Work Related Musculoskeletal Disorders among Osteopaths practicing in New Zealand: A National Survey

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ABSTRACT

Work Related Musculoskeletal Disorders (WRMSDs) have been shown to reduce job satisfaction, clinical efficacy, and personal safety in a variety of healthcare settings (e.g. physiotherapy, nursing, chiropractic). The purpose of the present study was to determine the prevalence of such disorders in a NZ Osteopathic context. This study surveyed 80 members of the Osteopathic Society of New Zealand. Analysis of data indicated a 97.3% WRMSD prevalence rate. Respondents most commonly suffered WRMSDs in the wrist/hands, head/neck, and upper back/thorax. The factors most respondents identified as contributing to their WRMSDs illustrate an association between the way respondents run their practice and their musculoskeletal health. These factors were performing the same task repetitively, treating a large number of patients in a single day, continuing to work when injured, and performing manual osteopathic techniques. The preferred technique modalities identified by respondents were soft tissue, OCF, and articulation. There was a positive effect between preferred techniques and the occurrence of WRMSDs (OR = 1.96, 95% CI = 0.30 to 12.70; RR = 1.05). The results of this study indicate many similarities in WRMSDs between the osteopathic profession and other manual health care professionals. Particular points of interest were the relatively high prevalence rate of WRMSDs and the relatively strong association between preferred practicing techniques and WRMSDs.

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

Work Related Musculoskeletal Disorders (WRMSDs) may reduce job satisfaction, clinical efficacy, and personal safety in the work place (2003). WRMSDs are of concern in all occupations but perhaps more so when the occupation requires medium to heavy lifting and holding awkward positions for prolonged periods of time. For an osteopath, lifting limbs and holding awkward positions are almost daily activities.

Currently there is considerable interest among health professionals and members of the public in New Zealand about the prevention and management of Occupational Overuse Syndrome (OOS). There were an estimated 3,200 files requested per month registered on Accident Compensation Corporation's (ACC) OOS website during 2004 (Boocock et al., 2005). WRMSDs are different from OOS and Repetitive Stress Injury (RSI). Both OOS and RSI fall under the umbrella of the term WRMSD, while at the same time are their own conditions. Many authors recognize this complex relationship of work-related diseases (Bernard, 1997; Buckle & Devereux, 2002). Defining WRMSDs is an ongoing process; currently each country uses its own definition (Boocock et al., 2005). This can cause difficulties for researchers. In this project a WRMSD is an injury that has meaningful causative risk factors within the workplace.

The development and implications of WRMSDs have been widely investigated internationally across numerous professions(Anderson et al., 2002; Aptel, Aublet-Cuvelier, & Cnockaert, 2002; Ariens, Mechelen, Bongers, Bouter, & Wal, 2000; Bork et al., 1996; Caragianis, 2002; Cromie, Robertson, & Best, 2000; Frost & Andersen, 1999; Hakkanen, Viikari-Juntura, & Martikainen, 2001; Kroemer, 1989; Peat, 2004; Roquelaure et al., 2000; Stock, 1991; West & Gardener, 2001). However, the development of WRMSDs among osteopaths in New Zealand has been minimally investigated. Peat (2004) investigated WRMSDs focussing on structural osteopathy. The author did not distinguish between osteopaths who do not use structural methods or use the concept of preferred techniques. Preferred techniques have not been associated with the development of WRMSDs in searches of international literature. Current literature also has not made a comparison of risk factors between the different techniques available to osteopaths. This project aims to investigate the difference in prevalence and impact of WRMSDs for different osteopathic techniques particularly, examining preferred techniques as a risk factor. The influence of techniques on WRMSDs, especially preferred techniques, is an area that has not received much attention. By identifying those at risk, the creation of protocols aimed at injury-prevention becomes possible.

This project is a study into an important aspect of WRMSD in New Zealand; namely the relationship between osteopaths and WRMSDs. Of particular interest is how an osteopath's choice of treatment affects their predispositions to a WRMSD. As the influence of technique choice on WRMSDs among

osteopaths has not been investigated this is a pilot study, testing the feasibility of more research in this area. This project made use of a self-administered electronic questionnaire to determine the prevalence, perceived risk factors, and consequences of WRMSDs from registered osteopaths within New Zealand.

1.1 Research Question

What is the association between preferred techniques and WRMSDs among New Zealand osteopaths?

1.2 Project Objectives

The objectives of this study are threefold; firstly, to determine the extent of WRMSDs, secondly, to determine risk factors for the occurrence of WRMSDs, within the New Zealand osteopathic profession, and thirdly, to establish any associations between preferred techniques and WRMSDs.

CHAPTER 2 LITERATURE REVIEW

Osteopaths expose themselves to biomechanical risk factors that can lead to the development of WRMSDs (Barr & Barbe, 2002; Peat, 2004; Szabo & King, 2000). Within the scope of osteopathy there are a range of techniques that can be applied, each with their own biomechanical risk factors. In order to better understand why WRMSDs occur among osteopaths it is necessary to understand an osteopath's preference and selection of different techniques. What follows is a narrative literature review; it begins with a general review of WRMSDs, the clinical course, pathophysiology, consequences and research performed in New Zealand. Biomechanical risk factors are then presented, focusing on the upper limbs and finally a review of biomechanical risk factors inherent within osteopathy.

2.1 Work Related Musculoskeletal Disorders

WRMSDs is an umbrella term for which repetitive strain injury, repetitive trauma disorder and cumulative trauma disorder are all used interchangeably (Szabo & King, 2000). Each of these terms is used to describe a number of ailments that can be categorised into seven broad sub-groups. These are tendon related disorders, peripheral nerve entrapment, neurovascular/vascular disorders, muscular disorders, joint and joint capsule disorders, spinal disorders and other (including clinically unreproducible aches and pains) (Yassi, 1997). The American Occupational Safety and Health

Administration has more specifically defined WRMSDs as “disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, blood vessels or spinal disks in the neck, back, shoulder, elbow, forearm, wrist, hand, abdomen (hernia only), knee, ankle, and foot associated with exposure to risk factors” (Barr & Barbe, 2002). These can result in pain and functional impairment of the affected anatomical region. People are predisposed to WRMSD development as a result of exposure to risk factors within their work environment. These risk factors include biomechanical factors such as repetition, poor work technique, poor posture and inexperience regarding the required work techniques (Aptel, Aublet-Cuvelier, & Cnockaert, 2002; Cromie, Robertson, & Best, 2000; Li & Buckle, 1999; MacFarlane, Hunt, & Silman, 2000; Yassi, 1997).

Failure of the body to effectively dissipate mechanical force will cause WRMSDs to occur. Usually fatigue and poor work technique amplify the risk of WRMSD development, resulting in tissue failure (Bork et al., 1996; Cromie, Robertson, & Best, 2000). When an individual performs any familiar task it is usually in a set manner using the same joints and the same muscles, and as time progresses or the workload increases, fatigue of these muscles and joints sets in (McCoy, 1996). This causes adaptation requiring new muscles and joints to perform the same task. This substitution can often be less biomechanically advantageous as the newly recruited muscle and joints are not practised, endangering these areas to damage, and further spreading the mechanical forces to larger muscles and joints in an effort to relieve the stress on affected tissues (McCoy, 2002).

WRMSDs can occur in most professions; physiotherapy, which shares some commonality with osteopathy, in that they are both physical therapies, also suffers from WRMSDs. The prevalence rate for physiotherapists suffering a WRMSD during the course of their profession is between 32% and 91% (Bork et al., 1996; Cromie, Robertson, & Best, 2000; Holder et al., 1999). The areas most commonly affected are the lower back (45% - 62%) and the wrist/hand (28% - 29.6%) (Bork et al., 1996; Holder et al., 1999); these studies all used a self-administered questionnaire to gather data and did not examine a cause and effect relationship nor preferred techniques and WRMSDs. Similar research performed on osteopaths showed a %69.23 WRMSD prevalence rate and reported the most commonly injured areas to be lumbar spine/sacrum (%16.2), followed by the wrist (%14.08) and upper back/thoracic spine (%13.38)(Peat, 2004). By comparing the two sets of data above it is easy to see similarities between the two professions in the anatomical areas commonly affected by WRMSDs. However, the two professions are distinct from one another, which may make like for like comparisons inappropriate.

2.2 When is a Musculoskeletal Disorder Considered to be Work Related?

Currently research into relationships between an individual's work environment and the development of a WRMSD has been unable to define concrete cause and effect relationships (Aptel, Aublet-Cuvelier, & Cnockaert,

2002; Cromie, Robertson, & Best, 2000; Hoogendoorn, Bongers, deVet, & Ariens, 2002; Li & Buckle, 1999; MacFarlane, Hunt, & Silman, 2000; Yassi, 1997). There are many factors that have been theorised to cause an increased risk of developing a WRMSD (Aptel, Aublet-Cuvelier, & Cnockaert, 2002; Cromie, Robertson, & Best, 2000; Hoogendoorn, Bongers, deVet, & Ariens, 2002; Li & Buckle, 1999; MacFarlane, Hunt, & Silman, 2000; Yassi, 1997). Because there is no direct cause and effect relationship and that there is many theorised risk factors there is much confusion in the nomenclature. The term currently used in New Zealand by ACC is Occupational Overuse Syndrome (OOS). This term is meant as an umbrella term specific to injuries that have occurred directly because of factors in the work environment; however, this term is not commonly used by other nations (Boocock et al., 2005).

Currently, international terminology shows a large variation and lack of consensus as to the most appropriate term to describe the range of conditions that fall under the OOS umbrella (Boocock et al., 2005). The different terms currently in use to describe this group of conditions are thought to be insufficient, in that they fail to encapsulate an appropriate meaning consistent with all conditions. For example, terms often presuppose the aetiology by defining a single risk factor within the name (e.g. Repetitive Strain Injury or RSI presupposes repetition as a causative factor). Or terms may be too restrictive in respect to the anatomical region affected; for example, “musculoskeletal” by definition pertains to muscles and the skeleton, excluding the viscera. Alternatively, terms may be too broad and encompass

a range of disorders irrespective of the stage of the condition or the mechanism of injury; for example, “upper limb disorders” by definition refers to any injury to the upper limbs including acute sporting injuries. OOS itself is not regarded as a satisfactory term, as ‘occupation’, ‘overuse’ and ‘syndrome’ fail to adequately encompass all associated risk factors or conditions (Boocock et al., 2005).

This is a complex situation where the nomenclature only adds to the confusion. Many authors now recognize the multifaceted nature of work related diseases (Bernard, 1997; Buckle & Devereux, 2002). The WHO (1985) states that:

“In occupational diseases, there is a direct cause-and-effect relationship between hazard and disease. In work-related diseases, in contrast, the work environment and the performance of work contribute significantly, but as one of a number of factors, to the causation of a multifactorial disease” (p. 9).

Hence the conditions that fall under the OOS umbrella may or may not have a work related causation. It is for this reason that instead of the New Zealand accepted term OOS, the label WRMSD was used for this project. Its use is similar to the World Health Organization (1985) in that the work environment is a significant causative factor but not necessarily the only factor, and that the injury expresses symptoms in the musculoskeletal systems.

In summary, a musculoskeletal injury is considered work related when there

exists a meaningful causative risk factor within the individuals work environment. For example, an individual may be a keen golfer and play regularly but with terrible technique, endangering his back, then while at work injures his back when lifting a box. For the purposes of this study this would be considered a work related musculoskeletal injury.

2.3 The Clinical Course of Work Related Musculoskeletal Disorders

Yassi (1997) proposed a model for the clinical course of WRMSDs, which suggests that the clinical course of WRMSDs can be divided into three stages. The first stage, which can persist for weeks or months, is reversible. In this stage most patients experience aching and weakness during the work activity, which improves on days off work. There are no physical signs and no great interference with work. In the second stage, which may persist for months, symptoms begin more quickly and persist for longer. Physical signs may be present, sleep may be disturbed, and the patient may have difficulty at work. In the third stage, symptoms are present even at rest, non-occupational activities and sleep are disturbed, and the patient is unable to carry out light duties. This stage may persist for months or years, and the prognosis is generally poor. Because intervention in the first two stages will curtail any further symptoms, the consensus of opinion is that early treatment reduces ultimate disability, so there is a strong need to encourage early reporting and intervention (Yassi, 1997).

2.4 Pathophysiology of Work Related Musculoskeletal Disorders

All soft tissues (e.g. muscles, tendons, ligaments, fascia) in the body can fail with a single application of sufficient mechanical force or by the repetitive application of a force (Buckle & Devereux, 2002). The pathophysiological response may cause pain and functional impairment associated with WRMSDs. Damage on a microscopic level and an inflammatory reaction will result from the tissue deformation(Guyton & Hall, 2006; Lederman, 2003).

The inflammatory reaction causes phagocytic cells to infiltrate the area of damage, removing debris, and proliferation of tissue progenitor cells to rebuild the damaged tissue. With repeated injury the increase in cellular infiltration causes the expansion of the extracellular matrix, oedema, elevated collagen deposition and tissue necrosis (Szabo & King, 2000). Continued exposure to biomechanical force generates friction in the now congested area. The effect of the friction can be accentuated by the adjacent structures (such as bone, tendon, or retinacula), especially when awkward posture is adopted or at the end of range on a joint (Buckle & Devereux, 2002). This cascade of events makes activity difficult, symptomatic, and predisposes the individual to further injury.

2.5 Consequences of Work Related Musculoskeletal Disorders

The consequences of a WRMSD may include one or more self-protecting behaviours or using extra equipment and aids. The sufferer may also seek treatment, modify their Activities of Daily Living (ADL) and leisure, or make changes to their technique, or in extreme cases leave the profession altogether.

Among physiotherapist's responses to WRMSDs have included taking time off from work, modifying leisure activities and ADL, seeking treatment, lodging a workers compensation claim and continuing to work with discomfit (Bork et al., 1996; Cromie, Robertson, & Best, 2000). This later option often included modifying techniques or choosing an alternative way to treat.

2.6 WRMSDs among New Zealand Osteopaths

In 2004 Peat used a retrospective self-administered questionnaire to determine the prevalence, location, perceived risk factors and consequences of sustaining a WRMSD. One hundred osteopaths were randomly selected to participate from throughout New Zealand. Sixty-five questionnaires were analysed.

Peat (2004) found the majority of osteopaths (69.23%) had suffered WRMSDs in the course of their professional practice, with the most frequently injured anatomical sites being the lumbar spine, wrist, and thoracic spine. The techniques most frequently associated with the onset of WRMSD were soft tissue. Respondents perceived working while injured or the use of poor posture as the greatest risk factors to the development of a WRMSD. As 65% of all respondents sustained a WRMSD in the first five years of practice inexperience may have considerable influence. Those osteopaths who did suffer a WRMSD found it to be a learning experience and modified their practice accordingly. Most did not feel that it impacted negatively on their practice, but there were some respondents mindful of the economic implications of WRMSD. This project makes three recommendations: more education for osteopathic students in the prevention of WRMSDs; greater exposure of students to different patient morphology while working within the clinic; and technique classes where osteopaths are able to learn new techniques, and learn to modify their use of old techniques to best fit the requirements of their circumstances.

The research by Peat (2004) is currently the only research investigating WRMSDs among New Zealand osteopaths. Peat's (2004) project differs from this project in that it did not examine preferred techniques or distinguish between structural and functional modes of treatment. This project aims to examine the role the osteopath's technique choices play on the occurrence of WRMSDs. Rather than focus on technique; Peat (2004) has carried out a general investigation of WRMSDs among New Zealand Osteopaths.

2.7 Biomechanical Risk Factors

In 2002 the American National Institute of Occupational Safety and Health conducted a study that concluded that repetitive motions, particularly when combined with awkward motions or high force increased the risk of developing WRMSDs (Barr & Barbe, 2002). However the exact amount of repetition needed to cause an injury is unknown and at the moment there is no conclusive way of investigating this (Barr & Barbe, 2002) because it would be unethical to cause tissue failure in living human subjects. Pace of work, insufficient recovery time and the level of muscular effort have all been identified as contributing to greater tissue damage (Szabo & King, 2000).

In a study by Bork et al. (1996) 1160 physical therapists selected 17 job-related risk factors for the development of WRMSDs and ranked them as problematic on a scale of 0 to 10 (0 represents 'no problem' and a score of 8 or higher represents a 'major problem'). The 17 job related risk factors fall into four categories (1) activities, (2) postural factors, (3) workload issues, and (4) personal factors. By implication the individual risk factors contributed to the development of WRMSD. However no attempt was made to link any risk factor to a particular WRMSD. Given that risk factors can be related to specialty areas or tasks there is a need to investigate these risk factors with regards to osteopathy. These job-related risk factors are presented in Table 1.

Table 1

Percentage of 17 risk factors rated by physical therapists as > 7/10

Performing the same task over and over.	15.2%
Treating an excessive number of patients in 1 day.	19.0%
Performing manual orthopaedic techniques.	17.7%
Not enough rest breaks or pauses in the day.	14.6%
Working in awkward of cramped positions.	18.4%
Working in the same positions for extended periods of time.	18.4%
Bending or twisting your back in an awkward way.	14.8%
Working at or near your physical limits.	11.6%
Reaching or working away from your body.	10.4%
Continuing to work while injured or hurt.	15.2%
Lifting or transferring dependent patients.	25.7%
Working on confused or agitated patients.	13.9%
Carrying lifting or moving heavy equipment.	7.0%
Unanticipated move or fall by the patient.	14.6%
Assisting patients during gait activities.	11.9%
Work scheduling, overtime, irregular hours.	13.1%
Inadequate training on injury prevention.	1.2%

(Bork et al., 1996)

2.8 Work Related Musculoskeletal Disorders of the Upper Extremity

In much of the literature on WRMSDs the focus is on the upper extremities including the head and neck. In osteopathy the primary applicator is the practitioner's upper extremities, specifically, fingers, palms, forearms and elbows (Ward, 2003). The following is a review of literature regarding WRMSDs of the upper extremities among the general population.
Each section is divided into prevalence, posture, force, repetition, combinations of factors, and demographic risk factors. The exception is the elbow in which data are presented in one section because less research was found that considered the elbow.

A critical review by Bernard (1997) is used in the following sections. The author identified approximately 2000 articles and by the following process of selection included over 600 in the review. The studies that were chosen for more detailed review specifically concerned the work-relatedness of musculoskeletal disorders, musculoskeletal problems of the neck, upper limbs, or back, and/or occupational and non-occupational risk factors. The studies used in the review had to meet the following inclusion criteria:

Population: Studies were included if the exposed and referent populations were well defined from the outset.
Health outcomes: Studies were included if they involved neck, upper-extremity, and low-back musculoskeletal disorders measured by well defined, criteria determined before the study.
Exposure: Studies were included if they evaluated exposure so that some inference could be drawn regarding repetition, force, extreme joint position,

static loading or vibration, and lifting tasks. Studies in which exposure was measured or observed and recorded for the body part of concern were considered superior to studies that used self-reporting or job titles as a measure for exposure.

Study design: Population-based studies of musculoskeletal disorders, case-control studies, cross-sectional studies, longitudinal cohort studies, and case series were included.

The process by which the articles were analyzed was to first categorize the articles by those studies that had objective exposure assessments, high participation rates, physical examinations, and blinded assessment of health and exposure status. The more of theses categories an article met the greater the qualitative weight it was given in the review. The next step was to sort the articles into those that found statistically significant result and those that did not. At that point any associations were assessed to determine whether they were likely to have been substantially influenced by confounding or other selection bias. The final step of the analytical process was to review and summarize studies with regard to strength of association, consistency in association, temporal association, and exposure-response relationship. This whole process is given in more detail in the original article.

2.9 Neck and Shoulder Conditions

Prevalence

Prevalence data for neck/shoulder pain and symptoms varies substantially between studies and may be dependent upon the decided diagnostic criteria. Prevalence ranged from 69% (Lundberg et al., 1999) to 4.2% (Roquelaure et al., 2002).

Posture as a Risk Factor

A cross-sectional study of 3123 workers employed from a wide range of industrial tasks identified a positive association between prolonged neck flexion (greater than 20° for more than 66% of the time) and neck/shoulder pain (a Prevalence Ratio (PR) = 1.7) (Anderson et al., 2002). This study assessed physical exposure using observational techniques, video analysis and electromyography (EMG). In a study by Lundberg et al. (1999) EMG was used to gauge muscle tension in 72 supermarket cashiers. They found higher levels of trapezius muscle activity in female cashiers who reported muscle pain while working compared to those cashiers who did not report muscle pain while working (averages = 37.5 and 33.4 respectively, $p < 0.05$).

Other research into neck pain found that those who worked in a sitting position for more than 1% of the working time were at higher risk for neck pain than those who seldom worked in a sitting position (>1% of work time). The

uni-variate analysis showed an Relative Risk (RR) varying from 1.41 (95% CI 0.88 to 2.27) for workers who were sitting for less than half of their work time to a significant RR of 2.01 (95% CI 1.04 to 3.88) for workers who were sitting for more than 95% of their time at work. After adjustments for confounders, the RR data remained more or less the same, with the exception of the RR for sitting more than 95% of the working time, which increased to 2.34 (95% CI 1.05 to 5.21) (Ariens et al., 2001).

Bernard's (1997) review concluded that there was strong evidence for a relationship between a working posture with a high level of static muscle contraction, prolonged static loads or extreme working postures involving the neck/shoulder muscles, and an increased risk for neck/shoulder conditions (twelve statistically significant studies with Odds Ratios (OR) over 3.0). One review found evidence of a positive relationship between twisting or bending of the spine at work and neck pain, however it was suggested that there was inconclusive evidence for a relationship between neck pain and neck flexion, extension and rotation, due to a lack in the quality of research papers reviewed (Ariens, Mechelen, Bongers, Bouter, & Wal, 2000).

Force as a Risk Factor

There were few studies that considered the association between forceful exertion and neck/shoulder conditions; which may be a reflection of the difficulty of obtaining reliable, objective measures of force during movements of the neck while in the workplace. Andersen et al.'s (2002) study involved

4162 workers at 19 different workplaces, including four food processing companies, three textile plants, seven other manufacturing, and five service companies. Daily repetitive tasks were classified and monitored in which force exertions were estimated based on measurements of muscle activity using EMG. They found some evidence for an association between force (greater than 10% Maximum Voluntary Contraction (MVC)) and increased risk for pain and tenderness in the neck and shoulders (PR = 2.0).

Bernard (1997) and Malchaire, Cock & Vergracht (2001) both concluded that there was evidence of an association between forceful exertions, physical workload and the occurrence of neck and or shoulder conditions. Bernard (1997) emphasised that most epidemiological studies defined 'forceful work' for the neck/shoulder as work activities that involved forceful arm or hand movements, which generated indirect loads to the shoulder or neck region. No studies directly measured force during neck movements.

Repetition as a Risk Factor

Studies have infrequently quantified the amount of repetitive neck motions, or sought to measure the number of neck movements directly. Andersen et al.'s (2002) study demonstrated some evidence of an association between highly repetitive work and an increased risk of pain and tenderness of the neck/shoulder region (PR 1.8, 95%, Confidence Interval (CI) = 1.1 to 2.9). Highly repetitive movements of the shoulders were defined as 16 to 40 shoulder movements per minute, which was measured using observational

and video recording techniques.

Bernard's (1997) review concluded that there is evidence of an association between highly repetitive work and neck/shoulder conditions (11 studies had ORs greater than 3.0, 11 had ORs between 1.0 and 3.0, and none had an OR less than 1.0). The author emphasised that repetitive motions may not be the principal physical exposure in the work environment causing these conditions; but rather that it occurs in combination with other risk factors like extreme postures and/or forceful movements. Bernard (1997) also states that most studies defined repetition in relation to movements of the arms or hands, rather than actual movements of the neck/shoulders.

Combinations of Physical Factors

Andersen et al. (2002) found an increased risk for neck/shoulder disorders when the combination of repetitive motion and force were present in the work task (PPR = 2.3). Nordander et al. (1999) and Häkkänen et al. (2001) did not identify individual risk factors but instead considered work tasks that had combinations of high physical load, repetition and postural stress. Nordander et al. (1999) observed 116 male and 206 female fish industry workers and compared them with 129 men and 208 women with more varied work. The author found that symptoms of the neck/shoulders were twice as likely to occur when a combination of physical risk factors was present. Häkkänen et al. (2001) examined sick leave among 532 trailer assembly workers. The researchers concluded that there was strong evidence of an increased risk for

neck/shoulder disorders among inexperienced workers involved in highly physical occupations (defined according to at least two combinations of postural strain, repetition and forceful exertion being present in the task) (Relative Risk (RR) = 11.1, $p < 0.01$) (Hakkanen, Viikari-Juntura, & Martikainen, 2001).

Demographic Risk Factors

Nordander et al. (1999), Andersen et al. (2002) and Häkkänen et al. (2001) all reported a positive association between gender and the occurrence of neck/shoulder conditions for those employed in strenuous work. Nordander et al. (1999) found that females employed in fish processing were almost twice as likely as males to be diagnosed with neck/shoulder conditions (Prevalence Odds Ratio (POR) = 1.9, CI = 1.1 to 3.2). In Andersen et al. (2002) study of 19 different workplaces a neck/shoulder disorder prevalence rate of 1.8 was reported amongst female workers employed in repetitive work tasks compared with their male counterparts. The above evidence for gender as a risk factor for neck/shoulder conditions is similar to previous review papers (Bernard, 1997; Malchaire, Cock, & Vergracht, 2001).

With regards to previous medical history, Andersen et al. (2002) found no evidence of a relationship between BMI and increased risk of neck/shoulder conditions. Yet a history of prior shoulder trauma was positively associated with neck/shoulder conditions (PR = 2.6). Malchaire et al. (2001) concluded that previous medical history had no association with neck/shoulder

conditions.

2.10 Shoulder Conditions

Prevalence

Prevalence data for shoulder pain and symptoms appears to vary markedly between studies and may be dependent upon diagnostic criteria. Prevalence data ranged from 27% (Nordander et al., 1999) to 6.9% as identified by Frost and Andersen (1999).

Posture as a Risk Factor

Except for Bernard (1997) no studies were found that considered exposure to postural stress as a physical risk factor for shoulder conditions. Bernard (1997) reviewed thirteen articles considering sustained shoulder postures greater than 60° of shoulder elevation; twelve of the thirteen concluded that there was evidence of a positive association between exposure and symptoms of rotator-cuff tendonitis and non-specific shoulder pain. He also concluded that the evidence was strongest when there was exposure to a combination of factors, for example holding a hedge trimmer and working above the head.

Force as a Risk Factor

Two studies examined shoulder tendonitis in relation to shoulder loads. Frost et al. (2002) found evidence of a fourfold increase (Odds Ratio (OR) = 4.21) in the risk of shoulder tendonitis when members of the exposed group regularly worked with loads equal to or greater than 10% of their MVC. In a study looking at recovery from shoulder tendonitis it was found that the odds of recovery were halved (OR = 0.5) for those workers involved in tasks requiring high force exertions (>10% MVC) compared to those involved in low force exertion tasks (10% MVC) (Bonde et al., 2003).

Interestingly, in Bernard's (1997) review it was concluded that there was insufficient evidence to derive an association between force and shoulder tendonitis, or force and non-specific shoulder pain. This was because the five studies reviewed had considerable diversity in exposure, assessment, and health outcomes measures even though theses studies showed positive associations ranging from OR = 1.8 to 18. This is starkly different to van der Windt et al.'s (2000) review, which found that heavy workloads were associated with shoulder pain (OR/RR range = 1.7 to 5.4). A key reason for the disagreement between the two reviews may be that they both used different methods to define force and to appraise the quality/strength of the article reviewed.

Repetition as a Risk Factor

Frost et al. (2002) showed an increased risk of shoulder tendonitis when associated with repetitive work tasks when compared to a control group of workers performing non-repetitive work tasks. Shoulder tendonitis was found to be three times higher among workers involved in repetitive tasks (OR = 3.12). Interestingly though, when workers who were exposed to low (1 to 14 movements/minute) or high repetition (15 to 36 movements/minute) were compared the two groups were similar (OR = 2.9 and 3.3 respectively), even though both groups were dramatically different from the control group of non-repetitive workers. Suggesting that the relationship between number of repetitions and shoulder tendonitis is non-linear, possibly because of unknown contribution factors. Bonde et al. (2003) reported a difference in the rate of recovery from shoulder tendonitis among those involved in repetitive work, although those workers exposed to higher shoulder movements (>15 shoulder movements/minute) showed an increased rate of recovery compared to those exposed to lower movement cycles (OR = 0.6), this could be because the extra movement facilitates healing by removing debris, metabolic waste and increases fluid circulation in the area.

Two earlier reviews are in agreement with the findings of Frost et al. (2002), suggesting that there is evidence for a positive association between highly repetitive work and shoulder conditions. Bernard (1997) concluded that shoulder tendonitis and non-specific shoulder pain were positively associated with highly repetitive work (OR range = 1.6 to 5.0). Similarly, this is supported

by van der Windt et al.'s (2000) review that concluded that there were consistent findings among studies showing an association between repetitive movements and shoulder pain (OR/RR range = 1.6 to 46).

Combinations of Physical Factors

One study by Frost and Andersen (1999) found that slaughterhouse workers were five times more likely to have a shoulder impingement condition than a comparison group involved in light manual or supervisory work (PR = 5.27). Frost and Andersen (1999) classified the work tasks in the slaughterhouse as both repetitive and requiring sustained force.

Demographic Risk Factors

Bonde et al. (2003) found that in industrial workers the occurrence of shoulder tendonitis was associated with increased age, high BMI, previous shoulder trauma, and reduced shoulder strength but not gender. When considering the rate of recovery from shoulder tendonitis, the authors found that being older was positively associated with a slower recovery for those aged > 55 years (OR = 3.8) (OR = 2.0 for 45 - 55 years, OR = 1.0 for < 45 years).

Bernard (1997) states that age and actively participating in sports are two of the most important effect modifiers for shoulder tendonitis, although no further conclusion was drawn about their role as individual risk factors. Bernard (1997) goes on to mention that it is unlikely that the majority of the positive

association between physical exposure and shoulder conditions is due to the effects of non-work related confounders. Van der Windt et al.'s (2000) review suggests evidence of a positive association between the time in employment and shoulder pain (OR/RR range = 1.4 to 3.9).

2.11 Elbow Conditions

Prevalence

Epicondylitis is considered an uncommon condition, Bernard's (1997) review found prevalence rates among the general population to be between 1% and 5%. In Bernard's (1997) review the conclusions were that there was evidence of an association between forceful work and epicondylitis (OR = 2.73, 5.5, 6.75); strong evidence for a relationship between exposure to a combination of risk factors and epicondylitis (Incidence Rate (IR) = 6.7). Bernard (1997) concluded that there was insufficient evidence of an association between repetitive work or posture and elbow conditions because the studies reviewed either had response rates less than 70%, the investigators were not blinded and or the researchers did not use physical examination to assess outcomes. In a review by Buckle and Devereux (2002) the authors write that there is insufficient evidence for repetition or posture as a risk factor for WRMSDs of elbow, evidence for force as a risk factor, and strong evidence for a combination of the above factors. Another review found inadequate evidence for repetition as a risk factor yet found epidemiological evidence for exertion

as a risk factor (Aptel, Aublet-Cuvelier, & Cnockaert, 2002). To summarize, evidence was found for force or exertion as a single risk factor, and for combinations of physical factors in contributing to WRMSDs of the elbow. However, there was insufficient evidence for repetition or posture as risk factors for WRMSDs of the elbow.

2.12 Wrist and Hand Conditions

Prevalence

Prevalence data for wrist and hand symptoms varies considerably between studies and may again be dependent on the diagnostic criteria that each study uses. One study presented prevalence data for disorders of the arms, wrists, and hands, the authors reported a high level of forearm symptoms has been reported among forestry employees (18%), supermarket workers (14%) and podiatrists (13%); compared to lower levels among army officers (4%) and police officers (0%) (Nahit, Taylor, Hunt, Silman, & Macfarlane, 2003).

Posture as a Risk Factor

Marcus et al. (2002) investigated 632 amateur computer users exposure to postural risk factors, subjects were individuals who had just received employment and anticipated using a computer >15 hours a week. Data were gathered by using observational, workstation and postural measurements.

This research showed a significant increased risk for hand and arm conditions when associated with ulnar deviation of the wrist (> 5°) while using a mouse with or without the use of a wrist support (RR = 1.82 and 1.69 respectively) (Marcus et al., 2002).

Roquelaure et al.'s (2000) retrospective case-control study examined postural risk factors associated with Radial Tunnel Syndrome (RTS) in 21 manual laborers. Static work of the hand for prolonged periods, such as squeezing tools or objects and working with the elbow extended (0° to 45°) was associated with RTS (OR = 5.9 and OR = 4.9 respectively). While holding the arm in an extreme twisted position increased the risk estimate (OR = 4.4). These above findings were similar to Bernard's 1997 review, which found evidence of a positive association between posture and hand/wrist tendonitis (Prevalence Ratio (PR) = 1.4 to 6.2).

Repetition as a Risk Factor

Latko et al. (1999) used 352 manual industrial workers employed in repetitive work to investigate the effects of repetitive movements of the hand and the incidence of distal upper extremity tendonitis. They defined highly repetitive as rapid steady motions or exertion of the hands with no regular breaks or having some difficulty in keeping up to the work rate. It was found that highly repetitive tasks were associated with an increased risk for tendonitis of the elbow, wrist and or hands (OR = 1.23 per unit of repetition; OR = 3.23 for high vs. low repetition) (Latko et al., 1999).

Previous reviewers have suggested that the literature provides stronger evidence for a relationship between repetition and hand/wrist conditions (Bernard, 1997; Malchaire, Cock, & Vergracht, 2001). For example in 1997 Bernard's review concluded that there was evidence for repetition as a single risk factor for hand/wrist tendonitis (PR ranges = 1.4 to 17.0). This is similar to conclusion drawn by Malchaire et al (2001), who found repetition to be associated with hand and wrist disorders in more than 50% of the studies they reviewed (data not given).

Force as a Risk Factor

Roquelaure et al. (2000) sampled a group of industrial manual laborers and found force exertions in excess of 1 kg more than 10 times an hour was the main biomechanical risk factor associated with RTS (OR = 9.1). Bernard's (1997) review found that there was evidence of force, by itself, as a physical risk factor associated with hand/wrist tendonitis. Malchaire et al. (2000) used the term 'physical workload' to describe forceful tasks in the studies they reviewed, from these they found a significant association with hand-wrist conditions in more than 50% (data not given).

Combinations of Physical Factors

Findings from previous reviews suggest that there is evidence for an association between combinations of physical risk factors (e.g. repetitive and

forceful tasks) and conditions of the arms, wrists and hands (PRR range = 1.38 to 38.5) (Bernard, 1997; Malchaire, Cock, & Vergracht, 2001; Stock, 1991).

Demographic Risk Factors

Latko et al. (1999) found an association between a history of soft tissue disorders and forearm tendonitis in manufacturing workers who were employed in repetitive tasks (OR = 2.62). Nordander et al. (1999) identified that females employed in fish processing were at an increased risk of developing OOS symptoms of the elbows and hands than men (POR = 2.8). Häkkänen et al. (2001) reported on the effect that gender has on the rate of sickness absence due to arm conditions varied according to work load. Women in high work load groups were five times more likely to be off work due to arm conditions than men; but in low load groups the rates for men and women were similar.

Malchaire et al.'s (2001) review, however concluded that there was no evidence of an association between demographic factors (age, weight, personality, medical history and personal hobbies/activities) and hand or wrist conditions (data not given) (Malchaire, Cock, & Vergracht, 2001).

2.13 Osteopathic Review

History

Osteopathy is a system of manual healthcare developed by Andrew Taylor Still little over 100 years ago, it primarily uses a mechanical or structural perspective to identify and treat symptomatic tissues (Becker, 1997; Ward, 2003). Still's original concept was that all diseases and ailments involved some impairment in the free flow of the material or energetic components of the body and thereby impede the body's self-correcting process from within (Becker, 1997). A modern osteopath is a primary health care practitioner who facilitates healing through osteopathic assessment, clinical differential diagnosis and treatment of the whole person (Sutherland, 2004).

Osteopathy in the Cranial Field

Andrew Taylor Still was well known for encouraging his students to be open minded and enquiring (Still, 1992). William Sutherland one of Still's early students became fascinated with the shape of the cranial bones, born from this fascination came osteopathy in the cranial field. Osteopathy in the cranial field (OCF) examines the inherent mobility and motility of the cranial system. Sutherland explained this as an extension of Still's own philosophies but went further to explain that it was an expression of the basic life force at work (Becker, 1997).

The distinction between OCF and regular osteopathy is in the way the practitioner examines and carries out treatment. Cranial osteopathy uses small movements with grams of pressure and focuses most usually around the skull and sacrum; while structural osteopathy uses much larger movements frequently with kilograms of pressure and works via any part of the body. These distinctions are, however, generalised and not absolute. Consequently practitioners of cranial osteopathy tend to hold static positions while bearing little weight, while a structural osteopath will tend to move more and with larger weights.

Biomechanical Risk Factors in Osteopathic Technique

There is a large range of techniques that an osteopath can use. Selections of possible techniques include articulation, soft tissue techniques, muscle energy techniques (MET), strain-counter strain, high velocity low amplitude technique (HVLA), functional, balanced ligamentous tension, fascial ligamentous release, visceral, facilitated positional release, Chapman's reflexes and OCF. This list is not exhaustive and the techniques within it are not the sole domain of osteopathy. In clinical practice this choice of approach allows the osteopath to select a technique based upon the individual requirements of the patient and the level of confidence the osteopath has in their ability to perform the technique safely and effectively. It is important to note that as an osteopath is able to choose their techniques this may reduce the relevancy of repetition as

a risk factor, especially as an osteopath has speciality knowledge of WRMSDs and their aetiology.

Every technique requires a force to be applied to the patient's body. The forces required range from extremely light to heavy. Unfortunately no research regarding the exact forces generated by osteopathic techniques could be found, however, as no two osteopaths will perform the same technique in the same way each technique would generate forces specific to the practitioner. With inter-practitioner reliability low (Moran & Gibbons, 2001; O'Haire & Gibbons, 2001; Spring, Gibbons, & Tehan, 2001; Vincent-Smith & Gibbons, 1999), it would be hard to generalise a specific technique as a biomechanical risk factor. As each osteopath chooses their own techniques however, clear preferences will tend to develop, leading the practitioner to perform a similar technique on numerous patients throughout a day. It is possible that the repetition of a favourite technique could predispose the practitioner to a WRMSD, alternatively it may make the practitioner more efficient with their techniques.

The practitioner's use of their own body in performing a technique will determine the type of biomechanical risk factors involved. There are however typical risk factors to which a practitioner may be exposed. Supporting the weight of the patient, repetitive tasks, and generating large forces are common aspects of many osteopathic techniques and have been identified in the literature as being associated with the development of WRMSDs (Barr & Barbe, 2002; Szabo & King, 2000). Depending on the practitioner's

preference for a technique these actions maybe repeated numerous times in a single treatment or per day.

HVLA techniques require the osteopath to generate comparatively large forces and are considered to be a biomechanical risk factor for WRMSDs (Barr & Barbe, 2002; Szabo & King, 2000). To perform this technique the practitioner must rapidly accelerate their body mass over a short distance while supporting the patient's body and bending and/or twisting their own body. These techniques are widely used and have been associated with an increase in prevalence of WRMSDs in the hand and wrist of physical therapists (Caragianis, 2002), because these HVLA techniques are similar to their osteopathic variants it is reasonable to predict that they would also predispose an osteopath to a WRMSD.

MET is a technique that requires the practitioner to resist a force generated by the patient (Ward, 2003). The practitioner may also be required to bend and or twist their own body while supporting the patient's weight and then also resist their force. If the force generated by the patient however, is greater than expected, a protective muscular reflex can occur in the practitioner's spine increasing compressive forces 30 – 70% (Mannion, Adams, & Dolan, 2000). This muscular contraction can substantially increase the compressive loading on the practitioner's spine, which has been associated with the occurrence of WRMSDs (Barr & Barbe, 2002; Szabo & King, 2000).

Cranial techniques usually involve applying extremely light pressure to the patient's body via the fingertips for extended periods of times; and may additionally involving bending and or twisting of the practitioner's body while maintaining this force (Becker, 1997; Chaitow, 1999). The force generated by the practitioner is less than used in many other techniques (e.g. HVLA or MET), however the sustained nature and repetition of work tasks have been associated with the formation of WRMSDs, especially in the hand and wrist (Barr & Barbe, 2002; Bernard, 1997; Latko et al., 1999; Malchaire, Cock, & Vergracht, 2001; Szabo & King, 2000). However as OCF techniques use such light pressure the repetition may be less of a risk factor.

Indirect vs. Direct Technique

Currently in the field of osteopathy there are practitioners who use a direct approach, those who prefer an indirect approach, and those who use both. Direct and indirect are terms used by osteopaths to describe groups of techniques that share common philosophies and mechanisms of action. The techniques known as direct are: soft tissue, MET, HVLA, and articulation; techniques known as indirect are OCF, visceral, BLT, functional and S-CS (Blaser, 2009).

Until recently these distinctions of indirect and direct osteopathy have been arbitrary, but new research has shown that this is a measurable distinction in the way New Zealand osteopaths refer to themselves and practice (Blaser, 2009). These distinctions serve to illustrate the differences in treatment

approach used by the two largest groups of osteopaths. One of the objectives of this study is to establish any relationship between preferred techniques and WRMSDs. To this end these distinctions help to clarify different osteopathic approaches to diagnostic and treatment approaches. It is important to note that osteopaths who describes themselves as indirect may practice techniques classified as direct and visa versa, they are not exclusive

Gaps in Current Literature

The current literature fails to adequately demonstrate if osteopaths do sustain WRMSDs and does not distinguish between their incidence for indirect and direct practitioners of osteopathy. Current research about osteopaths has not identified preferred techniques, making any association between preferred techniques and WRMSDs not yet possible. Research has thoroughly examined the occurrence of WRMSDs within the physiotherapy profession but to assume that osteopaths mirror physiotherapists in this regard would be unwise. Physiotherapists not only use different techniques but also often use machines to treat patients, and often work within hospitals. The use of machines could reduce the risk of WRMSDs while working on dependent patient within hospitals may increase the risk, what is relevant however is that the risk factors physiotherapists face are different than those osteopaths face.

Within osteopathy the main techniques used by indirect and direct osteopaths are dissimilar, while there is some overlap in the techniques a comparison between the two may not be appropriate. There exists theoretical

biomechanical risk factors in both direct and indirect techniques that vary in the amount of force generated, the weight supported, and the applicator used (finger tips, elbows or hands); automatic parallels between indirect and direct practitioners cannot be assumed. As there now is tentative evidence for osteopaths classified as either indirect or direct it is appropriate to examine WRMSDs with these distinctions in mind.

Due to this lack of data in the existence of WRMSDs among practitioners of osteopathy and their preferred techniques, this current study sets out to explore the relationship between an osteopath's preferred technique and the occurrence of WRMSDs. A cause and effect relationship between risk factors and WRMSDs will not be sought; rather the aim is to identify risk factors that the osteopaths identify as contributing to the development of their WRMSDs.

CHAPTER 3 METHODOLOGY

3.1 Subjects

The sample population was registered osteopaths from the Osteopathic Society of New Zealand (OSNZ). To be eligible as a member of the OSNZ subjects must hold a current Annual Practicing Certificate (APC), which is issued by the Osteopathic Council of New Zealand (OCNZ).

The names and e-mail addresses for members of the OSNZ were accessed via the Internet and the public listings on the OSNZ web page. The OSNZ uses peer support groups organised by geographical regions. Initially invitations were distributed to the peer group leaders detailing the study and requesting that they make contact with their groups on behalf of the researcher. At the time there was no group leader for the Wellington region so invitations were sent directly to the group members. This method of sampling provided access to 190 registered osteopaths within New Zealand.

3.2 Study Design

This study employed a survey to gather data. The type of data gathered were osteopathic opinions, perspectives and demographic information, which is data that can be effectively gathered using a survey (Polgar & Thomas, 2000).

This method was similar to that used by Holder et al (1999) who sampled 622 Physical Therapists and Physical Therapists Assistants in the United States. Peat (2004), Caragianis (2002), West and Gardener (2001); Cromie, Robertson and Best (2000); and Mierzejewski and Kumar (1997) also used a retrospective self-administered questionnaire to determine the prevalence of WRMSD's among Physical Therapists in New Zealand, Australia and Canada.

A survey is effectively used in this case also because it is a cost effective and ethical way of gathering data from a population, which can compare or explain the knowledge, attitudes, and behaviours of a pre-existing group of individuals (Fink, 1995; Wright, 2005). A survey can be administered without travelling to different locations, does not require any specialised or expensive equipment and osteopaths who wish to be involved are able to participate at a time best suited to them, allowing the participant to refer to any relevant records (eg. Medical records) ensuring that all pertinent information is recorded. This method was also chosen because it provided an anonymous method of data collection, which avoids interviewer bias and provides access to a large number of osteopaths spread nationally (Neutens & Rubinson, 1997). Also as the research objectives do not seek to establish a cause and effect relationship but rather an association between variables this was an appropriate method to employ (Polgar & Thomas, 2000).

E-mail was chosen as the method of distribution because it is a common method of communication. The International Telecommunications Union number the Internets users at 1'542'532'500 (International

Telecommunications Union, 2008). While it is impossible to provide truly accurate numbers this still represents a large potential population for the distribution of e-mails, and because the e-mail transcends the limits of time and space this population can be reached at any time of the day and in any geographical location that has an Internet connection; which must make this medium one of the few methods with such a far-ranging reach. Research has found no significant difference between mail and email survey response rate with prior notification to the sample population; their actual response rates were found to be between 20.7 and 31.5% (Kaplowitz, Hadlock, & Levine, 2004). To help facilitate a response this study used prior notification in the form of emails.

To facilitate the survey process SurveyMonkey (Portland, Oregon, 2009) was used. SurveyMonkey is an online survey tool, started in 1999, that enables people of all experience levels to make their own survey quickly and easily. The e-mail invitation posted to osteopaths had an electronic link to SurveyMonkey where the questionnaire was stored. SurveyMonkey stored all data from completed questionnaires, with access limited to the researcher and research supervisors. After the desired response rate was achieved the data were retrieved and stored on the researchers personal computer with access limited to the researcher only.

Surveys can be limited by an inability to tailor the questions specifically to each respondent, and there is the possibility of key questions being returned unanswered (Neutens & Rubinson, 1997). Also surveys can result in low

response rates, often as low as 30% (Black & Champion, 1976). To help facilitate questionnaire completion three follow-ups were sent to those who did not respond, starting one month after initial contact. Also to aid questionnaire completion a simple, clear format was used which, requires participants to indicate their answers but 'clicking' the appropriate box with their cursor.

For this research a response rate of 40% was anticipated. From the sample of 190 publicly listed OSNZ members would give a target total of 76 respondents. This is based upon the guidelines discussed by Barnett (1991), who suggests that using two follow-up reminders will achieve a response rate of 64%, however, as little as a 40-50% response rate will provide enough data to analyse in order to establish patterns, as this project is only pilot study.

The survey depended upon respondents' disclosure of their past WRMSDs. It was anticipated that respondents would be able to accurately recall and identify if they had sustained a WRMSD. This assumption was made as osteopaths are taught to recognize and diagnose musculoskeletal complaints including WRMSDs, and the associated predisposing and maintaining factors of the presenting complaint (Sammut & Searle-Barnes, 1998; Ward, 2003).

3.3 The Questionnaire

The questionnaire used was designed specifically with this project in mind. It consisted of mostly closed questions, which could be answered by choosing

an appropriate answer box to ‘click’. This questioning method encourages completion, as it is easy for the respondent to answer and is less time-consuming than open questions. Although little room is left for interpretation, closed questioning ensures that the answers gained are relevant to the research (Neutens & Rubinson, 1997). Neutens and Robinson (1997) state that using this method also makes it more likely that personal questions will be answered (questions such as how many hours do you work, or how many WRMSDs have you sustained). Often the option of ‘other’ has been included as an answer category; this allows the respondent to answer in ways not considered by the researcher (Neutens & Rubinson, 1997).

This questionnaire design also made statistical analysis relatively straightforward, as the data were already be in a form that could be analysed using descriptive and analytic statistical methods.

The last two questions were open-ended; these questions were designed as catch-alls, giving the respondent the option to mention anything that they felt was pertinent and had not been already asked, while at the same time providing a place in which respondents could offer some feed back on the questionnaire if they felt the need.

Basic demographic information such as age, gender, and weight were collected to allow the calculation of the BMI of each respondent. Typical number of hours worked was gathered as well to gain some understanding of the osteopaths’ experience and current work situation. The main body of

questions gathered data on the types of techniques that the osteopath used, how frequently they were used, and which techniques they most preferred to use. The osteopaths were also asked to record their experiences with WRMSDs. They were asked if they had had them in the past, where in their body had they occurred, and how had they dealt with them. Osteopaths were also asked how they perceived any WRMSD had affected their work.

The questionnaire was not validated specifically; although the questions were selected from questionnaires used in similar research published overseas. The majority of the questions were based on those used by Cromie et al (2002), Cromie et al (2000), Bork et al (1996), and Holder et al (1999). The questions were modified to make them more appropriate to osteopathy. Before the questionnaire was finalised various versions of each question were tested on the clinical tutors at UNITEC for face validity, to ensure that the questions were relevant, meaningful and easy to answer.

3.4 Ethical Considerations

The Ethics Committee of UNITEC New Zealand, UREC, granted approval for this research project for the period of 10/02/09 until 10/02/10. The UREC application number is 2009-925.

The data gathered were in accordance with UREC's principles of informed consent, privacy and anonymity of the osteopaths involved. All participants were provided with information describing the study and an invitation to

participate. Completion of the online survey was taken as informed consent. Participation was completely voluntary. Those osteopaths who began but later decided to refrain from completing the questionnaire were able to withdraw their data anytime two weeks before data analysis began.

As sensitive information was obtained from participants, some of who may have been know to the researcher, the completed questionnaires were anonymous as no identifying information was required from the respondents and the researcher did not know who had completed which form. The use of SurveyMonkey ensures anonymity, as the researcher does not receive any information linking the data to particular respondents, unlike a regular e-mail survey. Information of participant's ethnicity and faith was not required for the purposes of the study; however the participant's gender was required in order to calculate BMI's accurately and to observe any gender difference in the occurrence or response to WRMSD's.

3.5 Data Analysis

The majority of data gathered was quantitative, although the last two questions provided room for qualitative responses. The quantitative data were analysed using both descriptive and meta-analytical methods, including BMI data. Data were entered, checked twice and analysis was performed with the use of Microsoft Excel. All data were interpreted according to the magnitude of effect as described by Cohen (2008).

Descriptive Statistics

Measures of frequency, means and standard deviations were used to summarise data, and gauge the distribution format. These data were then presented in graphs and using percentages (Argyous, 2000).

Meta-analysis

Calculating Odds Ratios

Odds ratios can be defined as “the ratio of two odds and is a summary measure of the relationship (effect size) between two variables” (Garson, n.d.). Odds ratios are used for categorical data and do not require a normal distribution. An odds ration of 1 implies that an event is equally likely in both groups. Where as, an odds ratio from 1.1 to infinity implies that the event is more likely in the first group; and an odds ration from 0 to 0.9 implies that the event is less likely in the first group (Garson, n.d.).

A two by two table is used to calculate an odds ratio. This is shown below:

	X-	X+	
Y-	A	b	a + b
Y+	C	d	c + d
	a + c	b + d	n = a + b + c + d

(Garson, n.d.)

Garson (n.d.) explain that an odds ratio can be determined by first finding the odds of each row in the table. The resulting odds ratio is then a ratio of the two odds. In the example of the above two by two table this would be: firstly the odds of each row,

row Y- = a/b, & row Y+ = c/d;

then the ratio of the two odds,

odds ratio = (a/b)/(c/d) (Garson, n.d.).

Calculating Confidence Intervals for Odds Ratios

A confidence interval is an interval that includes an estimate of how likely it is that the interval contains the population parameter (Harnet & Horrell, 1998). There is only one true value for the population parameter, the confidence interval defines how likely it is to be within it. 'Likely' is usually defined as 95% of the time, with a range known as a 95% confidence interval (Hopkins, 2003). The values at either end of the interval are the confidence limits with all the numbers in between making up the confidence interval. The more narrowly the data are distributed the greater the sample precision (e.g. the degree of random error associated with it is less) (Sim & Reid, 1999).

To determine the confidence interval for the odds ratio the following formula was used:

$X^2 = n(ad – bc)^2/(a + c)(b + d)(a + b)(c + d)$ (Daniel, 1999).

Where a, b, c, and d are the cell values as seen in the two by two table above. The upper and lower confidence limits were calculated using the following formula:

Lower confidence limit = odds ratio $^{1-1.96/\sqrt{X2}}$

Upper confidence limit = odds ratio $^{1+1.96/\sqrt{X2}}$ (Daniel, 1999)

Qualitative Analysis

The last two questions were open-ended and provided qualitative data on information the respondent felt was important but had not been asked in the body of the questionnaire. This data were interpreted by use of thematic analysis. Such analysis is a search for themes that emerge as important in the description of the phenomenon being examined. This process involves identification of themes by careful reading and re-reading of the data, and is a form of pattern recognition (Fereday & Muir-Cochrane, 2006), where the emerging patterns become the data for further analysis.

CHAPTER 4 RESULTS

4.1 Response Rate

Of the 190 registered osteopaths invited to participate in this study 80 responded after a total of three reminder emails were sent out. One respondent started to answer the questionnaire and either abandoned the questionnaire before reaching the key questions or chose not to answer these questions; data from this respondent were excluded. The overall response rate was 41.6% (79 respondents from an eligible population of 190).

4.2 Demographics

Respondents consisted of 51.9% females (mean BMI 22.7 $\pm$ 3.38), and 48.1% males (mean BMI 25.1 $\pm$ 2.42). Table 2. summarises age and gender data and present national data taken from the Selected Health Professional Workforce in New Zealand 2006 report (New Zealand Health Information Service, 2007).

Table 2.

Gender and age of respondents

CHARACTERISTIC	NUMBER	PERCENTAGE	NATIONAL DATA[A]
GENDER:			
MALE	**38**	**48.10%**	**52.1%**
FEMALE	**41**	**51.90%**	**47.9%**
AGE:			
20 – 29 YEARS	**20**	**25.32%**	**16.2%**
30 – 39 YEARS	**14**	**17.72%**	**30.9%**
40 – 49 YEARS	**26**	**32.91%**	**30.5%**
50 + YEARS	**19**	**24.04%**	**22.4%**

a. Data from the 2006 Selected Health Professional Workforce in New Zealand survey. See New Zealand Health Information Service's website: http://www.nzhis.govt.nz

4.3 Work

The majority of respondents worked full time (63 respondents, 79.75%) compared to 15 respondents who worked part time (18.99%), and 1 person who worked casually (1.3%). Overall the respondents had practiced an average of 11.25 years (± 8.55) (see Figure 1.). The respondents on average had 30.02 hours (± 11.05) of direct patient contact each week (see Figure 2.).

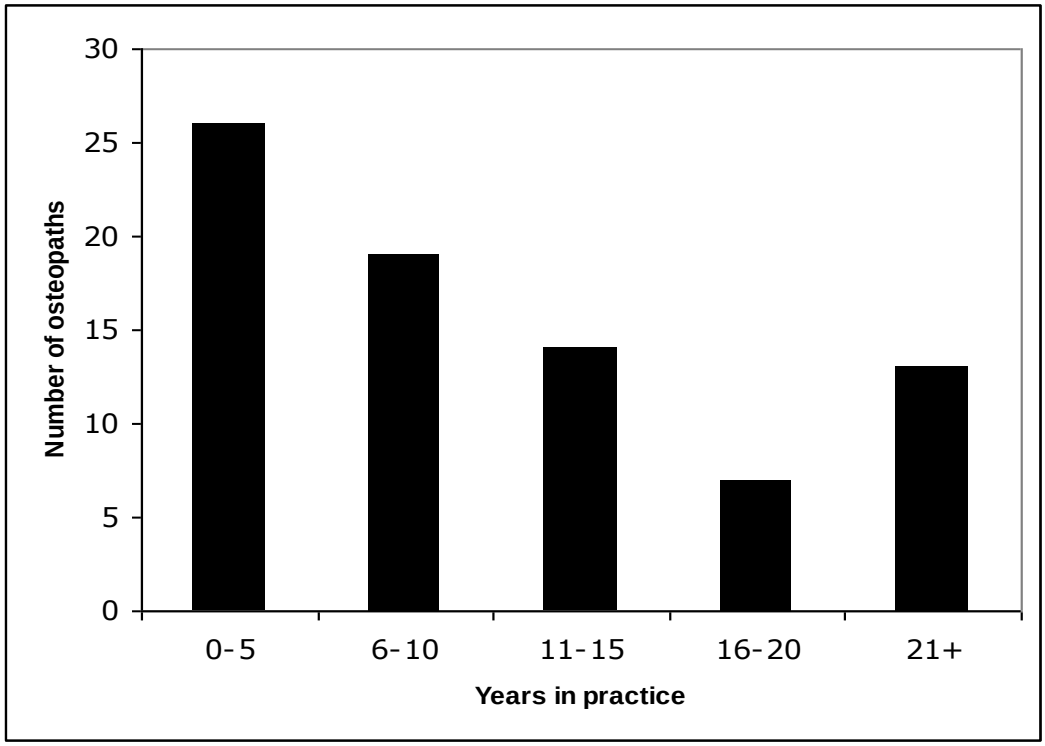

Figure 1. Years in practice of respondents

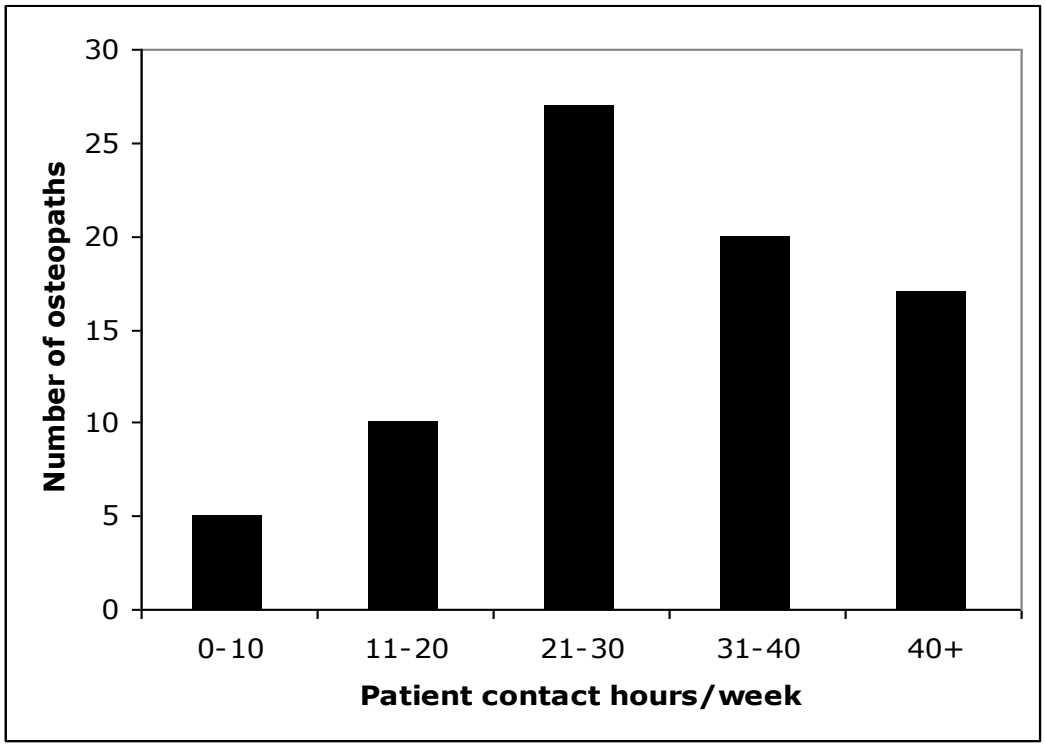

Figure 2. Hours of patient contact/week of respondents

4.4 Treatment modalities

Of the techniques used by osteopaths the most popular were soft tissue, MET, and HVLA each chosen by 75 osteopaths; articulation was selected by 74 osteopaths, followed by OCF, chosen by 65 osteopaths. These choices are shown in Figure 3. The category “other” was selected by 15 people, of which 10 gave these details: balanced membranous tension; acupuncture; Neurolink, Bodytalk, and kinesiology; Traditional Chinese Medicine; exercise; harmonics; fascial techniques; exercises, hydrotherapy, and education; inhibition; and neuromuscular muscle release.

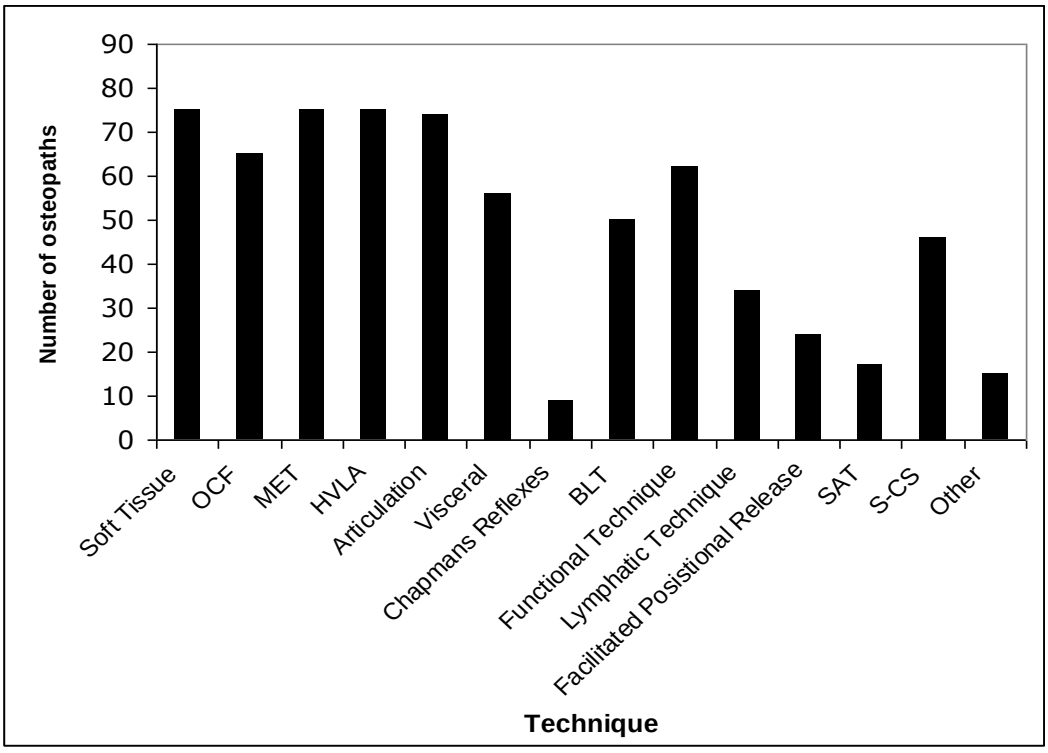

Figure 3. Techniques used by respondents

To better understand preferred techniques osteopaths were asked to select from those techniques they used, their favourite techniques ranked in order 1 (first choice) to 3 (third choice). The technique most often rated as favourite was soft tissue (31.65%) followed by OCF (18.99%) then articulation (16.66%). The most chosen second choice for favourite technique was articulation (21.52%), followed by HVLA (17.72%) and soft tissue (16.46%). The most popular third choice for favourite technique was HVLA (26.58%), followed by soft tissue (17.72%) and articulation (12.66%). These choices are presented in Figure 4.

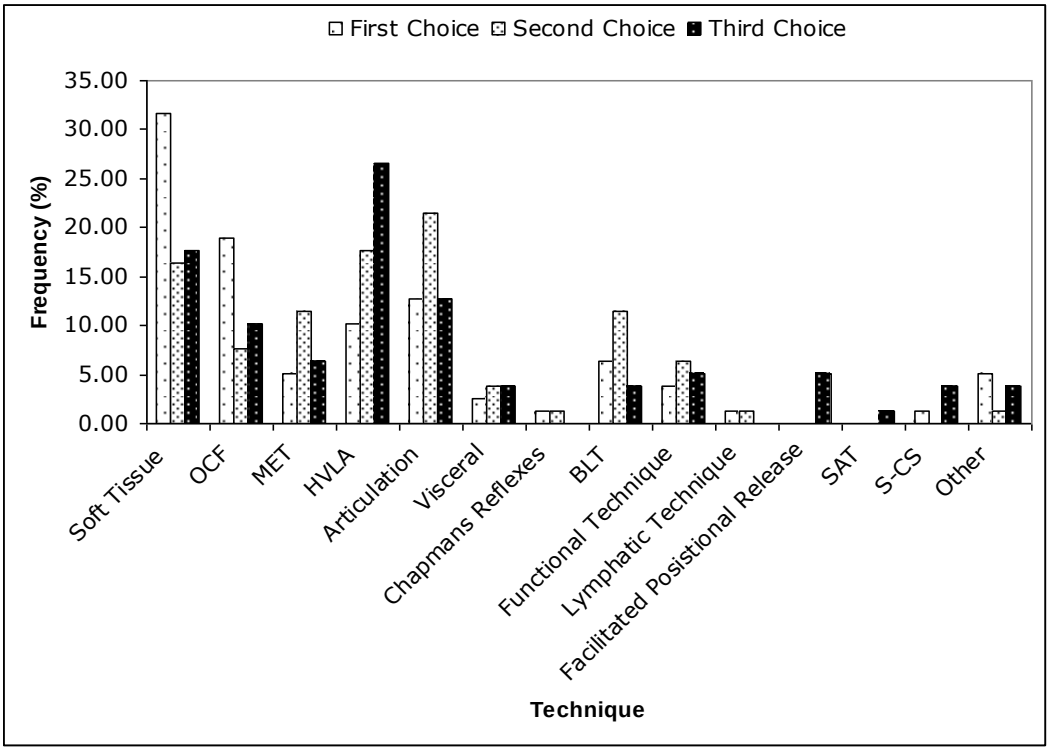

Figure 4. Favourite techniques ranked one to three by respondents.

Respondents were asked how often they would use a given technique on their patients. The responses they could choose from were: all patients, majority of patients, half of patients, occasionally, or never. Soft tissue (41 respondents),

articulation (32 respondents) and OCF (12 respondents) were the techniques most often used on all patients (see Figure 5.).

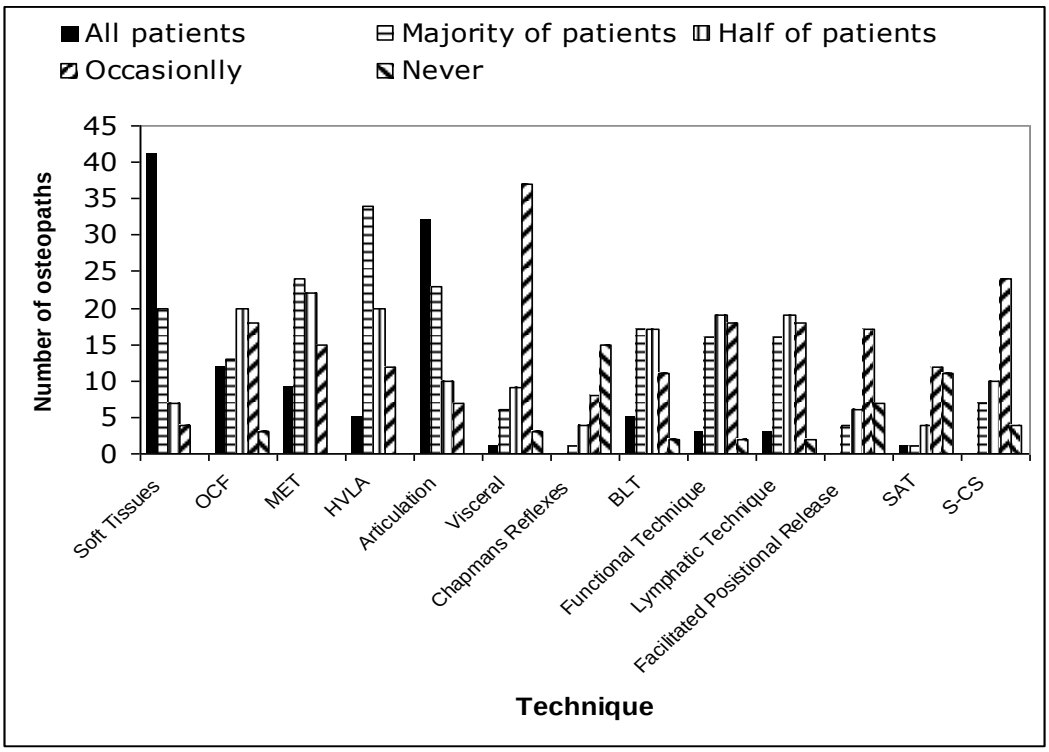

Figure 5. Frequency of techniques used on patients by respondents

The technique choices were merged into direct and indirect techniques. Direct techniques were: soft tissue, MET, HVLA and articulation; the indirect techniques were: OCF, visceral, BLT, functional and S-CS. Respondents who practiced direct techniques on all of their patients were more likely to have a WRMSD (OR = 1.96, 95% CI = 0.30 to 12.70; RR = 1.05). Those respondents who chose indirect techniques as their first choice of favourite technique were less likely to have a WRMSD (OR = 0.70, 95% CI = 0.07 to 7.09; RR = 0.98). The data prior to collapsing the technique choices can be found in Appendix C.

4.5 Work Related Musculoskeletal Disorders

From the sample of 79 respondents 97.3% reported the occurrence of a WRMSD in their career. Table 3. presents this by age bracket.

Table 3.

Occurrence of WRMSD among osteopaths surveyed

	RESPONDENTS WITH WRMSD		**RESPONDENTS WITHOUT WRMSD**	
AGE	**NUMBER**	**PERCENTAGE**	**NUMBERS**	**PERCENTAGE**
20 – 29 YEARS	**18**	**23.70%**	**1**	**1.31%**
30 – 39 YEARS	**13**	**17.10%**	**1**	**1.31%**
40 – 49 YEARS	**24**	**31.57%**	**1**	**1.31%**
50 + YEARS	**16**	**21.05%**	**2**	**2.63%**

Table 4. shows the occurrence of WRMSDs among respondents by anatomical site for the last 12 months. From 72 respondents, 43 reported a wrist/hands WRMSD (59.72%), 37 reported the lower back as a site of WRMSD (51.39%), and 34 reported the head/neck region (47.22%).

Table 4.

Frequency of WRMSD by site for respondents for the last 12 months

	RESPONDENTS REPORTING A WRMSD	
SITE OF WRMSD	**NUMBER**	**PERCENTAGE**
HEAD/NECK	**34**	**47.22%**
SHOULDERS	**29**	**40.28%**
UPPER BACK/THORAX	**33**	**45.83%**
ELBOW/FOREARM	**26**	**36.11%**
LOW BACK	**37**	**51.39%**
WRIST/HANDS	**43**	**59.72%**
THUMBS	**20**	**27.78%**
HIPS/THIGHS	**2**	**2.78%**
KNEES	**3**	**4.17%**
ANKLES/FEET	**6**	**8.33%**

Table 5. shows how respondents altered their practice in response to having a WRMSD. It was uncommon for respondents to reduce their hours or take time off from work, and 39.09% of respondents did not change how they treated as a result of a WRMSD.

Table 5.

Alterations in osteopaths practice as a result of a WRMSD

	TOOK TIME OFF WORK:		REDUCED THE HOURS WORKED:		ALTERED THE WAY YOU TREATED:		DID NOT C YOU TREA
SITE OF WRMSD	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE	NUMBER
HEAD/NECK	2	5.26%	2	5.26%	13	34.21%	21
SHOULDERS	2	7.69%	2	7.69%	12	46.15%	10
UPPER BACK/THORAX	0	0%	1	31.3%	14	43.75%	17
ELBOW/FOREARM	0	0%	0	0%	18	72.00%	7
LOW BACK	0	0%	2	4.88%	26	63.41%	13
WRIST/HANDS	2	5.00%	2	5.00%	29	72.50%	7
THUMBS	0	0%	1	5.00%	17	85.00%	2
HIPS/THIGHS	0	0%	0	0%	1	20.00%	4
KNEES	0	0%	0	0%	1	14.29%	6
ANKLES/FEET	0	0%	0	0%	1	11.11%	8

Those respondents with a WRMSD were asked if they sought treatment and if so from whom. Treatment was often sought from an osteopath; however this did depend upon the site of the WRMSD (see Table 6.). Of respondents with a WRMSD 32.36% sought no treatment.

Table 6.

Treatment sought for WRMSD for each site

	NO		YES, FROM A DOCTOR (GP)		YES, FROM AN OSTEOPATH		YES, FRO HEALTH C PRACTITI
SITE OF WRMSD	**NUMBER**	**PERCENTAGE**	**NUMBER**	**PERCENTAGE**	**NUMBER**	**PERCENTAGE**	**NUMBER**
HEAD/NECK	**6**	**15.38%**	**0**	**0%**	**31**	**79.49%**	**2**
SHOULDERS	**5**	**19.23%**	**0**	**0%**	**14**	**53.85%**	**7**
UPPER BACK/THORAX	**5**	**14.70%**	**0**	**0%**	**25**	**73.53%**	**4**
ELBOW/FOREARM	**11**	**44.00%**	**0**	**0%**	**8**	**32.00%**	**6**
LOW BACK	**7**	**17.00%**	**0**	**0%**	**29**	**72.50%**	**4**
WRIST/HANDS	**22**	**53.67%**	**0**	**0%**	**13**	**31.71%**	**6**
THUMBS	**11**	**68.75%**	**0**	**0%**	**4**	**25%**	**1**
HIPS/THIGHS	**2**	**50.00%**	**0**	**0%**	**2**	**50.00%**	**0**
KNEES	**4**	**57.14%**	**0**	**0%**	**2**	**28.60%**	**1**
ANKLES/FEET	**5**	**55.55%**	**0**	**0%**	**3**	**33.33%**	**1**

To gauge the severity of the WRMSD that respondents were reporting any symptoms lasting greater than 3 days were recorded (see Figure 6.); in most sites the majority of respondents reported their symptoms lasting greater than 3 days, the exception was WRMSD of the hips/thighs.

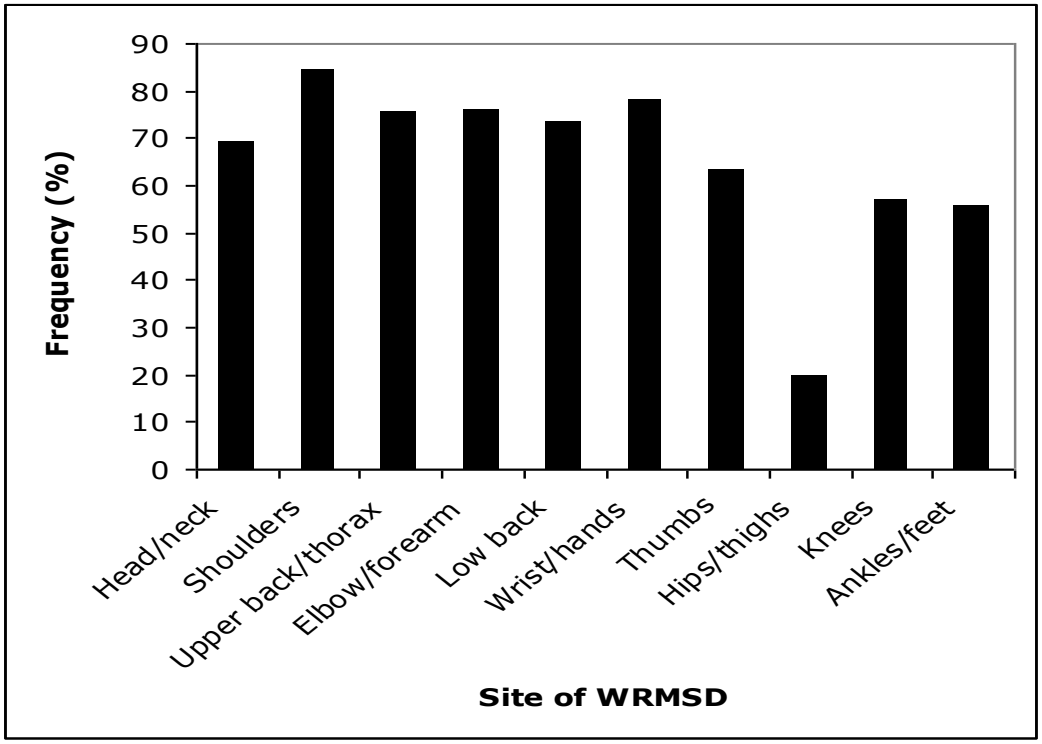

Figure 6. Frequency of respondents who had WRMSD symptoms for greater than three days by site

Respondents were presented with a list of factors that typically contribute to the development of WRMSD among physical therapists. They were asked to rate whether they felt a factor was relevant to their WRMSD(s). When considering strongly agree and agree the factors most highly rated as contributing to a WRMSD were: performing the same task over and over, 63 respondents (86.30%); treating a large number of patients in a single day, 63 respondents (82.89%); continuing to work when injured or hurt, 58 respondents (79.45%); and performing manual osteopathic techniques 53 respondents (69.74%).

Table 7.

Factors contributing to the respondents WRMSD

	STRONGLY AGREE		AGREE		NEITHER DISAGREE NOR AGREE		DISAGREE		STRONGLY DISAGREE	
	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
PERFORMING MANUAL OSTEOPATHIC TECHNIQUES	**22**	**28.95%**	**31**	**40.79%**	**11**	**14.50%**	**10**	**13.20%**	**2**	**2.63%**
PERFORMING THE SAME TASK OVER AND OVER	**24**	**32.88%**	**39**	**53.42%**	**5**	**6.95%**	**4**	**5.48%**	**1**	**1.37%**
TREATING A LARGE NUMBER OF PATIENT IN A SINGLE DAY	**29**	**38.16%**	**34**	**44.74%**	**5**	**6.58%**	**6**	**7.89%**	**2**	**2.63%**
NOT ENOUGH REST BREAKS DURING THE DAY	**13**	**17.80%**	**36**	**49.31%**	**7**	**9.59%**	**11**	**15.07%**	**6**	**8.22%**
WORKING IN AWKWARD OR	**16**	**21.62%**	**24**	**32.43%**	**11**	**14.86%**	**16**	**21.62%**	**7**	**9.46%**

CRAMPED POSITIONS										
WORKING IN THE SAME POSITION FOR A LONG PERIOD	**14**	**19.44%**	**30**	**41.67%**	**8**	**11.11%**	**14**	**19.44%**	**6**	**8.33%**
BENDING OR TWISTING YOUR BACK IN AN AWKWARD WAY	**15**	**20.83%**	**28**	**38.89%**	**8**	**11.11%**	**14**	**19.44%**	**7**	**9.72%**
REACHING OR WORKING AWAY FROM THE BODY	**12**	**17.14%**	**26**	**37.14%**	**11**	**15.71%**	**16**	**22.86%**	**5**	**7.14%**
UNANTICIPATED SUDDEN MOVEMENT OR FALLS BY PATIENT	**8**	**11.11%**	**14**	**19.44%**	**14**	**19.44%**	**22**	**30.56%**	**14**	**19.44%**
ASSISTING PATIENT DURING GAIT ACTIVITIES	**0**	**0.00%**	**2**	**2.78%**	**27**	**37.50%**	**25**	**34.72%**	**18**	**25.39%**
LIFTING OR TRANSFERRING DEPENDENT	**5**	**6.94%**	**22**	**30.56%**	**15**	**20.83%**	**15**	**20.83%**	**15**	**20.83%**

OR HEAVY PATIENTS										
WORKING WITH CONFUSED OR AGITATED PATIENTS	**2**	**2.78%**	**6**	**8.33%**	**25**	**34.72%**	**22**	**30.56%**	**17**	**23.61%**
CARRYING, LIFTING OR MOVING HEAVY MATERIALS OR EQUIPMENT	**6**	**8.33%**	**18**	**25.00%**	**11**	**15.28%**	**20**	**27.78%**	**17**	**23.61%**
WORKING AT OR NEAR YOU PHYSICAL LIMITS	**10**	**13.89%**	**29**	**40.28%**	**17**	**23.61%**	**8**	**11.12%**	**8**	**11.12%**
CONTINUING TO WORK WHEN INJURED OR HURT	**18**	**24.66%**	**40**	**54.79%**	**7**	**9.59%**	**5**	**6.85%**	**3**	**4.11%**
WORK SCHEDULING (OVER TIME, IRREGULAR	**8**	**10.81%**	**32**	**43.24%**	**17**	**22.97%**	**12**	**16.22%**	**5**	**6.76%**

HOURS, LONG WORK DAY)										
INADEQUATE TRAINING IN INJURY PREVENTION	**6**	**8.45%**	**15**	**21.13%**	**20**	**28.17%**	**22**	**30.99%**	**8**	**11.27%**

4.6 Additional Comments

The last two items of the questionnaire were open-ended questions, designed to allow the respondent a place where they would be able to add anything important they felt had been missed. The first questions asked was ‘have you anything you would like to add concerning work related musculoskeletal disorders’; 30 osteopaths responded to this question of whom 9 provided answers relevant to the question.

The majority of answers showed self-awareness regarding factors that contributed to their occurrence of a WRMSD. These comments included observations on their own work technique: “I am sure my symptoms are related to sitting in static positions for most of working a day…” and “I have found that many problems stemming from my work are my own fault - poor operator positioning etc…”. Some respondents felt that it was important to maintain their own fitness: “staying strong and fit really helps me” and “need to know about yoga, Pilates etc for our own… benefit”. Only one respondent mentioned a deficiency in education regarding injury prevention, and one other respondent noted that they “probably need longer spells off work to achieve better recovery”.

The second open question was ‘have you any other comments’, 28 osteopaths replied from which 11 were considered relevant to this study. Comments included the importance of self awareness while practicing especially with regard to “well designed” and “adjustable tables”, and also with

body symmetry: “consider osteopaths usually use their same side to perform techniques, leading to body asymmetry”.

One respondent mentioned: “it is fortunate that we can vary hugely what we do, so we should be able to self manage our musculoskeletal dysfunction”, suggesting that because of the range of techniques available an osteopath can manage the state of their own ease/dis-ease. Another respondent offered a directly contrasting perspective: “effective treatment tends to direct further application of technique rather than practitioner discomfort. So patient expectation/reputation of practitioner tends to trap the practitioner in a certain style regardless of wear and tear”. This speaks to the importance of patient expectation in the selection of technique.

A common theme found in the answers to the two open ended questions was self-awareness, the idea that the way in which the practitioner used their body precluded the occurrence of a WRMSD. Included in this was the concept prophylactic regimes, whether yoga, gym or Pilates. This suggests that the respondents were aware of WRMSDs and in their own way were trying to control against them.

CHAPTER 5 DISCUSSION

5.1 Overview

The aims of this study were threefold firstly, to determine the prevalence of WRMSDs secondly, to determine risk factors for the occurrence of WRMSDs and thirdly, to investigate any possible association between preferred techniques and the development of WRMSDs. It appears that, in this study, osteopaths by a large majority had sustained a WRMSD and in many cases more than one in their career. Respondents most commonly suffered WRMSDs in the wrist/hands, head/neck, and upper back/thorax; the factors most respondents identified as contributing to their WRMSDs were performing the same task repetitively, treating a large number of patients in a single day, continuing to work when injured, and performing manual osteopathic techniques. The preferred technique modalities identified by respondents were soft tissue, OCF, and articulation. There was a positive effect between preferred techniques and the occurrence of WRMSDs.

5.2 The Survey

Judging from the responses the questionnaire could be further developed and streamlined. The response rate was lower than initially hoped, although it is a common occurrence in surveys of the medical profession (Asch, Jedrziewski,

& Chrisakis, 1997). A study by Kaplowitz et al (2004) found no significant difference between mail and email survey response rate with prior notification to the sample population; the response rates from the study were found to be between 20.7 and 31.5%, suggesting this study's response rate of 41.6% was fairly robust. Young (2005) claims that surveys of physicians often have high validity even with lower response rates than the general public. One hindrance to a higher response rate in this study was the difficulty in accessing the e-mail addresses of every osteopath in New Zealand. Not all osteopaths publicly list their e-mail address and the Osteopathic Council were unwilling to facilitate initial contact with osteopaths.

Comparison of this project's demographic data with the national osteopathic workforce suggests respondents to this survey comprised a fairly representative sample in sex and age distribution when compared to that found in the general population. The survey respondents were approximately 50% male and 50% female which resembles the general population. By age group there was a higher predominance of younger respondents than found in the population as a whole. It is possible that using the internet as a data collection method skews the respondents towards younger age groups, however judging from the e-mails of encouragement received while gathering data an alternate explanation could be that recent graduates are more understanding of the difficulty of research and therefore more likely to help by participating.

5.3 Prevalence

Virtually all respondents of the survey had suffered a WRMSD, which was higher than expected. Previous research investigating osteopaths within New Zealand reported a 69.23% WRMSD prevalence rate (Peat, 2004). Comparison to other research is difficult because the data are quite spread and there is a lack of similar research performed on osteopaths, however research on physiotherapists in Australia and health professionals in Beijing both report similar WRMSD rate, 91% and 92.2% respectively (Cromie, Robertson, & Best, 2000; Smith, Zhang, Zheng, Zhang, & Wang, 2006).

This large spread in the prevalence of reported WRMSD could be attributed to the lack of consensus in defining a WRMSD. WRMSD is not a clinical diagnosis, but rather it is an umbrella term, and only one of many umbrella terms that are currently used around the world to describe musculoskeletal injuries related to the workplace. In each country different definitions of WRMSD are used and often the definition will come with clinical diagnoses so that only certain diagnoses can be considered as a WRMSD. This is a problem within any research in this field, as there is inadequate operational definitions for WRMSD and the conditions that fall under the WRMSD umbrella (Boocock et al., 2005). It would be important to identify internationally agreed diagnoses that fall under the WRMSD umbrella. At the very least, conformity of terminology must occur in the research setting in order to generalise findings.

Another explanation of this variance in prevalence would be that this study used osteopaths, not physiotherapists or other health professionals. The way physiotherapists practice is different from osteopaths. Not only are the techniques used different but also physiotherapists often work within hospitals or rehabilitation facilities (Ministry of Health, 2008). In these environments clinical practice would likely be different, for example the patients may be more dependent having recently been in surgery or recovering from an illness. This would impact on treatment and modify the risk factors for WRMSDs. As for “health professionals”, this term is vague and could likely include nurses, surgeons, osteopaths and physiotherapists, making direct comparison of dubious worth.

The most frequently injured sites indicated by respondents (the wrist/hands, low back and head/neck) were similar to previous data reported on New Zealand osteopaths (Peat, 2004), physiotherapists and occupational therapists (Bork et al., 1996; Cromie, Robertson, & Best, 2000; Holder et al., 1999; Mierzejewski & Kumar, 1997). The difference was that upper back pain was reported more often than head/neck pain. Upper back pain was reported as the fourth most common source of pain among respondents to this questionnaire. A possible explanation may be because members of the OSNZ practice OCF more frequently than the subjects used in previous research, because OCF is often practiced seated with your elbows supported (Ward, 2003). A position that supports your upper back possibly making it less likely to be injured, but one that may make the practitioner more likely to round their shoulders and protrude their chin, thereby jeopardizing their head/neck.

Another consideration alongside prevalence data is the background rate of injury within the profession. Every profession has a repetitive motion or repeated posture that is used most days. After a number of years this may cause a WRMSD, however, it would be helpful to make a distinction between what could be called an expected injury and an accident causing an injury. Expected injuries would be a WRMSD that is commonly seen within the profession; whereas an accident causing an injury might be an injury that is work related but not typically seen in the patients occupation or an injury that is sustained outside of expected parameters. For example being diagnosed with carpal tunnel syndrome after one week of working in a data entry role. Being able to distinguish WRMSDs in this manner would allow organizations like ACC to forecast based upon expected injury types. If a profession was then exhibiting high rates of unusual injuries appropriate occupational safety and health procedures could be reviewed.

5.4 Favourite Techniques & the Development Work Related Musculoskeletal Disorders

From the fourteen technique choices available, soft tissue, OCF, articulation and HVLA were the most popular (in that order). In comparison, recent research performed in America, 955 respondents rated soft tissue, HVLA, MET, and S-CS as the top four preferred techniques (Johnson & Kurtz, 2003). Soft tissue techniques and HVLA were rated in the top four in both cases, in

the project MET and S-CS were rated sixth and eighth respectively. In the American research OCF was rated as the least popular technique, while in New Zealand respondents have rated OCF as the second most popular technique.

One explanation for the difference in popularity could be the different way in which osteopathy is represented in New Zealand and America. Osteopathy in America is closely related to allopathic medicine; 26% of osteopathic practitioners surveyed never use osteopathic manipulative techniques (OMT), and 50% said they only use OMT on less than 5% of their patients (Johnson & Kurtz, 2003). Allopathic medicine is heavily influenced by the evidence-based paradigm, which rejects intuitive and unsystematic approaches in favour of methodical clinical decision making derived from the latest research (Keith, 1999). OCF is a contentious field and one that perhaps least fits the tenets of evidence-based medicine (Hartman & Norton, 2002; Moran & Gibbons, 2001).

Another explanation for this large difference in the popularity of OCF in New Zealand could be that the New Zealand sample was taken from the OSNZ. It could be that members of the OSNZ are more inclined to use OCF than members of the osteopathic population at large due to OCF education being a fairly recent addition in NZ osteopathy teaching and recent graduates have tended to join the OSNZ compared with their peers who have been in practice for a longer period of time. It is interesting to note however, that after the first choice of favourite techniques were organised into direct and indirect techniques, the direct techniques rated more highly as the favourite group of

techniques, which was the same result as the American study (Johnson & Kurtz, 2003).

When comparing respondents who favoured direct techniques to those who favoured indirect techniques there was a slight increased risk for WRMSDs. This increased risk was small and not statistically significant, however as there was an effect (relative risk close to 1 in both techniques), a positive relationship between direct techniques and an increased risk of WRMSDs should not be ignored. Anecdotally, direct techniques inherently involve more biomechanical risk factors therefore; it would be reasonable to expect that there would be more risk involved.

5.5 Risk Factors & Consequences

Not all the job related risk factors were relevant to all respondents. For example most osteopaths work in a private practice where physiotherapists also work in hospital settings (Ministry of Health, 2008). In a hospital setting patients are typically more dependent (Bork et al., 1996), requiring assistance with gait activities and may be confused or agitated because of medications. These situations occur less frequently in private practice.

Performing the same task repeatedly as a risk factor was highly rated by respondents and calls into question the wisdom of practicing in such a way. While repetition of a technique may lead to increased ability in force transference there is a point where it becomes disadvantageous. In other

industries often the concepts of job rotation and variety in work are employed to avoid overloading any particular anatomical area, either by sustained postures or by repetitive activities. It is known that repetitive activities are a risk factor for WRMSDs (Latko et al., 1999; Malchaire, Cock, & Vergracht, 2001). Alternating work activities that allow breaks in repetitive or maintained activities is essential in the prevention of cumulative trauma injuries (Kroemer, 1989). Osteopathy includes a variety of different techniques, enabling an osteopath to choose a range of different techniques that would place varying stresses on different areas of the body. For example if a practitioner is experiencing pain in their thumb they could use the heel of the hand or their elbow as an applicator of force when performing technique. In this way an osteopath could ensure that they vary their workday and thereby reduce exposure to a WRMSD risk factor. It appears that the wide range of techniques available may not be used to their full, however this is not a conclusion that can be drawn from the data at hand, but could possibly a topic for future research.

Respondents also rated performing manual osteopathic techniques as a WRMSD risk factor. Manual osteopathic techniques are similar to many techniques used by physiotherapists and chiropractors. These techniques are often reported by these professions as a risk factor for WRMSDs. Performing manual osteopathic techniques can be very laborious, however there is a large range of techniques available, and the choice of technique belongs to the osteopath. For example a repetitive articulatory technique would be more

physically taxing than a single application of HVLA technique, and an OCF technique would require a minimum of physical labour.

An osteopath's knowledge of WRMSDs and anatomy/physiology allows an insight into risk factors inherent in different techniques. Coupled with the wide range of techniques available this knowledge may allow the osteopath a limited control over their work-related musculoskeletal health; however, this presupposes that the osteopath is self-aware, and has an extensive knowledge of technique and WRMSD risk factors.

Furthermore, it could be argued that those techniques that remain as part of the osteopathic curriculum are the best and most efficient. Natural selection may mean that the techniques that are now practised are the most safe and effective. If one accepts this theory then it may be that the respondents have been incorrectly using these techniques. Rather than the osteopathic technique it may be the way in which it is employed that places the practitioner at risk of the development of a WRMSD (e.g. an articulatory technique performed with the plinth a too low a level will cause the practitioner to bend excessively and thereby place strain on the low back).

Treating a large number of patients in a single day was rated highly by respondents as a contributing factor to the development of WRMSDs. Osteopaths are usually self-employed in private practice, which allows the practitioner to work autonomously, and control the number of patients seen in anyone day. Hence booking large numbers of patients each day probably

reflects a desire for increased income. Similarly, continuing to work when hurt or injured, which also rated highly, may illustrate the need to keep working when you are self-employed as you are unable to claim sick days. If practitioners have become accustomed to a level of financial comfort or have debt that requires repayment, they may feel like there is no other option but to continue work. It seems that there is a relationship between the way respondents run their practice and their musculoskeletal health, where these issues directly relate to the income of the individual. If a practitioner is suffering from a WRMSD some of the onus for rehabilitation is on them. The practitioner has a cost/benefit decision to make, their musculoskeletal health or financial gain.

Respondents would often not reduce the hours worked or take time off when recovering from a WRMSD, and over a third of respondents did not change how they treated in response to a WRMSD. However, treatment for these injuries was sought from a variety of health providers. Most often treatment was from fellow osteopaths and interestingly not one of the respondents used the services of a general practitioner. It could be that osteopaths are aware of their injuries and realize that it does not require the attention of a GP. Alternatively it could be that osteopaths do not value the services provided by a GP, but it is not possible to tell with the data in this study. It would be helpful to contextualize this by considering what WRMSD each respondent suffered; unfortunately these data were not gathered.

5.6 Limitations

In this project a cross-sectional design was employed, therefore general inferences or cause and effect relationships cannot be drawn from the results. A second limitation of this project is the reliance on self-reported data. With all self-reported data there is a possibility that individuals with symptoms tend to over or under estimate their exposure. In this project, some therapists with injuries may have overestimated the number of hours per week they spent performing techniques they subsequently perceived as contributing to the injuries.

Osteopaths are trained to understand WRMSDs and their causes, which lends some credibility to their self-reported symptoms, but at the same time it may make them more self-aware than other populations, possibly making them likely to over-report symptoms. There is little evidence to support either of these views, and further research is necessary to clarify the accuracy of the self-reporting of symptoms by osteopaths.

This project had a low response rate, 41.6%. To encourage more respondents an incentive raffle (e.g. an Ipod) could have been used. Alternatively the e-mail invitations could have been sent to all registered osteopath in New Zealand, rather than just those registered and listed with the OSNZ.

The questions in the questionnaire were not thoroughly validated; however, all the questions came from previously published research, and were tested for

face validity. They were otherwise constructed for this project, and have not been formerly validated. The data should be taken at face value.

5.7 Implications for Future Research

If the questionnaire used in this study were to be reused some questions should be revised as they either caused confusion or were too similar to another question. Question 9 caused confusion; osteopaths did not clearly think of techniques as favourites, which resulted in many emails requesting clarification. Commonly it was ranking the techniques that proved difficult, the question may be better asked by requesting only for the most favourite or preferred technique. Questions 13 and 15 gathered similar data. In analysis question 13 provided more useful data, so question 15 was unnecessary. Questions 17 and 18 provided little information of use, however there are good reasons for including an open-ended question at the end of a predominately closed question survey; hence one of these would probably suffice, alternatively different questions could be used.

To better understand the relationship between WRMSDs and technique a longitudinal research design could be used. This would allow more accurate data collection and give more rigour to the research conclusions. To facilitate more accurate recording of WRMSDs researchers could provide templates for respondents to complete at the time of the injury, rather than retrospectively reporting on injuries. Data could be collected on the site, type of injury, aggravating and relieving factors, maintaining factors and aetiology.

Alternatively video analysis of practitioners performing their favoured technique could allow ergonomic analysis to quantitatively record any known risk factors. This would best be done before the practitioner had sustained a WRMSD, as it is known that some practitioners modify their technique in response to an injury (Cromie, Robertson, & Best, 2000).

As OCF appears to be disproportionately more popular in New Zealand than in America, researchers could interview osteopaths about the reasons they either do or do not use OCF and why. Interviews could be carried out with New Zealand osteopaths and American osteopaths via the use of Skype or a similar Internet based video conferencing service.

5.8 Recommendations

The results of the study highlight the high frequency of WRMSD in New Zealand osteopathy; however, osteopaths do not feel as if their training in injury prevention was inadequate and did report repetition of technique as a risk factor, possibly indicating an underlying lack of technique variety among respondents, whether because respondents are unwilling to practice another way or are no aware of other technique options is unknown.

Formal techniques classes for practicing osteopaths in New Zealand would be beneficial. Technique classes would provide opportunity for practitioners to further refine and master techniques they frequently use, learn new

techniques, refresh injury prevention strategies, and receive feedback from peers. This could be organised regionally by each peer group and contribute towards compulsory Continued Professional Development. As respondents reported working when injured or treating large numbers of patients in a single day as risk factors, the proposed technique groups could provide an opportunity to engage osteopaths on the issue of workload; either by written material or open discussion.

5.9 Conclusion

Work Related Musculoskeletal Disorders (WRMSDs) have been shown to reduce job satisfaction, clinical efficacy, and personal safety in a variety of healthcare settings (e.g. physiotherapy, nursing, chiropractic). The purpose of the present study was to determine the prevalence of such disorders in a NZ Osteopathic context. Analysis of data indicated a 97.3% WRMSD prevalence rate. Respondents most commonly suffered WRMSDs in the wrist/hands, head/neck, and upper back/thorax.

The high prevalence of WRMSDs among osteopaths illustrates the need for a range of easily accessible strategies to reduce risks posed by their work and avoid injury. Most importantly, there is need for further research to identify specific techniques as risk factors so that adequate injury prevention protocols can be introduced.

Direct techniques were the most popular yet OCF was more popular than comparisons to America would indicate. When compared to indirect techniques, there was an increased risk to WRMSDs for those who either preferred direct techniques or practiced them on all patients.

A relationship between income and the osteopath's musculoskeletal health was reflected in the reported risks of treating a large number of patients in a single day and treating while injured. Respondents also perceived repetition as a risk factor. This seemed counter intuitive initially as it was assumed that with a large range of different techniques at their disposal and knowledge of WRMSDs and their aetiology an osteopath would be able to change technique as needed; thereby spreading the load and preventing injury at any one anatomical site. Highlighting a need for a review of osteopathic workloads and possibly reflecting a need for education in a breadth of technique.

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APPENDIX A

INFORMATION SHEET

Dear participant,

Hello, my name is Greg Fitchew. I am a fifth year osteopathic student at Unitec, undertaking a research dissertation as part of my Master of Osteopathy. Along with my supervisor, Clive Standen, I would like to invite you to participate in a study investigating work-related musculoskeletal disorders. The purpose of this study is to establish if an osteopath's preference for certain techniques create a predisposition to a work related musculoskeletal disorder.

With regards to the questions any mention of "work related pain or discomfit" and/or "symptoms" is referring to work related musculoskeletal disorders. I would ask you to use the following definition for identifying any work related musculoskeletal disorder.

"Work Related Musculoskeletal Disorder is an umbrella term for which repetitive strain injury, repetitive trauma disorder and cumulative trauma disorder are used interchangeably (Szabo, R., & King, K.; 2000)".

Essentially, the injury is work related but could possibly have aetiological factors that are found outside the workplace. The injury would be of the musculoskeletal system and is not limited to occupational overuse, repetitive strain, repetitive trauma or cumulative trauma.

We are interested in your opinion and the way that you work in practice; not the opinions of others or the way you may think you should practice. The scales do not require you to have had clinical experience with patients or specific knowledge about pain science.

Please answer ALL of the questions by marking the relevant options with the answer that best represents your views.

This questionnaire will be emailed out to all registered NZ osteopaths, giving two weeks before a second distribution is anticipated, targeting the non-responders. Use of this internet survey host defines those who have and have not responded independent from the results; preserving full anonymity. Participants are asked not to identify themselves. Return of questionnaires is taken as IMPLIED CONSENT for participation in the study. It is up to you whether you decide to participate.

Please remember this is not assessing your knowledge. There are no anticipated risks involved in this study as we are asking for your views and opinions. However, if you do have questions about the study do not hesitate to contact any of the investigators below:

Contacts:

Greg Fitchew
Unitec NZ
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021 349 979

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Your voluntary contribution is appreciated. By participating in research such as this, you are assisting in extending the literature base and investing in the future of Osteopathy.

UREC application number 2009-925: approved for the period of 10/02/09 until 10/02/10.

APPENDIX B

QUESTIONNAIRE

Work Related Musculoskeletal Disorders among Osteopaths practising in New Zealand: The prevalence, associated risk of preferred techniques, perceived risks and consequences.

1. Age?

2. Height (cm)?

3. Weight (kg)?

4. Sex?

Female	
Male	

5. Work status (please choose one)?

Full time	
Part time	
Casual	
Other (please specify)	

6. What year did you graduate?

7. How many years have you been practicing osteopathy?

8. On average, per week how many hours would you spend in direct patient contact?

9. What treatment modalities do you use (tick all that apply)?

Soft tissue	
Osteopathy in the Cranial Field (OCF)	
Muscle energy technique (MET)	
High velocity low amplitude technique (HVLA)	
Articulation	
Visceral	
Chapmans Reflexes	
Balanced ligamentous tension (BLT)	
Functional technique	
Lymphatic technique	
Facilitated positional release	

Specific adjustment technique (SAT)	
Strain-counter strain (S-CS)	
Other (please specify)	

10. With what frequency do you use each treatment modality?

	All of patients	Majority of patients	Half of patients	Only occasionally	Never
Soft tissue					
Osteopathy in the Cranial Field (OCF)					
Muscle energy technique (MET)					
High velocity low amplitude technique (HVLA)					
Articulation					
Visceral					
Chapmans Reflexes					
Balanced ligamentous tension (BLT)					
Functional technique					
Lymphatic technique					
Facilitated positional release					
Specific adjustment technique (SAT)					
Strain-counter strain (S-CS)					

11. What is the treatment modality you most favour (please choose one)?

Soft tissue	
Osteopathy in the Cranial Field (OCF)	

Muscle energy technique (MET)	
High velocity low amplitude technique (HVLA)	
Articulation	
Visceral	
Chapmans Reflexes	
Balanced ligamentous tension (BLT)	
Functional technique	
Lymphatic technique	
Facilitated positional release	
Specific adjustment technique (SAT)	
Strain-counter strain (S-CS)	

12. Have you ever experienced any work related pain or discomfit in any part of your body?

13. In the last 12 months have you had any work related musculoskeletal symptoms at all (please indicate the site)?

Neck	
Shoulders	
Upper back/thorax	
Low back	
Wrist/hands	
Thumbs	
Hips/thighs	
Knees	
Ankles/feet	

14. Have the symptoms you noted in question 13 prevented you from working (please indicate severity by crossing through choice)?

Neck	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated
Shoulders	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated
Upper back/thorax	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated
Low Back	Took time off from work
	Reduced the hours worked
	Altered the way you treated

	Did not change the way you treated
Wrist/hands	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated
Thumbs	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated
Hips/thighs	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated
Knees	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated
Ankles/feet	Took time off from work
	Reduced the hours worked
	Altered the way you treated
	Did not change the way you treated

15. Did you seek treatment for the symptoms you noted in question 13 (please indicate by crossing through choice)?

Neck	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner
Shoulders	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner
Upper back/thorax	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner
Low Back	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner
Wrist/hands	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare

	practitioner
Thumbs	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner
Hips/thighs	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner
Knees	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner
Ankles/feet	No
	Yes, from an osteopath
	Yes, from a doctor (GP)
	Yes, from another healthcare practitioner

16. Of the symptoms you noted in question 13 have you experienced your symptoms for greater than 3 days (please indicate with a tick)?

Neck	
Shoulders	
Upper back/thorax	
Low back	
Wrist/hands	
Thumbs	
Hips/thighs	
Knees	
Ankles/feet	

17. This list describes factors that could contribute to work related discomfort or pain. In your opinion how have the following factors contributed to your work related discomfort or pain?

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
Performing manual osteopathic techniques					
Performing the same task over and over					

Treating a large number of patients in a single day					
Not enough rest breaks during the day					
Working in awkward or cramped positions					
Working in the same position for a long period					
Bending or twisting your back in an awkward way					
Reaching or working away from the body					
Unanticipated sudden movement or falls by patient					
Assisting patient during gait activities					
Lifting or transferring dependent or heavy patients					
Working with confused or agitated patients					
Carrying, lifting or moving heavy materials or equipment					
Working at or near you physical limits					

Continuing to work when injured or hurt					
Work scheduling (over time, irregular hours, long work day)					
Inadequate training in injury prevention					

18. Have you anything you would like to add concerning work related musculoskeletal disorders?

19. Have you any other comments?

APPENDIX C

ADDITIONAL DATA

Techniques used on all Patients and WRMSD

Soft Tissue
OR= 1.04556962
CI= 0.193 - 5.676
SE= 0.863

OCF
OR= 0.405607477
CI= 0.073 - 2.262
SE= 0.877

MET
OR= 0.744360902
CI= 0.035 - 15.692
SE= 1.555

HVLA
OR= 1.545454545
CI= 0.078 - 30.510
SE= 1.522

Articulation
OR= 2.12605042
CI= 0.110 - 41.156
SE= 1.512

BLT
OR= 0.413533835
CI= 0.018 - 9.732
SE= 1.611

Functional Technique
OR= 0.244444444
CI= 0.009 - 6.738
SE 1.692

Preferred Techniques and WRMSD

Soft Tissue
OR= 0.692631579
CI= 0.127 - 3.779
SE= 0.866

OCF
OR= 0.981308411
CI= 0.143 - 6.728
SE= 0.728

MET
OR= 0.744360902
CI= 0.035 - 15.692
SE= 1.555

HVLA
OR= 0.354330709
CI= 0.048 - 2.610
SE= 1.019

Articulation
OR= 2.12605042
CI= 0.110 - 41.156
SE= 1.512

BLT
OR= 0.744360902
CI= 0.035 - 15.692
SE= 1.555

Functional
OR= 0.237410072
CI= 0.009 - 6.542
SE= 1.692

S-CS
OR= 0.237410072
CI= 0.009 - 6.542
SE= 1.692