar area (52.7%), back pain (40.5%), wrist pain (27.1%) and pain in the shoulders (24.3%). Forty two percent experienced pain in three or more locations, 20.3 % in two locations and 17.6% in one location. Only 15% of the dentists applied for sick leave and 12% used non-steroidal anti-inflammatory drugs (NSAIDS). Nearly 34% reported doing some preventative activity like sport (52%), posture correction exercises (16%), physiotherapy (16%), stretching (8%), yoga (8%) and massage (8%). Pains in the cervical and lumbar regions were associated with pain in other regions. Wrist pain was associated with shoulder pain and oral surgeons reported higher incidence of wrist pain than the rest of the professionals (Harutunian et al. 2011).

A study conducted in Shiraz, Southern Iran reported that 33% of dentists presented with lower back pain, 28% had neck pain and 10% had both. Forty percent of the dentists with pain had radicular pain and 47% had paraesthesia in their limbs (Pargali and Jowkar, 2010).

A study carried out among dental students in the 8th, 9th and 10th semester at the College of Dentistry at the University of Cartagena in Columbia, South America reported that 80% of students had muscular pain due to clinical practice. They experienced most pain during surgery and periodontics. Fifteen percent of the students had pain in the neck and lumbar zone, 13% reported pain in the cervical, dorsal and wrists zones followed by 6% in forearm and wrist. Nearly 90% of participants varied the working posture during clinical practice, 67% frequently change positions and only 13% did stretching exercise (Diaz-Caballero, Gomez-Palentia and Diaz-Gadenas, 2010).

Hayes, Cockrell and Smit (2009) reported that the most prevalent region for pain among dentists were back (30.1 to 60.1%), neck pain (19.8 to 85%) and hand and wrist pain (60 to 69%) and that dental hygienists were most affected by hand and wrist pain (Hayes et al. 2009).

Shrestha, Singh and Niraula (2002) researched the work-related complaints among dentists in Biratnager and Daran in Nepal. In this study, 47% of dentists found that endodontic treatment was the most tiring dental procedure. Seventy nine percent experienced backache in the last year, 59% had one episode of neck pain and 47% experienced shoulder pain. Thirty five percent attributed their pain to endodontic procedures (Shrestha, Singh and Niraula, 2008).

A study carried out in South East Turkey described the prevalence and distribution of symptoms of MSDs among dentists. Subjects were asked to report on the following

symptoms if they occurred one month prior to the receipt of the questionnaire: headache, pain, numbness, pins and needles, foot and leg pain, finger weakness and body pain – weakness. Ninety four percent reported one or more of these symptoms, 29% headache, 8.1% pain, 9% numbness, 7.6% needles, 30.9% leg pain, 7.6% weak fingers and 30.9% total body weakness. Nearly 63% of dentists took medication for their pain. Subjects were asked to report on trunk pain (neck, lower back, thorax/lumbar, pain in the arms and legs) and 84% percent reported having one or more of these symptoms in these locations. Pain sites were distributed evenly between the neck and lumbar regions. The location of pain in the trunk area was not significantly different between the male and female dentists (Polat et al. 2007). With regard to positioning during treatment - standing was the preferred practice position (35.2%), 26.0% preferred sitting and standing and 11.7% used the sitting position only - those that preferred to stand were younger. One hundred percent of dentists reported that they practiced four handed dentistry (Polat et al. 2007).

Rising et al. (2005) conducted a study to investigate the body distribution and severity of musculoskeletal pain in dental students – 46-71% reported some type of body pain. The highest overall percentage was in the neck and shoulder area, followed by mid back, lower back, right arm/hand and left arm/hand. The female students reported a significantly higher prevalence of neck/shoulder pain while the males reported the worst pain in the mid back area. There was a significantly higher prevalence of dental pain among dental students who were acquiring clinical skills and providing dental procedures (Rising et al. 2005).

A study in Greece presented the 12 month prevalence of complaints of back, neck, shoulder and hand/wrist among dentists. Nearly half reported lower back pain, 26% neck pain, 26% hand and wrist pain and 20% shoulder pain. Chronic lower back pain was reported by a quarter of all subjects. Hand and wrist complaints were more prevalent among orthodontists than general dentists (42.1% among orthodontists and 25.5% in general dentists). Sixty two percent of all subjects reported at least one musculoskeletal complaint, 35% reported at least two, 15% reported at least three and 6 % reported all four complaints in the past 12 months. There was a strong association between neck and hand /wrist pain since 50% of subjects with neck pain reported hand/wrist pain in the last 12 months. Chronic back pain and absence from work was strongly associated. One hundred and thirty six dentists sought medical care from orthopaedic surgeons (60% in cases of back and shoulder complaints and 50% of neck and hand wrist complaints) (Alexopoulos, Stathi and Charizani, 2004).

Rucker and Sunell (2002) conducted studies among British Columbia dentists (67% male and 91% general dentists). More than two thirds were in practice for 5 years or more. Almost all (94%) practiced seven or more hours each day and 86% practiced four or more days each week. Just under a quarter (24%) experienced neck pain that was work-related, 19% upper back pain, 18% shoulder pain, 17% lower back pain, 13% mid back pain and 9% hand pain. One in three dentists (34%) attributed their pain to clinical work. Another 54% attributed their symptoms partially to clinical work and 7% felt their symptoms were solely to factors other than clinical work. On account of their MSD, 13% decreased their number of working days per week, 19% had a decreased ability to perform recreational activity, and 14% reported pain after performance of activities at home. Seven percent of practitioners purchased specialized equipment to deal with their work related problems but only 5% redesigned their surgeries. Sixty percent of dentists reported that they "lived with the pain". Four percent of respondents recorded loss of 99 work days during the previous 12 months as a result of MSD (Rucker and Sunell, 2002).

Szymanska (2002) conducted a survey among 268 dentists in Poland and more than a third were practicing for up to 10 years. Nearly 60% reported pain in the thoracic - lumbar region of the back, 53.6% in the neck, 47.8 % the lower extremities and 44.0 % in the wrist and hand (Szymanska, 2002).

Nearly 74% of dental personnel in Riyadh in Saudi Arabia reported back pain at some stage in their lives. Fifty four percent reported neck pain. Dentists had significantly more neck and back problems than dental hygienists, dental assistants and technicians (Al Wassan et al. 2001). A study carried out among registered dental hygienists in South Africa reported that 61.3% had experienced hand symptoms, while 17.9% reported that they had suffered from arthritis, gout, trauma or had previous treatment to hand, fingers or wrist. Twenty-eight percent performed hand scaling, 39.2% hand scaled between one to four hours per day and 32.8% of the sample did not scale at all. Of the respondents 41% and 34.3% respectively, spent one to four hours, and five or more hours on sonic/ ultrasonic scaling. Nearly 25% did not perform sonic or ultrasonic scaling at all. Only 25% exercised their hands at work. Sixty-five and a half percent reported neck symptoms, 56.6% reported a shoulder symptom, while 23.9% reported trauma or previous treatment to the neck and 7.2% reported trauma or previous treatment to the shoulders. Twenty-six percent worked on immobile operator chairs, 9.7% of the chairs had no back support and 21.4% had no arm support. History of trauma or treatment to the neck, shoulder symptoms and the limited mobility of the operator chair

showed independent associations with the presence of neck symptoms. Neck and hand scaling for five hours or more were independently linked with shoulder symptoms. Nearly 60% reported lower back symptoms and 15.4% reported trauma or previous treatment to back. This study concluded that hand scaling is associated with musculoskeletal symptoms in the hands and that the levels of symptoms is proportional to the time spent hand scaling (Booyens et al. 2009).

Table 1: Summary of Musculoskeletal (MSD) prevalence rates

Author & Year	Country	Participants	Over all MSD	Back (%)	Hand & wrist (%)	Neck (%)	Shoulder (%)	Lower extremities (%)
Ellapen et al. 2011	South Africa	Dentists n=94	54.26	49.32	18.75 (wrist)		16.7	12.5
Harutun et al. 2011	Spain	Dental students & staff n=74	79.8	40.0	27.1 (wrist)	58	23.4	
Moradia & Patel, 2011	Pakistan	Dentists n=77	63.6	75.5	1.0 (wrist)	42.9	22.5	1.0
Lin et al. 2011	Taiwan	Dentists n=197	92.4	66.5 (lower)		71.6	75.1	
Samat et al. 2011	Malaysia	Dental team		44.9				
Pargali & Jowkar, 2010	Iran	Dentists n=82		33		28		
Booyens et al. 2009	South Africa	Dental Hygienists n=362		59.6	61.3 (hand)	66.5	56.6	
Shresta et al, 2008	India	Dentists n=68		80		58.8	47	
Polat et al, 2007	Turkey	Dentists n=113	94	30.63		23.75		23.3
Leggat & Smith, 2007	Australia	Dentists n=285	87.2	53.7 (lower back)		57.5	53.3	
Alexopoulos et al. 2004	Greece	Dentists n=430	62	46 (lower back)	26	26	20	
Hayes et al. 2006	Review	Dentists	64-93	36.3-60.1		19.8-85		
Rucker & Sunell, 2002	Canada	Dentists n=421		19	9	24	18	
Szymanska, 2002	Poland	Dentists n=268		60.1	44	56.3	51.5	47.8
Al Wazzen et al. 2001	Saudi Arabia	Dentists n=91 Assistants n=72 Technicians n=29 Hygienists n=12		73.5		54.4		

2.4 Prolonged Static Postures (PSP)

The human body is designed for movement and human beings were previously hunters and gatherers (Valachi and Valachi, 2003). After the Industrial Revolution there has been an increase in the number of sedentary workers and with the development of computers the prevalence of MSD has risen. Dentists assume static postures which require half of the body's muscle to contract to hold the body motionless while resisting gravity. The static postures are more strenuous on the body than the moving forces. When the human body is repeatedly subjected to prolonged static postures (PSP) it initiates a series of reactions that leads to pain. The physiological consequence of PSPs are muscle imbalances, ischemia, trigger points, joint hypomobility and spinal disk degeneration (Figure 1) (Valachi and Valachi, 2003).

Figure1: Flow chart showing how prolonged static postures lead to MSD (Valachi and Valachi, 2003)

2.5. Mechanism leading to musculoskeletal disorders

In a standing position the spine has four natural curves (Figure 2) - cervical, thoracic, lumbar and sacral - all are interdependent and a change in one will result in a change in the curve above or below it. The sacral curve is fused and its movement is limited while the lumbar and the cervical curves are more mobile and can be easily influenced. When the curve of the spine is balanced against the centre of gravity, the spine is supported by the bony structures of the vertebrae. When the curve becomes flattened, the spine becomes dependant on muscles, tendons and tissues to support it (Valachi and Valachi, 2003).

In dentistry, sitting unsupported is a common feature and this result in the lumbar curve flattening. This causes tension in the muscles, ligaments and connective tissue. Maintaining the cervical curve is therefore important. A forward head posture (Figure 3) common in dentistry involves holding the head and neck in a forward position. In this position the vertebrae can no longer support the spine. The muscles of the cervical and thoracic spine must contract constantly to support the weight of the head in the forward position. This results in a tension neck syndrome which presents as pain in the neck, shoulders, inter-scapular muscles and head. The pain may radiate into the arms. Sustained contractions without changes in the posture will lead to disc degeneration. A forward head posture can lead to muscle imbalances and to a rounded shoulder and rotator cuff impingement. The static position of the arms in an elevated or abducted position impedes blood flow to muscles and tendons. This can lead to trapezius myalgia (Valachi and Valachi, 2003).

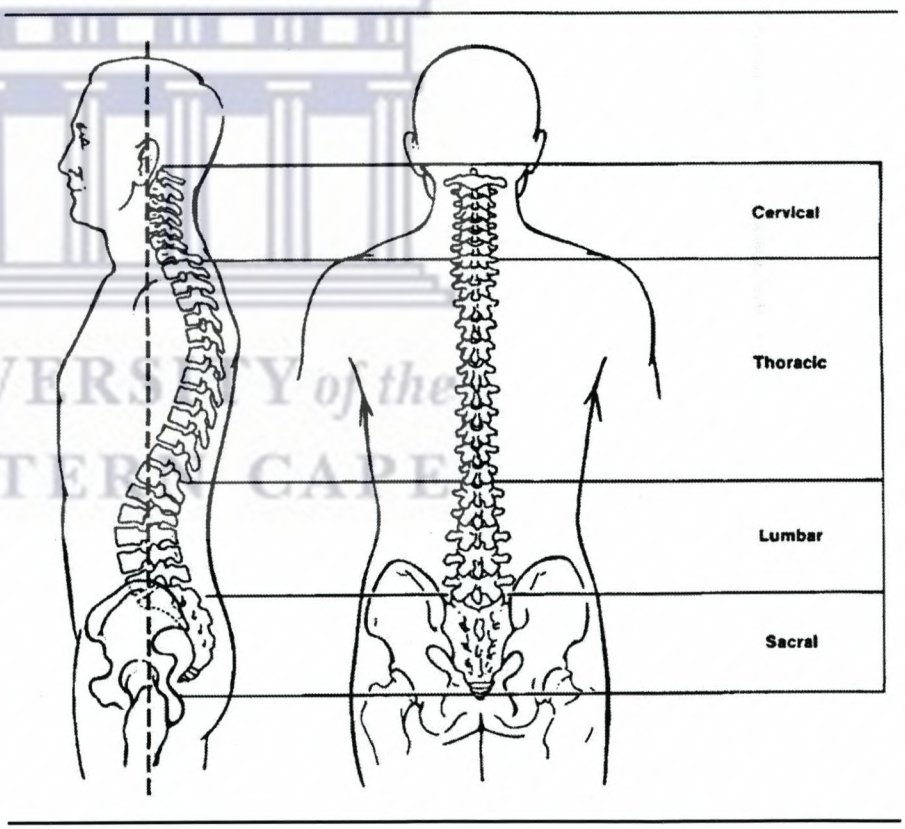


Figure 2: The primary curves of the spine (Valachi and Valachi, 2003)

Figure 3: The effect of poor posture on the curves of the spine (Valachi and Valachi, 2003)

2.6. Common Musculoskeletal Disorders

2.6.1 Back pain

Ninety percent of people will have back pain at some stage of their lives (ADA, 2004). Lower back pain is second to the common cold as the main reason for seeking medical attention (ADA, 2004). Pain in the lower back often refers to pain in the hip, buttock or one leg. The causes maybe muscle strain, instability due to weak muscles or degeneration or herniation of the spinal discs (Valachi and Valachi, 2003). Lower back pain is pain in the lumbosacral region accompanied by the contraction of the paraspinal muscles hence the expression "muscle sprain" or "strain". Trunk rotation, sitting and bending forward usually exacerbates the pain and lying down with hot or cold pack usually alleviates it (Frontera, Silver and Rizzo, 2008).

2.6.2 Neck pain

2.6.2.1 Tension neck syndrome

Tension neck syndrome is a constant feeling of fatigue or stiffness, or both in the neck together with one more subjective symptom. An example is pain in the neck with headaches, palpable hardening, at least two tender spots or muscle tightness in neck movements. Workers at risk are shop assistants, office workers, film rolling assistants and typists (Hagberg and Wegman, 1987).

2.6.3. Hand and wrist problems

2.6.3.1. Tendinitis (Tenosynovitus)

Tendinitis is the inflammation of the lining of the sheath that surrounds a tendon. The wrists and hands are commonly affected (ADA, 2004).

2.6.3.2. De Quervain's disease

De Quervain's disease is an inflammation of the common tendon sheath of the two muscles of the thumb (abductor pollicislongus and extensor pollicisbrevis). Postures that maintain the thumb in abduction and extension, forceful gripping, and thumb flexion combined with wrist ulnar deviation are the predisposing activities that cause De Quervain's disease. Symptoms include sharp pain and swelling over the radial styloid process of the wrist, the bony prominence just proximal of the wrist joint. The pain may radiate up the forearm or down

into the thumb. This may result in muscle weakness and decreased ability to grip with the thumb (ADA, 2004). The differential diagnosis includes osteoarthritis of the wrist or first carpometacarpal joint, Wartenburg syndrome (ulnar nerve compression at the wrist) and intersection syndrome (tendonitis of the dorsal wrist extensors). De Quervain's disease has been associated with assembly line work, goods manufacturing, meat and poultry processing, textile production, key punching and computer use. Repetitive hand movement with frequent extension of the thumb and extreme lateral wrist deviation increases the risk. The treatment includes rest with the thumb in a splint, anti-inflammatory therapy, physical or occupational therapy. Cortizone injections are an option following conservative treatment. Changes in work routine and workplace design may be necessary for recovery and prevention of further injury (Mani and Gerr, 2000).

2.6.3.3. Trigger finger

Tenosynovitis is caused by the swelling of the finger flexor tendon and manifests as pain in the flexor tendon sheath. The affected finger will present with a decreased range in motion (Mani and Gerr, 2000). A nodule will form on the tendon and create a clicking or triggering movement. It is due to forceful grip power and /or repetitive motion. The symptoms may include pain during physical movements that place the tendons in tension, the presence of warmth, swelling and tenderness of the tendon on palpation (ADA, 2004).

Physical examination reveals palpable tenderness, sometimes a nodule over the metacarpal head and swelling of the finger. Opening and closing of the hand produces a painful clicking, as the inflamed tendon passes through the constricted sheath. The functional limitations include difficulty with grasping and fine manipulation of objects due to pain, locking or both. Fine motor problems may include difficulty with inserting a key into a lock, typing or buttoning a shirt. Gross motor skills may include limitations in gripping a steering wheel or in grasping tools at home and at work. Magnetic resonance imaging can confirm tenosynovitis of the flexor sheath but it offers minimal advantage over clinical diagnosis. The goal of treatment is to restore normal gliding of the tendon by splinting or by injecting steroids into the area. Surgical intervention is successful should the conservative treatment fail (Zhao and Burke, 2008).

2.6.3.4. Rotator cuff impingement (RCI)

Rotator cuff impingement is pain in the shoulder when reaching overhead, with sustained arm elevation or sleeping on the affected side. Incorrect body mechanics and a rounded shoulder posture can lead to impingement (Valachi and Valachi, 2003). The rotator cuff is the name given to the functional unit of the supraspinatus, infraspinatus, teres minor and subscapularis muscles. Tendonitis of the rotator cuff is caused by impingement of the cuff structures on overlying bone. The patient presents with weakness, pain and tenderness and may have limited range of shoulder abduction and external rotation. Clinically the pain is localized in the lateral and superior shoulder and it may radiate down the arm. The muscles of the affected arm may present as normal, or mildly diminished. Radiographic examination may reveal calcific deposits in the rotator cuff tendons. Differential diagnosis includes subdeltoid bursitis, biceps tendonitis, arthritis and pain from cervical radiculopathy. The risk factors are forceful or repetitive work involving all movements of the shoulder especially abduction, flexion, and rotation. Performing overhead work, holding a tool while working with the hand above heart height, forceful work with repetitive pulling and pushing for long periods, predisposes to RCI. Heavy lifting and static postures are other risk factors (Mani and Gerr, 2000).

The occupations at risk are plumbers, mechanical maintenance staff, construction workers, welders, telephone operators, garment workers and dentists. Varying work tasks have been shown to improve symptoms of RCI. The shoulder should be rested but not immobilized to avoid the complication of frozen shoulder syndrome. All overhead work should be avoided for a few weeks. NSAIDs provide symptomatic relief and steroid injections reduce acute pain. Physical therapy should be started immediately after acute pain has been resolved and should start with gentle range motion to strengthening exercises. Surgery should be considered when conservative measures fail (Mani and Gerr, 2000).

2.6.3.5. Carpal tunnel syndrome (CTS)

Cumulative trauma disorder, repetitive strain injury and repetitive stress disorder are terms used to describe the condition when nerves innervating the hands are compressed. Any three nerves of the hand (medial, radial or ulnar) may be affected. The most common nerve compression in dentistry and the general population is called carpal tunnel syndrome. There are many medical conditions that predispose patients to carpal tunnel syndrome including obesity, arthritis, diabetes, hyperthyroidism, neoplasms, gout, myxoedema, amyloidosis,

multiple myeloma, pregnancy, oral contraceptive, hormone replacement and menopause. It is three times more common in women than in men and usually manifests in middle age (ADA, 2004).

Carpal tunnel syndrome is one of the disorders dentists and hygienists are prone to with the latter group being most affected. The ergonomic risk factors associated with carpal tunnel syndrome are the repetitive nature of work, forceful exertions, vibration, tight gloves and stress. Vibration caused by the instruments leads to increase permeability of the blood vessels, thereby increasing the pressure in the carpal tunnel area. This decreases the sensory output and leads to more forceful gripping (Werner et al. 2002). The use of mechanically driven instruments, ultrasonic scalers, polishing devices and air and water syringes use high vibration frequencies ranging from 25,000 to 30,000 Hz for ultrasonic scalers and 500 to 600 Hz for polishing instruments. The use of instruments with a smaller diameter handles demands greater forces from digital flexors to operate them than those with larger diameter handles because the extrinsic finger flexors are attempting to contract from an already shortened position. This causes the intrinsic hand muscles to overcompensate for the finger flexors and places stress on the carpometacarpal ligament (Saunders and Turcotte, 2002). The symptoms are numbness, tingling and pain in the palmer surface of the thumb, index finger and middle finger. The symptoms are worse at night and with repeated activity (Saunders and Turcotte, 2002).

Sleeping patterns are affected by CTS due to the painful symptoms. Because certain sustained or repetitive motions are difficult to perform, tasks such as driving and sustained use of a computer becomes a problem. As the condition progresses there is difficulty in maintaining a grip, and this may result in functional limitations such as the inability to tie one's shoelaces, to button shirts and put a key in a lock. The more common special tests include the Phalen, the Tinel and the nerve compression tests. The Phalen test involves a forced flexion of the wrist at 90% for one minute and positive result reveals pain. The "gold standard" test of CTS is electro-diagnostic testing. Electromyography and nerve conduction studies can confirm diagnosis, determine the severity of nerve damage and can guide and measure the effect of treatment. The initial treatment should be conservative management for example night time wrist splinting may relieve pain or full-time splinting if tolerated. NSAIDS are frequently prescribed together with splinting or oral steroids have proved to be of some benefit. Rehabilitation should include relative rest, improved ergonomics, flexion as well as extension stretching of the wrist (Zhao and Burke, 2008).

2.6.4 Shoulder Disorders

2.6.4.1 Trapezius Myalgia

Trapezius Myalgia is localized discomfort of the trapezius muscle, sometimes referred to as tension neck syndrome. It is the most common occupational disorder of the shoulder and neck. Patients present with pain, tenderness, stiffness or burning of the upper back, shoulders and area lateral to the neck. On physical examination there may be muscle tightness or trigger points of increased muscle tone and tenderness. There may be mild decreases in the range of motion. Differential diagnosis includes cervical spine disorders and shoulder pathology. Risk factors are unvarying job tasks requiring static position of the head, neck, shoulders and back. This disorder occurs among office workers, dental workers, some medical workers, jewellers and microelectronic workers. The treatment is to apply hot and cold packs to relieve symptoms and to maintain active use of arms and shoulders. Altering work postures and taking frequent breaks will also help to alleviate symptoms (Mani and Gerr, 2000).

2.7. Impact of MSD

MSDs are a common cause of early retirement from the profession. Sixty percent of dentists and hygienists have reported being absent from work or have experienced job loss due to MSD (Rucker and Sunell, 2002). Harutunian et al. (2011) in a Spanish study reported that only 15 percent of dentists applied for sick leave. Brown et al. (2010) investigated ill-health retirement among dentists and found that more than half had retired due to musculoskeletal disorders (Brown et al. 2010). According to Leggat et al. (2007) MSDs contribute to an increase in sick leave, decreases in productivity and increases in the rate of dentists leaving the profession.

2.8. Prevention

"Self-recognition" is the clinicians sign that there are problems and that there is a need to make changes. Pain and discomfort should be a sign that ergonomic changes need to be made. Appropriate educational measures should be provided in undergraduate training. Continuing education courses should include awareness of MSDs (Rucker and Sunell 2002). Dentists should seek out and receive education about musculoskeletal health, injury prevention and ergonomics (Valachi and Valachi, 2003).

A proper dental patient chair and operating stool is important in a dental surgery. There must be optimal working conditions. If the operator stool is immobile this will lead to the development of neck pain. If the patient chair is difficult to adjust then it would predispose the operator to neck and lower back pain (Booyens et al. 2009). A saddle style operator stool promotes the natural lower back curve and increases the hip angle. The chair should be adjusted so that the hips are slightly higher than the knees and the feet firmly on the ground. The edge in the front of the chair should compress the back of the thighs. It is also recommended that practioners use lumbar support by adjusting the lumbar support forward to contact the back (Valachi and Valachi, 2003).

The use of surgical magnification could be associated with decreased risk of MSD. The operatory light should be positioned close to the clinician's sight line for maxillary treatment (Rucker and Sunell 2002). The declination angle of operating loupes and telescopes should allow the operator maintain less than 20 degrees of neck flexion. An angle greater than twenty degrees has been associated with neck pain (Valachi and Valachi, 2003).

Static postures should be avoided as it increases the dentist's susceptibility to injury. The human body is designed for movement and changing postures, therefore it is critical that there are variations in work postures. The dentist should alternate between standing and sitting to prevent injuries. When one is sitting or standing a different set of muscles is used and alternating between the two allows for one set of muscles to rest (Valachi and Valachi, 2003; Tandon, Garg and Agrawal, 2010). It is therefore recommended to alternate between standing and sitting. This is an effective measure to prevent injuries.

Patients should be positioned at a proper height. If the patient is positioned too high the operator will need to elevate shoulders and abduct the arms leading to static muscular tension in the neck and shoulders (Valachi and Valachi, 2003). The dentist should work with an assistant (four handed dentistry) as this will maintain a well organised workstation with minimum stress and fatigue. Four handed dentistry also increases productivity and efficiency (Thornton et al. 2008). The ideal from the point of view of ergonomics is six handed dentistry which allows the spreading of the physical work and thus prevention of injuries (Szymanska, 2002).

Changes in the position of the feet would shift the workload from one set of lower back muscles to another. This would allow the overworked tissues to get replenished with nutrients (Tandon et al. 2010). There should be constant repositioning of feet to prevent injuries.

The position of the instruments in the surgery is important. Rear delivery systems promote detrimental twisting movements. It encourages extensive trunk twisting and shift of vision to retrieve instruments. Side delivery requires moderate twisting. Instruments should be placed within easy reach and one should avoid twisting and reaching over the body. Repeated unilateral twisting in one direction may lead to muscle imbalances and lower back pain (Tandon et al. 2010). With poor postures and rotations the muscles responsible for the tilting and the rotation become stronger and shorter while the opposing muscle becomes weaker and elongated. The stressed muscle becomes painful due to lack of oxygen.

There may be a combination of pain, tingling and numbness (Valachi and Valachi, 2003). Twisting movements should be avoided during the workday. The operatory design plays a role in the number of times a dentist perform detrimental twisting movements (Tandon et al. 2010). When designing a surgery rear delivery systems should be avoided as this increases the number of times a dentists has to perform twists.

The principle of ergonomics is to create an appropriate balance between the work requirements and the capacity of the working person, by adapting the work to the person or by developing the capacity of the worker by training. The ideal should be to adapt the working conditions to the capacity of the worker and not adapting human beings to the work infrastructure and layout. Not all work functions can be performed by all persons (WHO, 2011).

The Proprioceptive Derivation (PD) concept is to provide dentists with a good posture and proper control of dental tasks thereby reducing muscular skeletal discomfort. This is an ideal posture with the dentist sitting upright, both hands at the level of the heart, being easily able to reach all equipment and materials. The patient should be horizontal. The dentist must maintain posture while having maximum balance and comfort (Figure 4). Once the dentist establishes a comfortable and balanced working posture, he/she should integrate this into their clinical practice. Once the dentist is sitting properly the patient's position must support the dentist's attained position (Chaikumarn, 2005).

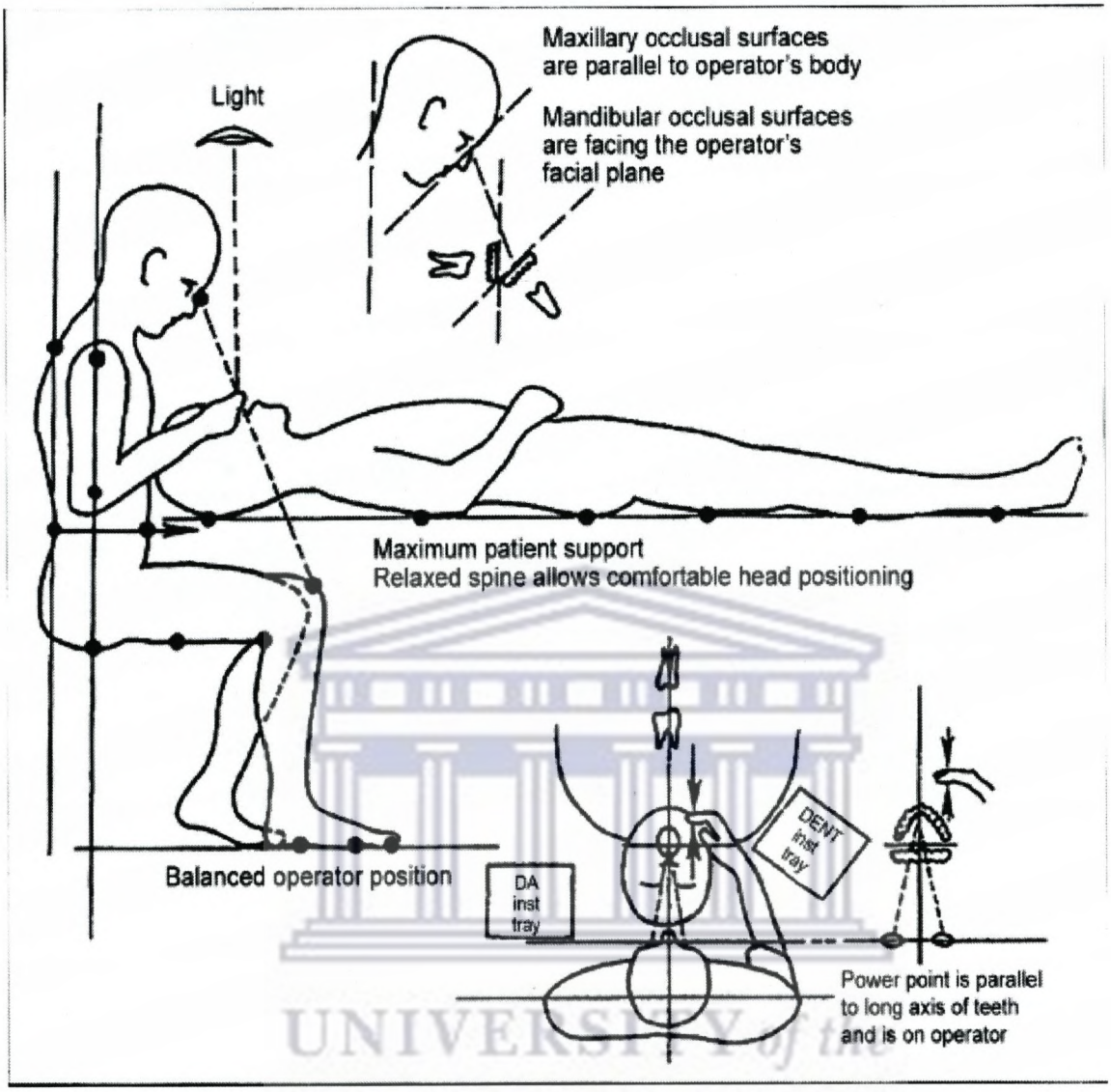


Figure 4: Dentist and patient posture according to PD concept (Chaikumarn, 2005)

2.9. Interventions

2.9.1. Exercise

Muscles that are strong support the vertebrae to handle better loads. Weak muscles make the back work less efficiently. The load that the muscles normally bear is shifted to the vertebrae. Aerobic, weight training, cycling, walking and swimming will keep the back in good shape (Tandon, Garg and Agrawal, 2010). Aerobic exercise is recommended to limit general pain or prevent pain, facilitate weight loss and strengthen the torso (Harutunian et al. 2011). Dentists should perform strengthening exercises to strengthen the shoulder and back to enhance the health of the spinal column, maintain good posture and optimise the functions of the arms and

hands. Weak, unconditioned muscles make the back work less efficiently with loading on the vertebrae and discs. Relaxation exercises may serve to reduce stress. Stress may produce chronic muscle contraction which decreases circulation and increases toxins in the muscle. The toxins stimulate nerve endings to generate lower back pain. Deep breathing and relaxation exercises serve to reduce stress and should be performed during the day or in-between patients. Breathing exercises are a simple way of relaxing in any stressful situation. The operator should take five to ten minutes to sit and breathe deeply. The second breathing exercise is to clench the hands and while keeping them clenched pull the forearms tightly against the upper arm and raise the shoulders against your neck. While these muscles are tensed, the operator should keep their eyes shut and hold their breath for five seconds and then let go. This will assist in letting go of all the tension in the neck and back (Tandon et al. 2010).

2.9.2. Instrument Design

The design of hand instruments should include the following features as it impacts on the user: the size and shape of the instrument, diameter of the handle, surface configuration, weight, balance and alignment, manoeuvrability, manipulation of moving parts and the cutting edge. Most instruments are the size of a no. 2 pencil. To grip this, the operator has to use the tips of the fingers. The pen grip grasp concentrates the strain within a small set of hand muscles. Larger diameter instruments are gripped by the pads of the finger thereby distributing through a larger muscle group (ADA, 2004). The instruments with larger diameters and lighter weight required less muscle load and pinch force (Dong et al. 2006). Therefore manufacturers should develop instruments with a variety of handle sizes, shapes, textures and materials. This would shift the work to various muscle groups. A smooth round handle requires greater pinching force. Handles with shallow grooves and texturing allows for better grip and require less force. Instruments should be dry to maintain a grip. The working ends of the instrument should be sharp to decrease stress (ADA, 2004).

Guidelines are required for the use of dental equipment to prevent work related MSDs. Dentistry should focus on the health of the current practitioners and the health of future dentists. Dental work should be organised in a way that enables a rational distribution of work function between dentist and assistant. The dentist has to be aware of physical activity and its advantages in ensuring efficiency. The workplace of the dentist should be designed and fitted using the principles of ergonomics (Szymanska, 2002).

2.9.3. The use of magnification

The use of magnifying glasses minimises neck flexion and maintains a neutral posture. The ideal patient operator distance should be fourteen to sixteen inches but many operators work closer in order to obtain better visibility. Magnification lenses are available as loops that are mounted around the head or as glasses (Saunders and Turcotte, 2002). Magnification reduces fatigue and increases productivity (Harutunian et al. 2011)

2.9.4. Work Planning

When planning a workday the dentist should plan breaks to allow muscles to rest in order to maintain productive work. It is recommended that a professional who performs repetitive work should take a six minute break for every hour worked (Harutunian et al. 2011). Three types of breaks are recommended: frequent pauses (relaxing and dropping arms during work for two to three minutes), breaks between patients (perform movements for about two to three minutes using the opposite muscles) and breaks to allow recovery (ten to fifteen minutes every three hours) (Harutunian et al. 2011).

Dentists who perform more manual scaling can modify their work practice by careful scheduling of patients with heavy calculus, taking appropriate breaks and ensuring that instruments are kept sharp. Instruments with larger diameters (10mm and 11.5 mm) and lighter weight (15g) require less muscle load and pinch force. These are recommended and preferred by clinicians (Dong et al. 2006). There is a need for developing better ergonomic procedures and practices in dentistry. Dental teams need functionally designed dental equipment and proper training in ergonomic methods. Knowledge about the scope of ergonomics as well as health and safety should be imparted to all undergraduates and should be included in continued professional development programs. The dental practice should be designed and fitted according to the principles of ergonomic practice. There should be more rational way of distributing work functions between dental staff within a team (Szymanska, 2002).

There is a lack of prevalence data in KZN therefore the researcher considered this study. There is a need to establish the prevalence of MSD among the dentists in KZN. Dentists work in a stressful environment, in a limited space and seated for long periods of time

CHAPTER 3: AIM AND OBJECTIVES

3.1 Aim

The aim of this study was to determine the prevalence, features and risk factors associated with musculoskeletal disorders among dentists in KwaZulu-Natal.

3.2 Objectives

- To determine the prevalence and symptoms of MSDs among dentists
- To determine the risk factors of MSDs
- To determine the location of pain and discomfort experienced by dentists
- To establish whether there is a relationship between the years of practice and the symptoms experienced

CHAPTER 4: METHODOLOGY

4.1 Introduction

This chapter presents the aims and objectives of the study, the study design, sampling, matching and inclusion criteria. In addition, the survey method, development and piloting of the data capture sheet, data entry and method of analysis are described.

4.2 Study design

A cross-sectional study using a combination of qualitative and quantitative data was used.

4.3 Study population

All qualified dentists registered with SADA in KwaZulu-Natal were included in the sample (n= 350).

4.4 Study sample

A convenience sample was used.

4.5 Establishing contacts

Participants were contacted via the South African Dental Association (SADA) KwaZulu-Natal branch. Questionnaires were emailed to all dentists in KwaZulu-Natal and were handed out by the researcher at the local SADA branch meetings.

4.6 Development of the questionnaire

Planning of the questionnaire began in February 2011. It was developed from information obtained from the review of literature on musculoskeletal disorders. For the purposes of the present study, the data gathered was divided into three sections:

- Socio-demographic – age, gender, height and weight of the dentist and area of practice. Also included was the type of professional practice, hours spent at work and the average number of days worked per week.
- Medical history of patient – medical problems and the current medication
- Work and posture - intensity of work, work load, patient positioning, recording of pain and exercise.

4.7 Piloting the questionnaire

A pilot study was conducted to test the questionnaire in terms of practicability and relevance. The pilot study was carried out to:

- test the suitability of the method of collecting the data
- test how long it would take to record information
- check the adequacy of the questionnaire
- check that all the parameter measurements were clear and unambiguous
- ensure that no major items had been omitted and
- remove any items that did not yield usable data.

The self-administered questionnaire was tested on 6 participants before the study commenced. Each questionnaire took about ten minutes to complete. After the pilot study, irrelevant and problematic items were identified and consequently deleted or reformulated. A final copy of the questionnaire was then printed and used for the final study (Appendix 1).

4.8 Obtaining consent

Prior to the completion of the research questionnaire, all respondents were given written information about the study and asked to read and sign a consent form (Appendix 2) if they were willing to participate in the study. This consent form included the researcher's qualifications and contact details, the supervisor's details as well as the institution the researcher was registered with.

4.9 Validity and reliability

The researcher was the only one involved in data collection, thereby ensuring standardization in the manner the questions were asked and recorded. The researcher followed a clearly structured format and asked questions in a standard way. The emailed questionnaires were answered online and returned to the researcher.

4.10 Data analysis

Questionnaire data were categorized, coded and then entered into the computer. The data was captured in Excel spread sheet. A basic descriptive analysis was done using Excel. The database was imported into SPSS® to perform complex statistical analyses. Descriptive statistics were used to describe the demographic factors. A body chart and a diagram of the

right and left hand were used and respondents plotted areas of pain. The independent t-test was used to determine any correlation between the scale variables. The Chi-square test was used to determine the association between the nominal and the ordinal variables.

4.11 Ethical considerations

The protocol was submitted to the Senate Research Ethics Committee of the University of Western Cape and ethical approval was subsequently obtained in June 2011. Informed consent was obtained prior to the interviews. Participation in the study was entirely voluntary and the participants were allowed to withdraw from the study at any time should they wish to do so. It was emphasized that strict confidentiality would be maintained at all times and that no names or personal details would be mentioned in the write-up of the study. Confidentiality was achieved by not using the participant's names on the questionnaire and the questionnaire was recorded with a serial number.

CHAPTER 5: RESULTS

This chapter presents the results of the survey and discusses the findings obtained from the questionnaire. The data was analysed with SPSS version 20.0. The results are presented below.

5.1. Demography

One hundred and nine dentists responded to the questionnaire (n=109). The response rate was 31%. The majority of the respondents were male (72.5 %). A third of the respondents were aged between 30 – 39 years (30.8%) and the ratio of females to males was 1:3 (Table 2).

Table 2: Gender and Age

Gender			
	Frequency	Percent	Valid Percent
Female	29	26.6	26.9
Male	79	72.5	73.1
Total	108	99.1	100.0
Age in years			
Age (years)	Frequency	Percent	Valid Percent
20 - 29	15	13.8	14.0
30 - 39	33	30.3	30.8
40 - 49	27	24.8	25.2
50 - 59	24	22.0	22.4
> 60	8	7.3	7.5
Total	107	98.2	100.0

5.1.1. Body Mass Index (BMI)

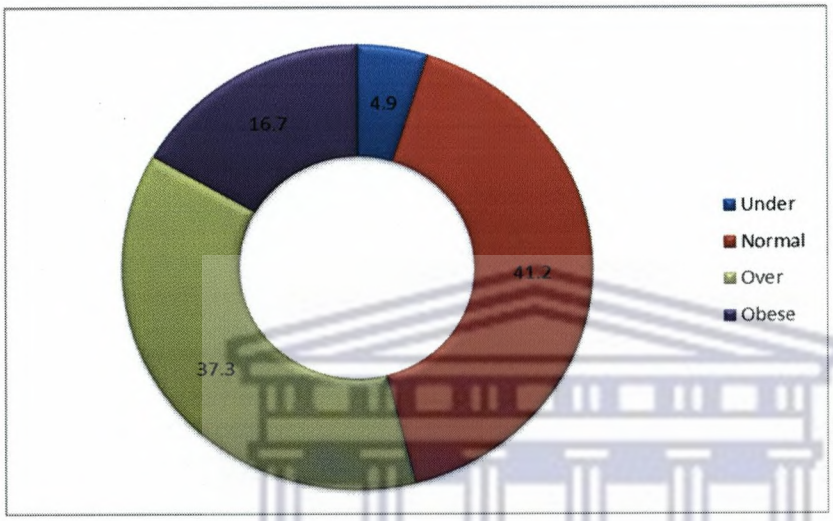
The body mass index for the respondents was determined using height and weight. It is calculated by the weight of the individual divided by the square of his or her height. Results were classified as follows:

- Underweight = <18.5
- Normal weight = 18.5–24.9

- Overweight = 25–29.9
- Obese = BMI of 30 or greater

Just over a third (37.3%) of the respondents were overweight and 16.7% were obese (Figure 5).

Figure 5: Body Mass Index



5.1.2. Work practice

A third of the respondents were in practice for more than 21 years. The majority of the dentists worked 5 to 6 days per week and 7 to 9 hours per day (Table 3). Since the p-value (0.364) from the chi square test is greater than the level of significance, there is no significant relationship between the number of years in practice and the levels of pain experienced.

Table 3: Years in practice, Average workday per week and Average hours worked per day

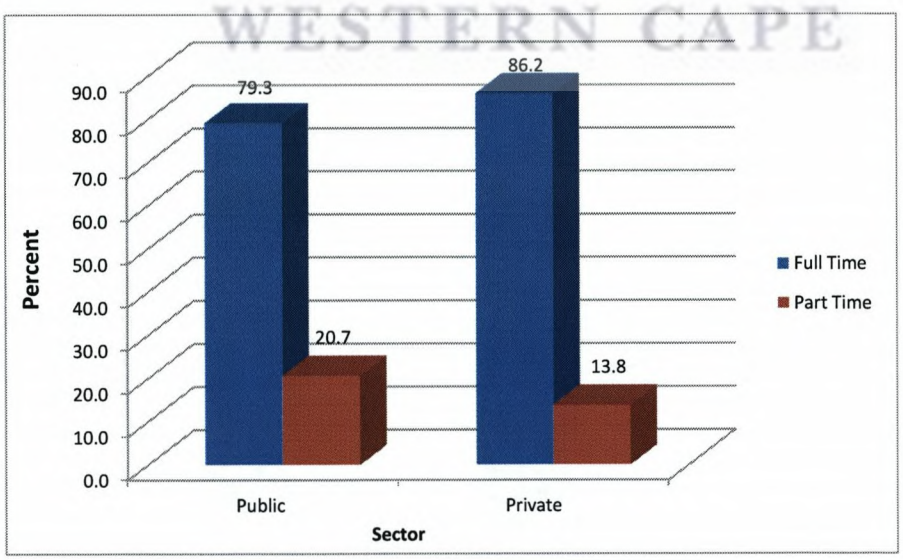
The number of years in practice			
Number in years	**Frequency**	**Percent**	
0 - 5	20	18.3	
6 - 10	19	17.4	
11 - 15	18	16.5	
16 - 20	17	15.6	
> 21	35	32.1	
Total	**109**	**100.0**	

The average workday per week			
Days	**Frequency**	**Percent**	
1 - 2	2	1.8	
3 - 4	4	3.7	
5 - 6	94	86.2	
7	9	8.3	
Total	**109**	**100.0**	
The average hours worked per day			
Hours	**Frequency**	**Percent**	**Valid Percent**
1 - 3	3	2.8	2.8
4 - 6	11	10.1	10.2
7 - 9	86	78.9	79.6
> 9	8	7.3	7.4
Total	**108**	**99.1**	**100.0**

5.1.3. Public versus private sector

Twenty nine dentists worked in the public sector and 79.3% (n=23) in full time public sector practice. Ninety four dentists responded that they were in full time practice in the private sector (n=94) (Figure 6). There is no relationship between type of employment (private or public) and levels of pain (P- value=0.19).

Figure 6: Public and Private Practice



5.2. Medical History

Nearly two thirds of the dentists perceived that their health was good and had no medical conditions and 72.5% were not on any medication. Fifteen dentists were diabetic, five reported that they had arthritis, two reported carpal-tunnel syndrome and 18 were hypertensive.

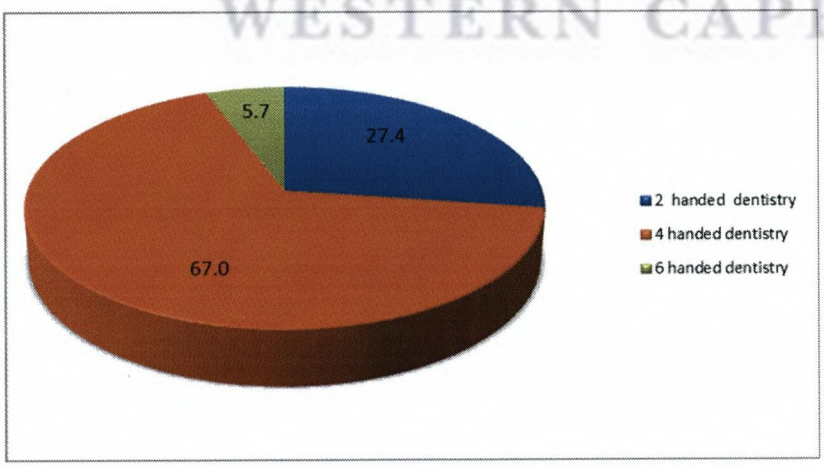
5.3. Work and Posture

Nearly one hundred dentists (90.8%) were right handed. Respondent's spent less than 45% of their total time on all five activities (Minor oral surgery, restorative dentistry, scaling and polishing, prosthetics and administration). The most common activities (30% or more) were for administration, prosthetics and scaling and polishing. More than half of the respondents (52.7%) spent more than 45% of their time on restorative dentistry. Approximately half of the respondents reported approximately 50% of their time standing.

5.3.1. Working with an assistant

Figure 7 depicts the percentage of dentists performing two, four or six handed dentistry, dentists that work with one dental assistant perform four – handed dentistry, and dentists that work with two assistants perform six –handed dentistry. Nearly 27% of dentists work with no dental assistant. Two-thirds (67%) of the respondents perform four - handed dentistry and less than 6% perform six -handed dentistry.

Figure 7: Working with a dental assistant

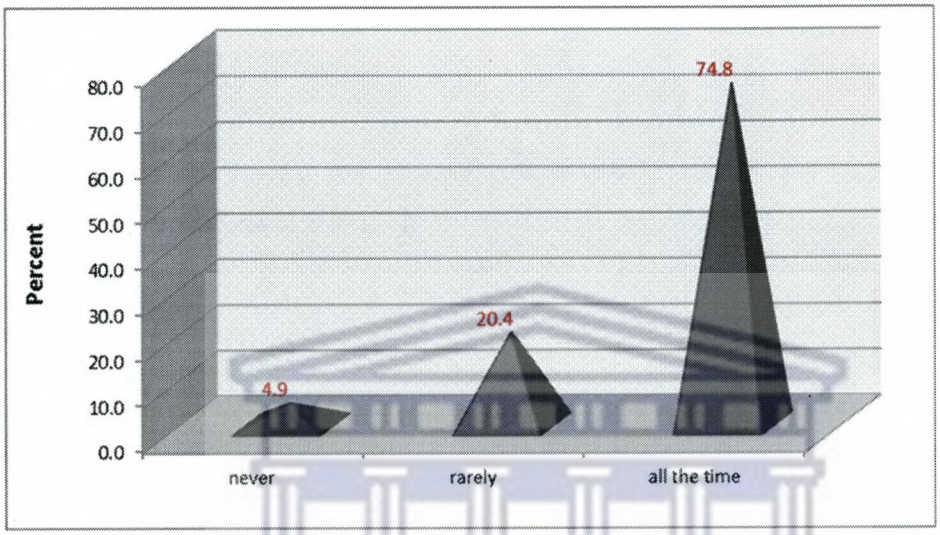


5.4. Work habits

5.4.1. The use of finger rest

Nearly three quarters (74.8%) indicated that they used a finger rest all of the time while doing restorative procedures and scaling and polishing (Figure 8).

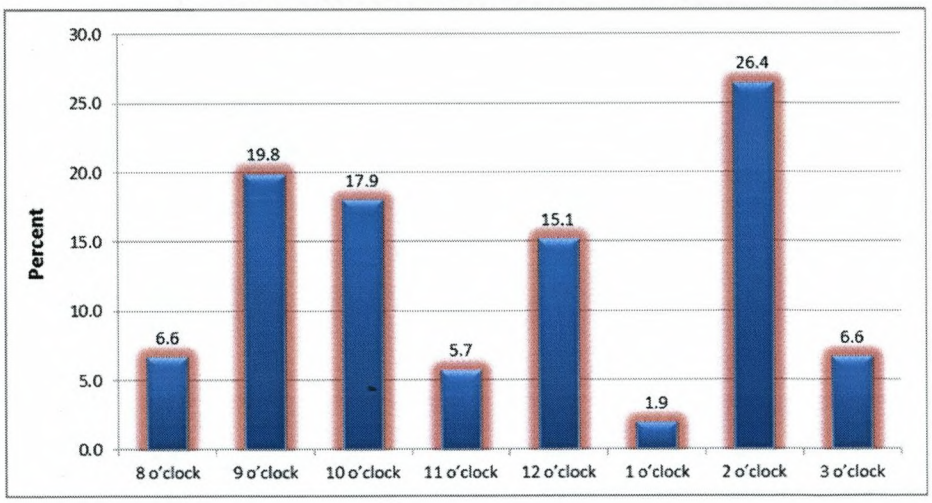
Figure 8: Finger rest



5.4.2. Working in different Clock Positions

The most common working position reported was the 2 'o clock position (26.4%). Most (58.5%) dentists used the 9 to 12 o'clock position (Figure 9).

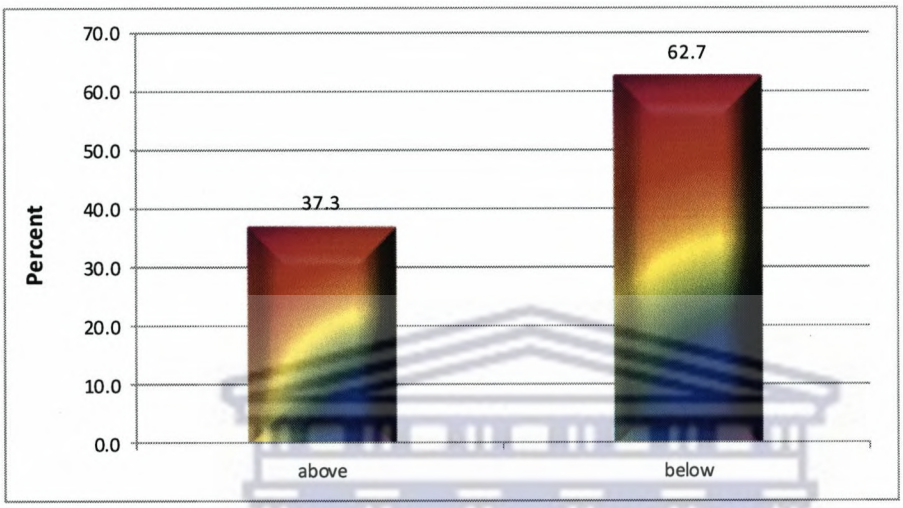
Figure 9: The Position respondents are most comfortable in when treating patients



5.4.3. Elbow Raising

Two thirds reported that they worked with their dominant hand below the work area and sixty four dentists reported that they worked with their dominant elbow below (Figure 10).

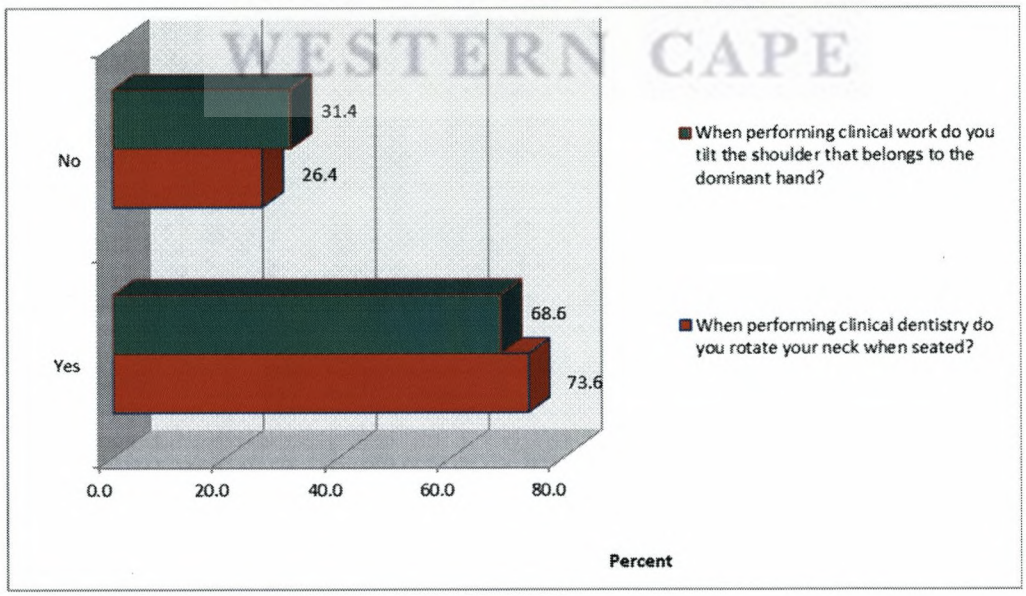
Figure 10: Elbow Raising



5.4.4. Shoulder tipping and neck rotation

Nearly three quarters of dentists rotated their necks while performing clinical dentistry. Only a third of the respondents tilted their shoulders towards their dominant hand (Figure 11).

Figure 11: Shoulder tipping and neck rotation



5.5. Prevalence of pain

Almost all the dentists reported pain in the neck (98.2%), lower back (99.1%) and shoulder (98.2%). Only 22.5% of dentists reported hand pain, 19.4% reported numbness in the hands and 24.4% a tingling sensation in the hands while performing clinical work (Table 4).

Table 4: Prevalence of Pain

	Prevalence of pain
Lower Back	99.1
Shoulder	98.2
Neck	98.2
Hands	22.5
Total Prevalence (dentist reporting pain in one or multiple sites)	99.1

5.5.1. Pain in the hands

The majority (78%) indicated that they had no negative effects when performing restorative work and scaling and polishing. However, a small number reported extreme levels of pain (Table 5). It is noted that the levels of the pain have increased slightly from work hours to at night for the categories of pain and numbness.

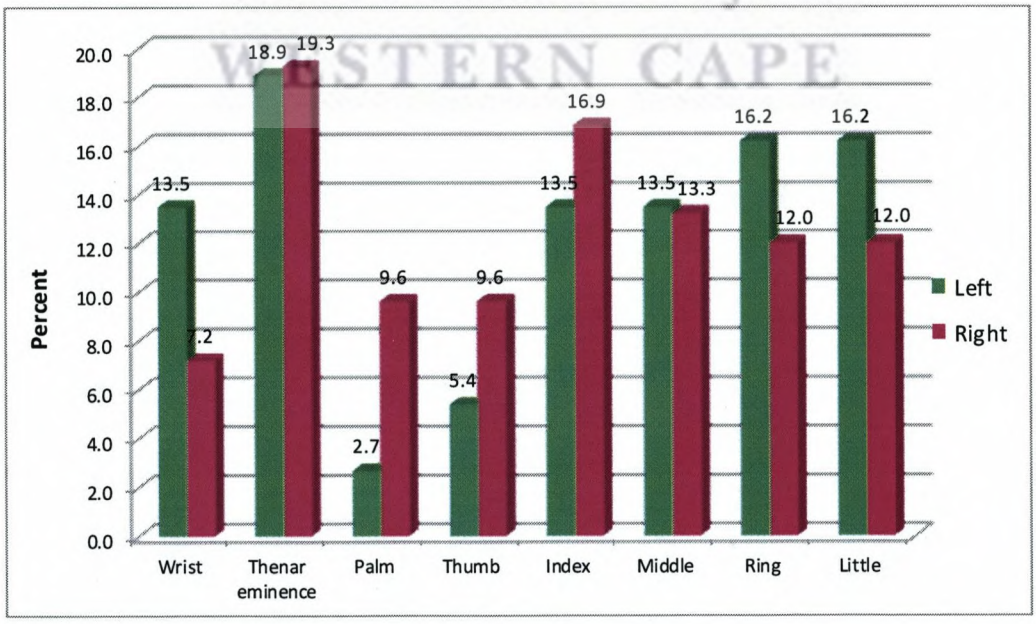
Table 5: Symptoms of the hand while working

Pain			
	Frequency	**Percent**	**Valid Percent**
No pain	76	69.7	77.6
Moderate pain	19	17.4	19.4
Extreme pain	3	2.8	3.1
Total	**98**	**89.9**	**100.0**
Numbness			

	Frequency	Percent	Valid Percent
No pain	79	72.5	80.6
Moderate pain	18	16.5	18.4
Extreme pain	1	0.9	1.0
Total	**98**	**89.9**	**100.0**
Tingling			
	Frequency	**Percent**	**Valid Percent**
No pain	74	67.9	75.5
Moderate pain	22	20.2	22.4
Extreme pain	2	1.8	2.0

If a respondent had hand pain they were asked to plot it on a hand chart. The thenar eminence was the most plotted site for pain (Figure 12). The thenar eminence is a muscle group located in the thumb as well as on the palm of the hand and it allows for different muscle movement of the thumb.

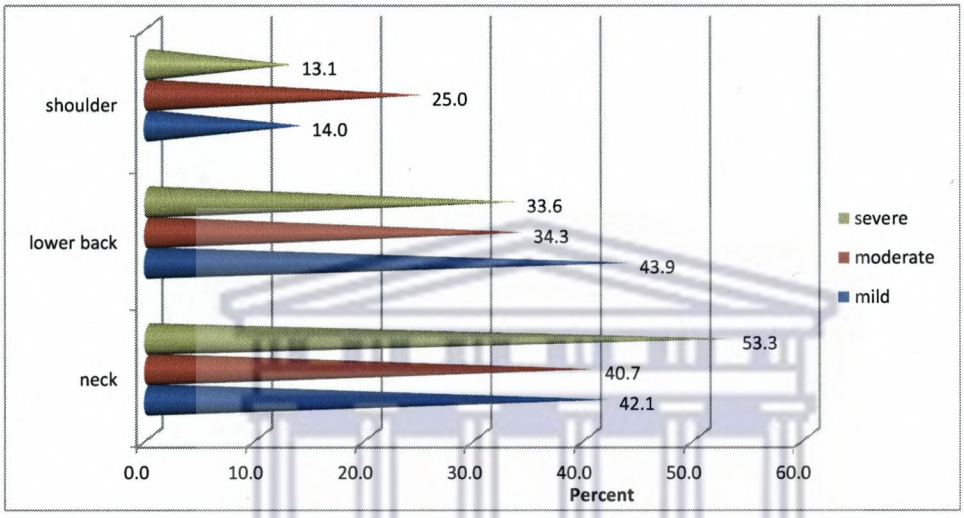
Figure 12: Pain as plotted on the hand chart



5.5.2. Pain in the neck, shoulder and lower back

More than half (53.3%) reported severe neck pain and 78.2% reported mild and moderate lower back pain. The ratings for shoulder pain were the lowest (Figure 13). The respondents were asked to plot pain on a body chart and the highest frequencies were for pain in the lower back and the base of the neck.

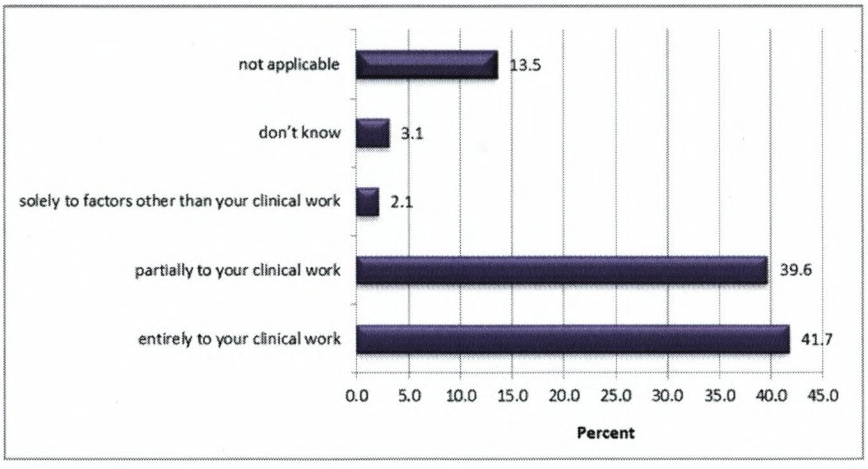
Figure 13: Pain in the neck, shoulder and lower back



5.6. Reasons for pain in the neck, shoulder and lower back

The perceived reason for pain is shown in Figure 10. More than 80% of the respondents identified clinical work (either partially or wholly) as being the major reason for the pain (Figure 14).

Figure 14: Reasons for pain



For those respondents that indicated that they had pain, they were asked to mark it on the body chart in order to identify the areas where pain was experienced. The highest frequencies were for the lower back (n=43) and the base of the neck (n=32). Fifty respondents (n=50) complained of shoulder symptoms (Table 6).

Table 6: Pain as plotted on body chart

	Count	Percent
Front right neck	10	9.17
Front left neck	12	11.01
Front right arm	5	4.59
Front left arm	4	3.67
Front right shoulder	8	7.34
Front left shoulder	6	5.50
Base of neck	32	29.36
Back right shoulder	21	19.27
Back left shoulder	15	13.76
Back right	12	11.01
Back left	6	5.50
Back lower (lumbar spine)	43	39.45
Right forearm	3	2.75
Left forearm	1	0.92

5.7. Absence from work

Despite pain due to neck, shoulder, hand or back pain in the last year 70.4% of dentists (n=76) did not miss work (Figure 15).

5.8. Exercise routine

Nearly a quarter of the sample (25.5%) did not exercise at all (Table 7). Of the dentists that exercised, nearly 50 % of them performed a high impact cardio routine, 9.2% yoga and relaxation exercises and 28.4% did stretching and toning exercises. There was a statistically significant relationship between pain while preforming clinical work and *frequency of exercise* (p-value 0.016). There was also a statistically significant relationship between severity of pain and *frequency of excercise* (p-value 0.05).

Figure 15: Absence from work

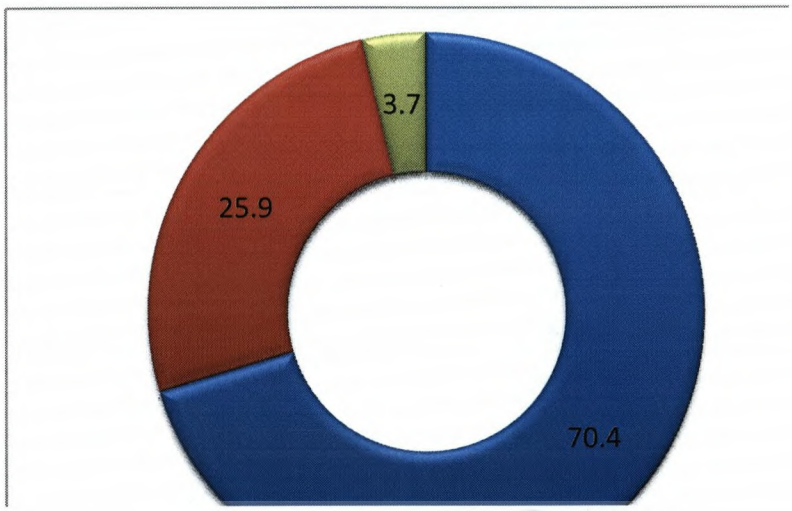


Table 7: Exercise routine per week

Are you involved in an exercise routine?			
	Frequency	Percent	Valid Percent
Never	27	24.8	25.5
Twice a week	38	34.9	35.8
3 to 5 times a week	32	29.4	30.2
>5 times a week	9	8.3	8.5
Total	106	97.2	100.0

5.9. Gender versus medication

Significantly more males than females were on medication (p-value= 0.010).

Table 9: medication versus gender

		Gender		Total
		Female	Male	
Are you on any medication?	Yes	3	27	30
	No	26	52	78
Total		29	79	108

5.10. Pain versus missing work

There was no significant relationship between absenteeism due to *pain in the neck* (p-value =0.099). However there was a statistically significant relationship between absenteeism and *pain in the lower back and shoulder* (p-value 0.003) (Table 8).

Table 8: Relationship between pain and missing work

		Have you missed work due to neck, back or hand problems in the last year?			Total
		Never	Rarely	Often	
When performing clinical work do you have pain in the neck?	Mild	34	9	1	44
		32.1%	8.5%	0.9%	41.5%
	Moderate	34	11	2	47
		32.1%	10.4%	1.9%	44.3%
	Severe	6	8	1	15
		5.7%	7.5%	0.9%	14.2%
Total		74	28	4	106
		69.8%	26.4%	3.8%	100.0%

5.11. Neck rotation versus pain in the neck

There was no statistically significant relationship between neck rotation and pain in the neck while performing clinical work (p- value=0.16) (Table 10). There was a strong association between pain in the neck while performing clinical work and the number of years in practice (p-value=0).

5.12. Pain in the lower back versus number of years in practice

There was no relationship between pain in the lower back and the number of years in practice (p-value= 0.36) (Table 11).

Table 10: Relationship between neck rotation and pain in the neck

		When performing clinical dentistry do you rotate your neck when seated?		Total
		Yes	No	
When performing clinical work do you have pain in the neck?	Mild	26	18	44
	Moderate	40	7	47
	Severe	12	3	15
Total		78	28	106

Table 11: Relationship between pain in the lower back versus number of years in practice

			Number of years in practice					Total
			0 - 5	6 - 10	11 - 15	16 - 20	> 21	
When performing clinical work do you have pain in the lower back?	Mild	Count	7	2	8	9	18	44
		% of Total	6.5%	1.9%	7.4%	8.3%	16.7%	40.7%
	Moderate	Count	9	8	6	3	11	37
		% of Total	8.3%	7.4%	5.6%	2.8%	10.2%	34.3%
	Severe	Count	4	9	4	4	6	27
		% of Total	3.7%	8.3%	3.7%	3.7%	5.6%	25.0%
Total		Count	20	19	18	16	35	108
		% of Total	18.5%	17.6%	16.7%	14.8%	32.4%	100.0%

5.13. BMI versus standing or sitting and BMI versus Back pain

There was no relationship between BMI and whether respondents sat (p=0.909) or stood (p=0.808) and not between pain in the lower back and BMI (p-value=0.75).

In summary the results show that the prevalence of MSD among this cohort is very high especially back, neck and shoulder pain. The majority of the dentists identified clinical work as the major factor causing pain.

CHAPTER 6: DISCUSSION

6.1. Introduction

This chapter discusses the findings of the present study whose aim was to assess the prevalence of musculo-skeletal disorders among dentists in Kwazulu-Natal. In this chapter, an overview of the main themes arising from this study will be presented and compared with other relevant studies from the literature review.

The majority of the respondents were male and the ratio of females to males was 1:3. Studies by Polat et al. (2007) and Szymanska (2002) reported much higher numbers of female dentists. A third of the respondents were aged between 30-39 years, and this was in line with the Malaysian study conducted by Samat et al. (2011) in which there was no association between age and pain, unlike Leggat et al. (2007) who reported age as a significant factor with the younger Australian dentists more prone to back pain. In addition, there was no difference in the reporting of pain symptoms between dentists in the public and private sector.

In this study just over a third of the respondents were overweight and 16.7% were obese. However, similar to the findings of Samat et al. (2011) and Al Wassan et al. (2001), BMI was not found to be a significant factor in the present study. Although there was no correlation between BMI and MSD in this study, BMI should not be ignored as a risk factor for MSD.

The majority of respondents in this study work a 5-6 day week and work 7-9 hours per day. Most had over 5 years of experience and reported good health with no medical conditions. Fifteen dentists were diabetic, five reported that they had arthritis, two reported carpal-tunnel syndrome and 18 were hypertensive. Despite the fact that nearly all said that they had pain, only eight percent were on pain medication. It needs to be established how these dentists are coping with pain.

The respondents spend less than half of their total time on the majority of five activities: minor oral surgery, restorative dentistry, scaling and polishing, prosthetics and administration. The ideal workday should be divided between all categories of dentistry. If one performs clinical work in a seated position for a long time it impacts on the muscles of the lower back especially if these muscles are not unsupported. This is aggravated if the dentist works with the neck in the forward position. This results in neck and shoulder pain.

Dentists in this study have a high prevalence of neck and back pain and this could be due to the high levels of neck rotation discovered in this study.

Dentists in KZN spent approximately half their working time in the standing position. This was slightly higher than that reported by Symanska, (2002) and much less than Marklin and Cherney (2005) who reported that dentists in their study spent 78% of their time standing. Standing was the preferred practice position (only 11.7% used the sitting position while working) reported by dentists in the Polat et al. (2007) study. Dentists should adopt various positions while at work and alternating between standing and sitting is ideal. When one alternates between standing and sitting a different set of muscles is used allowing the other set of muscles to relax. Furthermore, Moradia and Patel (2011) also reported that sitting or standing for a long time was the factor that most aggravated the pain. Prolonged standing also puts the dentist at risk to varicose veins and haemorrhoids (Leggat at al. 2007). Static postures for a long time cause fatigue and a decrease in microcirculation, increase in pressure and insufficient removal of lactic acid and thereby result in pain.

In the present study, just over two thirds of the dentists performed four-handed dentistry lower than the nearly ninety percent reported by Rucker and Sunell (2002) and the 100% reported by Polat et al. (2007), but similar to the Szymanska (2002) in which just over a third worked without a dental assistant. The use of four and six handed dentistry is a big advantage as it allows the dentist to save time, resting the back, back muscles and lower extremities. From an ergonomic point of view the use of six handed dentistry is the ideal and in this study less than six percent performed six handed dentistry. To decrease the prevalence of pain, dentists in KZN should look at working with two assistants. However Kumar et al. (2005) reported that dentists working with assistants reported a higher prevalence of hip and thigh symptoms and it has been recommended that while working with an assistant, it is advisable to alternate between standing and sitting.

Nearly three quarters of dentists in this study indicated that they used a finger rest all of the time while doing restorative procedures and scaling and polishing. The use of hand and finger rests balances the fatigue of the forearms during the use of fine motor applications for intricate intra-oral treatment. Therefore the use of finger rests and hand rests prevents shoulder and hand injuries

The most common work position was the 2 o' clock position in this study. Most dentists used the 9 to 12 o'clock positions in this study which was similar to the findings of Chaikumarin,

(2005) who found that 80% of the dentists preferred the 10 o'clock position. There is an increase in MSD with the use of the 7 to 8.30 position and 3.30 to 5.30 positions. This is due to the difficult postures the dentists have to adopt in these clock positions. These poor postures include neck rotation, torso twisting and elbow raising and increases the probabilities of MSD.

In this study two thirds of dentists reported that they worked with their dominant hand below the work area, while Rucker and Sunell (2002) found that 66% raised their dominant elbow while working (Rucker and Sunell, 2002). Elbow raising increases the risk of MSDs in various parts of the body. Dentists who raise elbows while working have a 50% chance of experiencing hand, neck, shoulder and upper back pain.

Shoulder tipping is associated with hand pain and neck rotation is associated with neck pain. Nearly three quarters of dentists in this study rotated their necks while performing clinical dentistry which predisposes them to neck pain. Only a third of the respondents tilted their shoulders towards their dominant hand which predisposes them to hand pain. The neck rotation occurrence is high in this study when compared to other studies in the literature and this is a possible explanation for the high prevalence of neck pain.

The prevalence of pain in the neck, lower back and shoulder is very high among the dentists in KZN (99.1%). Almost all the dentists reported pain in the neck, lower back and shoulder in the mild, moderate and severe categories. Just less than a quarter reported hand pain, numbness and a tingling sensation in the hands while performing clinical work. Lin et al. (2012) also reported a high prevalence (92.3%) of pain among Taiwanese dentists, as did Leggat and Smith (2006) among Australian dentists and Polat et al. (2007) who reported that 94% percent of dentists reported at least one MSD. A nearly eighty percent pain prevalence was reported by Harutunian et al. (2011). In the Greek study 62% of dentists reported at least one musculoskeletal complaint (Alexopoulos et al, 2004).

Symptoms of pain, numbness and tingling were found to be more intense at night than while performing restorative procedures and scaling and polishing. Similar results were reported by Alexopoulos et al. (2004); Elappen et al. (2011) and Harutunian et al. (2011), but were not as high in the Taiwanese study by Lin et al, 2012 who reported a 41% prevalence of hand symptoms.

Nearly all the dentists in this study reported that they had pain in either the neck, back or shoulder. Ellapen et al. (2011) in a study in Durban and the surrounding areas reported that the frequency of back pain was 49.32 percent and 16.6 percent in the shoulders, much lower than that reported by Lin et al. (2012) (66.5% back pain and 75.1 % shoulder pain) and by Shrestha et al. (2008) (79% back pain and 47% shoulder pain). Moradia and Patel (2011), Shrestha et al. (2008), Leggat and Smith (2006) and Alexopoulos et al. (2004) also reported that the highest prevalence for pain was the back, neck and shoulder. Moradia and Patel (2011) reported that 96% of the cohort reported that the pain started when they started dentistry and that the pain was triggered or aggravated by prolonged sitting. Samat et al. (2011) however reported that back pain was the least prevalent among dentists when compared to dental nurses and technicians, and speculated that since dentists were trained for a longer time they were more aware of ergonomic practices.

In a systematic review conducted by Hayes et al. (2009), the overall MSDs recorded in studies ranged between 64-93%. Back and neck were the most prevalent regions for pain among dentists. The prevalence for back pain was 36.3% - 60.1% and neck pain between 19.8% and 85%. Szymanska (2002), reported 60.1% of the respondents in the study conducted, experienced pain in the back (thoracic – lumbar region) and 56.3% reported neck pain (Szymanska, 2002). Al Wassan (2001) reported a 74 percent frequency of back pain. The prevalence of neck, shoulder and back pain in KZN (99.1%) is very high when compared to most other countries.

More than 80% of the present respondents identified clinical work as being the major reason for the pain. This figure is very high when compared with the findings of Rucker and Sunell (2002) where only one in three dentists attributed pain to their clinical work (Rucker and Sunell, 2002). Hayes et al. (2009) and Leggat et al. (2007) recognised that MSDs contributed to increased sick leave, reduced productivity and early retirement from the profession. However, the literature in this regard is conflicting. Shrestha et al. (2008) found no relationship between absenteeism and pain. Rucker and Sunell (2002) reported that nearly 60% of dentists experienced work loss due to MSD and 13% reduced the number of working days per week. Harutunian et al. (2011) reported that only 15 percent of dentists applied for sick leave due to pain and chronic pain was the cause of absenteeism and seeking medical care (Alexopoulos, 2004). In the present study, despite having neck, shoulder, hand or back pain in the last year, nearly seventy percent did not miss work.

Less than 5% reported being absent from work often due to severe pain. The reason for this could be that dentists in the private sector have to continue to work for economic reasons.

Nearly a quarter of the present sample was not involved in an exercise routine at all, however, there was no significant relationship between exercise and pain. Harutunian et al. (2011) reported that aerobic activity improves pain, assists in weight loss and strengthens the torso. Stretching of muscles also assists in relieving back pain. Moradia and Patel (2011) also reported that muscle relaxing exercises and rest helped to ease the pain. Hayes et al. (2009) reported that lack of exercise was strongly associated with back pain. Szymanska (2002) found no significant relationship between physical activity and pain.

In the present study there was no significant relationship between absenteeism due to pain in the neck. However there was a significant relationship between absenteeism and pain in the lower back and shoulder (*p-value*=0.003). There were significantly more females on pain medication than males (*p-value*=0.01).

Marklin and Cherney (2005) reported that dentists spent nearly half the working time with their necks flexed and a reduction in neck and trunk rotation would improve the occupational health of dentists. In the present study, there was a significant relationship between neck rotation and pain in the neck while performing clinical work (*p-value*=0.16) and a strong association between pain in the neck and neck rotation. Furthermore, there was a very strong association between pain in the neck while doing clinical work and the number of years in practice (*p-value*=0.00).

There was no relationship between BMI and whether respondents sat or stood while treating patients nor between pain in the lower back and BMI (p-value=0.75). Similar results were found in the Malaysian study conducted by Samat et al. (2011). Although there was no significant relationship between pain and the BMI, weight maintenance is critical in the overall health of a dentist, as an increase in weight increases the load on the back muscles, and may subsequently cause pain.

Limitations of study

The reliance on self-reported data is an obvious limitation.

Dentists could have over or under reported data about pain.

The study might have been strengthened by including the actual observation of dentists at work.

This study included only dentists. It may have been better to include dentists, dental therapists, oral hygienists and dental nurses so that a comparative analysis could be done.

CHAPTER 7: RECOMMENDATIONS AND CONCLUSIONS

This study has highlighted the need for the prevention and reduction of MSDs among the dental profession in Kwazulu-Natal. To promote awareness of preventive procedures; the following recommendations are suggested:

Exercise

It is recommended that dentists should be involved in a proper exercise routine which should include stretching, strengthening and weight training to reduce the risk of injuries. Muscles that are strong allow the body to handle better loads and work efficiently. It also assists with weight loss, decreasing the abdominal girth and reduces back pain. It is also recommended that breathing exercises are done during the day and between appointments. This assists the operator to relax and de-stress. Regular breaks should be taken to perform stretching exercises between patients. Planned procedures should alternate between standing and sitting and this will allow the different sets of muscles to work and relax. Appointments should be scheduled to avoid repetition of work. If this cannot be avoided, a six minute break should be scheduled after working for one hour.

Operator position

A dentist should alternate between standing and sitting. It is critical that the operator maintains variation in work posture. Proper patient, operator and dental assistant position allow for efficiency in work and reduce muscle injury. The patient should not be positioned too high as this leads to tension in the neck and shoulders of the operator. Tandon et al. (2010) recommends that there needs to be constant changes in the dentists foot positions. This allows for overworked tissues to get replenished with nutrients thereby preventing injuries.

The ideal position for a dental operator is to follow the Proprioceptive derivation concept illustrated in figure 4. The operator should be in an upright position, hands at heart level and should be able to reach instruments with ease. The patient should be horizontal and once the operator has attained his or her position the patient's position must support the operators' attained position (Chaikumarin, 2005)

The use of a proper chair with 5 castor wheels and proper back rest is required. The surgery design should conform to ergonomic principles. The chair must have proper lumbar support. The castor wheels must move freely or the operator will present with neck and back symptoms (Booyens et al. 2009). The chair should be a saddle style operator chair which promotes the lower back curve and increases the hip angle (Valachi and Valachi, 2003).

Checklist for newly qualified dentists that are setting up practice

Younger dentists with less experience are more prone to MSD of the neck, back and shoulders (Leggat and Smith, 2006). There is a need for a proper checklist for newly qualified dentists to use when setting up a new practice. This will assist new dentists to set up ergonomic practice and thereby reduce the prevalence of MSD. A checklist should include the type of chair, the types of instruments required, the dental surgery design and lighting required.

Instruments & instrumentation

The advice from the literature regarding instruments is: Dental instrument weight and diameter plays an important part in the pinch grip and the hand muscle load. The ideal would be a light weight instrument and a handle diameter of 10mm. The weight and size of instruments should be looked at before ordering. One should not order instruments with a narrow pinch grip because it increases the risk of hand pain. The instruments should have handles with grooves and should be textured for the reason that they are easier to grip and requires less force. The working edges of instruments must be sharp in order to decrease stress and increase efficiency of work. When the edge is dulled the operator needs to add additional forces which create increase tension in the fingers. Hand pieces should be as light as possible and balanced. Hose length must be short; if too long it would add weight and cause tension on muscles. Retractable or coiled hose should be avoided because the tension in the hose is transferred to the wrist and arm (ADA, 2004).

Position of instruments

The literature supports the fact that instrument delivery is critical in the prevention of MSDs. When designing a surgery the rear delivery system should be avoided. This is the cause of detrimental trunk twisting and a hazardous shift in vision when instruments are required. The side delivery also requires moderate twisting. The best delivery system is the front delivery which allows for easy reach of instruments without repeated trunk twisting.

Training of dentists

Although not looked at in this study, ergonomic work practices should be included in the training of dentists and it should be reinforced in the clinical training. Too often operator positions are ignored by clinical supervisors and the problem continues in professional practice. Thornton et al. (2004) recommended that while biomechanical principles are taught in dental schools they must be reinforced by implementing an ergonomic awareness program, the student will then became a more ergonomically aware clinician.

Surgical magnification

Many researchers recommend that the use of surgical magnification could be associated with a decreased risk in MSD (Rucker and Sunell, 2002; Yamalik, 2007). The use of magnification reduces fatigue, decreases neck flexion and increases productivity.

Continuous education courses

There is a need for ergonomic practice courses to be included in continuous education courses. It is important for the dentist to understand that the work environment should be adapted to his or her needs and not the other way around.

Self-recognition

Dentists should not ignore pain as they may require medical intervention, ergonomic changes in the practice, lifestyle chances, reduction of stress and involvement in an exercise routine. Dentists are responsible for their own muscular skeletal health and the health of staff. Ignorance of pain in the early stages and ignoring risk factors predisposes them to more severe pain. Early intervention leads to lesser cost and inconvenience.

Concluding remarks

MSD is a major occupational health problem among dentists in KZN. Ergonomic work practice should be included in the training of dentists; it should be reinforced in the clinical training and should be included in CPD activities. Dentist working conditions need to be improved and there is a need for a preventive program to reduce the risks of MSD. The profession should make dentistry a safer, healthy career and prevent MSD.

From this study it can be deduced that there is a need for dentists in KZN to increase their knowledge of ergonomics and improve how they are practicing dentistry. There is a need for

further prevalence studies in South Africa to establish the prevalence of MSDs in other provinces. Similar studies should be conducted among dental therapists, oral hygienists, dental assistants and dental technicians. Further studies should be conducted in creating ergonomically correct dental procedures and ergonomic dental units. There is a need for research in mental stress in both male and female dentists and how this impact on MSDs. Studies in clinical training in dental schools in South Africa should be conducted to improve teaching and clinical supervision so that MSDs can be prevented.

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APPENDIX 1: ETHICAL APPROVAL

Office of the Deputy Dean
Postgraduate Studies and Research
Faculty of Dentistry & WHO Collaborating Centre for Oral Health

UNIVERSITY OF THE WESTERN CAPE
Private Bag X1, Tygerberg 7505
Cape Town
SOUTH AFRICA

Date: 10th June 2011

For Attention: Ms R Moodley
Department of Restorative Dentistry

Dear Ms Moodley

STUDY PROJECT: The prevalence of musculoskeletal disorders among dentists in Kwazulu-Natal

PROJECT REGISTRATION NUMBER: 11/4/28

ETHICS: Approved

At a meeting of the Senate Research Committee held on Friday 6th May 2011 the above project was approved. This project is therefore now registered and you can proceed with the work. Please quote the above-mentioned project title and registration number in all further correspondence. Please carefully read the Standards and Guidance for Researchers below before carrying out your study.

Patients participating in a research project at the Tygerberg and Mitchells Plain Oral Health Centres will not be treated free of charge as the Provincial Administration of the Western Cape does not support research financially.

Due to the heavy workload auxiliary staff of the Oral Health Centres cannot offer assistance with research projects.

Yours sincerely

Professor SudeshniNaidoo

APPENDIX 2: INFORMATION SHEET FOR PARTICIPANTS

Study Title

The prevalence of musculoskeletal disorders among dentists in KwaZulu - Natal.

Overview

I, Ms Rajeshree Moodley, am a Dental Therapist working at the School of Dentistry UKZN. I am a registered Masters student in the Department of Community Dentistry at the University of Western Cape.

I would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and why it should involve you. Please take time to read the following information carefully. Ask questions if anything you read is not clear or would like more information. Take time to decide whether or not you would like to participate.

Musculoskeletal Disorders (MSD) is a work related health issue. This is due to the stressful work environment and ergonomics of the dental practice. When compared to other health workers, dental health workers have been known to report the highest number of MSD. Dentists work under both mental stress and a great deal of physical demand and this adds to the occurrence of MSD.

Purpose of the study

The prevalence of MSD among dentists in Kwa-Zulu Natal is not known. MSD have various implications on the employment and lifestyle of dentists. In this regard, we would like to undertake a study to establish the prevalence of MSD, to describe the signs and symptoms and to establish the impact that MSD has on the profession. This study is an important one and will be of great value to the dental profession.

In order to be able to carry out this study and to obtain information regarding MSD, I need to ask you a few questions. This will take about 15 minutes of your time. There are no risks

involved in participating in this study and it is entirely voluntary. If you do not want to take part, you can withdraw from the study at any time without it being held against you. All information gathered in the study will be treated as strictly confidential. No one will have access to this information except me, the principal investigator. No names will be used in the reports of this study. All information collected will be maintained and stored in such a way as to keep it as confidential as possible.

The researcher intends completing the study in 2 years. This study is purely questionnaire based and there is no need to revisit or to have any clinical test done. If the researcher withdraws from the study, all records will be destroyed.

If you have any questions or queries regarding the proposed study please do not hesitate to contact me, Ms Rajeshree Moodley on telephone: 0312426415(work) and 0844132600(Mobile). My email address is moodleyra@ukzn.ac.za.
Should you have any comments or complaints you can contact my supervisor Professor S. Naidoo at the University of Western Cape.

The intention of the researcher is to publish the findings in an accredited journal but under no circumstance will any information about a single participant be published. The results will also be presented at a Local SADA congress.

Thanking you in advance for your co-operation.

Yours sincerely

Rajeshree Moodley

Appendix 3: Informed consent form

Informed Consent Form

Title of Project: The prevalence of musculoskeletal disorders among dentists in Kwa-Zulu Natal.

REC Ref No: 11/4/28

Name of Researcher: MsRajeshree Moodley

➢ I confirm that I have read and understood the information sheet for the above study (version x- date) and what my contribution will be	**Yes**	**No**
➢ I have been given the opportunity to ask questions (face to face,via telephone and e-mail)	**Yes**	**No**
➢ I agree to take part in the interview	**Yes**	**No** **NA**
➢ I understand that my participation is voluntary and that I can withdraw from the research at any time **without giving any reason**	**Yes**	**No**
➢ **I agree to take part in the above study**	**Yes**	**No**

Name of participant .....

Signature .....

Date .....

Name of researcher taking consent - Rajeshree Moodley

Researcher's e-mail address - moodleyra@ukzn.ac.za

APPENDIX 4: QUESTIONNAIRE

Record no	

Demographic Details

Indicate your answer with an X

1. Gender

female		male	

2. Age

20 - 29	30 - 39	40 - 49	50 - 59	Over 60

3. Height

4. Weight

5. Are you practicing as a :

dentist		specialist		entrepreneur		academia		other	

6. In which suburb do you practice?

7. Do you practice in the public or the private sector?

public				private			
full Time		part time		full Time		part time	

8. Please indicate the no. of years you are in practice.

0-5 years		6-10 years		11 -15 years		16-20 years		more than 21 years	

9. Please indicate your average workday per week

1 to 2 days		3 to 4 days		5 to 6 days		7 days	

10. Please indicate your average workday hours

1to3 hours		4 to 6 hours		7 to 9 hours		10 hours and over	

Medical history

11. Please can you indicate your medical history

clear		hypertension	
diabetes		cardiac conditions	
arthritis		thoracic-outlet syndrome	
auto-immune diseases		any disabilities	If so what?
carpal-tunnel syndrome		other	If so what?
previous history of Surgical procedures			

12. Are you on any medication?

yes	no

13. Please indicate the medication that you are taking and how long you are on the current medication:

_____

_____

_____

_____

_____

Work and Posture

14. What percentage of time in your work day (in an average week) do you spend on the following procedures and activities?

minor oral surgery	
restorative dentistry	
scaling and Polishing	
prosthetics	
administration	
	100 %

15. What percentage of your time in your work day do you spend sitting or standing?

sitting	
standing	

16. Is your right or left hand dominant at work?

right hand		left hand		both the same	

17. When performing your duties as a dentist do you practice 2, 4, 6 handed dentistry

2 handed dentistry		4 handed dentistry		6 handed dentistry	

18. When treating patients in which position are you most comfortable :

8 o'clock		9 o'clock		10 o'clock		11 o'clock	
12 o'clock		1 o'clock		2o'clock		3 o'clock	

19. During restorative procedures or scaling and polishing, do you use a finger rest?

never		rarely		all the time	

20. During restorative procedures or scaling and polishing, is your dominant elbow above or below the working area?

above		below	

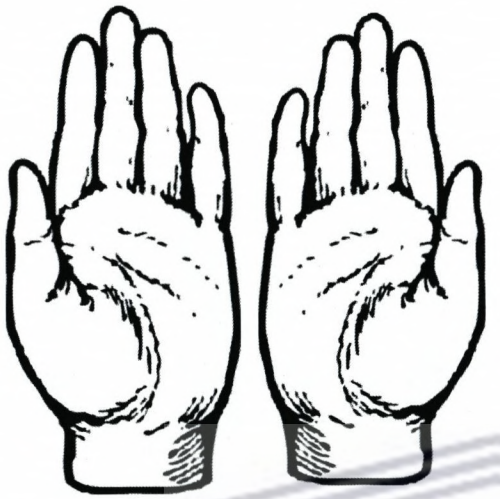
21. During restorative procedures or scaling and polishing do you have pain, numbness or tingling in any of your fingers?

	no	moderate	extreme
Pain			
Numbness			
Tingling			

22. At night do you have pain, numbness or tingling in any of your fingers?

	No	moderate	extreme
Pain			
Numbness			
Tingling			

23. If your answer is yes for question 21 and 22 indicate with an X the areas where you are having pain

left  right

24. When performing clinical dentistry do you rotate your neck when seated?

yes		no	

25. When performing clinical work do you tilt the shoulder that belongs to the dominant hand?

yes		no	

26. When performing clinical work do you have pain in the neck?

no		mild pain		moderate pain		severe pain	

27. When performing clinical work do you have pain in the lower back?

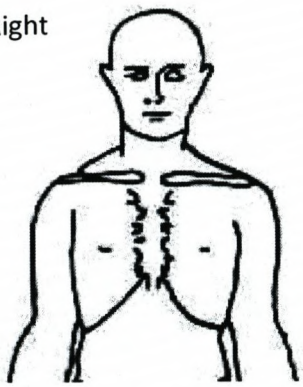
no		mild pain		moderate pain		severe pain	

28. When performing clinical work do you have pain in the shoulder?

no		mild pain		moderate pain		severe pain	

29. If your answer is yes to 26, 27 or 28, mark with an X on the body chart below the area where pain is experienced.

Right



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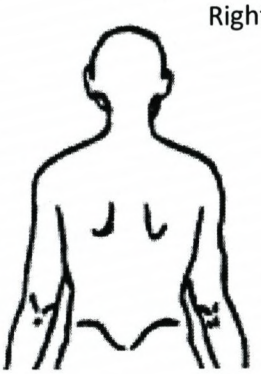

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30. Do you attribute the pain you experience:

entirely to your clinical work	partially to your clinical work	solely to factors other than your clinical work	don't know	not applicable

31. Have you missed work due to neck, back or hand problems in the last year?

never		rarely		often		very often	

32. Are you involved in an exercise routine?

never		twice a week		3 to 5 times a week		more than 5 times a week	

33. What type of routine do you follow?

none		cardio		yoga and relaxation		stretching and toning		other	If so what?

Thank you for your time in completing this questionnaire. It is much appreciated.