An investigation into the relationship of myofascial trigger points in the head and neck region in association with temporomandibular joint dysfunction.

BY:

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Chiropractic

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DEDICATION

To my Husband, **Darren**, thank you for insisting that I complete this. Without that and your assistance, I may not have come this far.

To my Boys, **Steven** and **Ethan**, this is for you. I hope you always know how important you are to me.

To **Dad**, thank you for all your support both financially and emotionally. You are the best.

To **Mom**, you have always believed in me and nudged me in the right direction. Thank you.

And finally,

To **all my sisters**, you have always been there for me.

I love you all. Thank you.

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Thank you for all your unfailing support and commitment in assisting me to complete my degree.

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TO

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Thank you for your assistance. Without you it would have taken a lot longer to complete my research.

Abstract

Introduction: The aetiology of Temporomandibular Joint Dysfunction (TMJD) is not fully understood and the treatment of TMJD is controversial. Most treatment plans are based on postulated aetiology. Treatment plans currently range from pharmacological to surgical and occasionally physical therapy is also used for any myofascial component. Myofacial Trigger Points (MFTP's) in the head and neck region have similar pain referral patterns as TMJD and there is overlap in aetiology and epidemiology. If correlation can be proved to exist between the severities of TMJD and MFTP's then the treatment of MFTP's can potentially decrease the severity of TMJD and then the more radical treatments can be avoided.

Objectives: To determine whether TMJD was present and establish severity. To locate any MFTP's in the Sternocleidomastiod (SCM), Temporalis, Masseter, Posterior Cervical (PC), Lateral and Medial Pterygoid muscles and determine their severity.

Methods: A random sample of 25 participants were evaluated. A p value <0.05 was considered as statistically significant. Quantitative variables were summarized using median, inter-quartile range and range due to skewness of distribution, while categorical variables were described using frequency distributions and bar charts. Spearman's nonparametric correlation analysis, and curve estimation were used to determine the existence of a relationship between TMJ severity and MFTP severity. A scatterplot was used to graphically assess the relationship.

Conclusion: The results suggested that the participants were actually chronic neck pain suffers that developed TMJD over the long term as a result of chronic neck pain changing the kinematic biomechanics or as a result of a completely different and independent event as suggested by Foreman and Croft (1995).

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CHAPTER ONE

1.1 Introduction

The temporomandibular joint (TMJ) is part of a kinematic chain including the teeth, the opposite TMJ, the muscles of mastication and the upper cervical complex as well as the posterior cervical musculature (Foreman and Croft, 1995). In this context temporomandibular joint dysfunction (TMJD) refers to a group of non-specific related disorders of the muscles of mastication and the TMJ, but excludes non musculoskeletal disorders in the orofacial region such as neoplastic, vascular or infectious diseases that produce very similar symptoms (Jagger, Bates and Kopp, 1993).

In this regard it is estimated that 85% to 90% of the population will develop some symptoms of TMJD in this form at some point during their life (Souza, 1997), and research has shown that the prevalence of females to males seeking treatment will be 3:1. (McNeill, 1991).

However, the epidemiological estimates of TMJD are confounded by the clinical presence of myofascial trigger points (MFTP's). These are hyperirritable spots within a taut band of muscle and / or its fascia that is tender to palpation and can give rise to referred pain, tenderness and autonomic phenomena (e.g. dizziness, numbness, dysaesthesias) (Gatterman, 1990). In addition MFTP's also cause shortening of the muscle and can give rise to motor dysfunction (Travell and Simons, 1999) e.g. decreased mouth opening. Furthermore, both active (referring pain) and latent (causing stiffness and restricted range of motion) MFTP's are common (Bruce, 1995). In one study it was found that of 164 patients attending a dental clinic for chronic head and neck pain, 55% had a primary diagnosis of myofascial pain syndrome caused by active trigger points (Travell and Simons, 1999).

In addition the epidemiological estimates of TMJD are further complicated by the biomechanics of the muscles of the head and neck which work together forming an integrated system to bring about mandibular and cervical movements as well as postural changes (Foreman and Croft,

1995). The anterior muscles of the neck must balance the posterior muscles of the neck for correct function. Any alteration in these muscles will change this relationship. Thus the TMJ system is affected by disturbances in this balance which may result in derangement and dysfunction (Curl, 1992 and McNeill, 1991). Therefore, it is necessary to investigate and evaluate the role of MFTP's of the superficial muscles of mastication on the clinical presentation of TMJD as well as to explore the role that the TMJ plays within the biomechanical chains of the head and neck and visa versa.

In consideration of the literature, this study was therefore designed to investigate and evaluate the role of MFTP's of the superficial muscles of mastication and the head and neck on the clinical presentation of TMJD. This was done by establishing presence of TMJD and MFTP's and then by evaluating their severity to investigate possibility of correlation.

1.2 Aim and objectives

The aim of this study was to investigate and evaluate the co-existence of MFTP's and TMJD and to correlate severity of MFTP's of the superficial muscles of mastication and head and neck and the severity of TMJD. The role that MFTP's of the superficial muscles of mastication and the head and neck region could have in the clinical presentation of TMJD was thus demonstrated.

- Objective one was to determine the existence of TMJD in the participants of the study.
- Objective two was to determine the severity of the TMJD.
- Objective three was to determine the specific location of MFTP's in the superficial muscles of mastication.
- Objective four was to determine the severity of the MFTP's.
- Objective five required that the research confirms the possibility/type of relationship between the MFTP's and TMJD.

Null Hypothesis

There is no expected relationship / correlation between the signs and symptoms of TMJD and MFTP's.

1.3 Rationale

Literature has postulated that there is a relationship between MFTP's and TMJD (Davies, 2001) but the extent to which this relationship exists has not been documented.

Surgery and dental treatment of TMJD has been widely accepted, however due to the postulated relationship as stated above, it is possible that once the MFTP element is treated the need for surgery will decrease. Conservative treatments need to be considered (Clark and Solberg, 1987).

Research has found that if TMJD develops into a chronic form it is extremely debilitating and impacts on psychosocial interaction (Jagger, Bates and Kopp, 1993) and if there is a strong relationship between its severity and MFTP's, the treatment of these MFTP's would decrease the severity of the signs and symptoms of TMJD and would thus improve quality of life (Clark and Solberg, 1987).

1.4 Benefits

If a relationship between MFTP's and TMJD is demonstrated and a correlation exists between the various participant findings (objectives one and five), then it could be stated that treatment of MFTP's can decrease the signs and symptoms of TMJD and thereby contribute to the effective clinical management of TMJD.

1.5 Pre-existing Limitations

This study was limited to investigating only the extent of the relationship between and the severity of MFTP's in the head and neck region and the severity of TMJD.

This study did not investigate the impact or role that the TMJ plays within the biomechanical or kinematic chains of the head, neck, upper back and shoulder girdle regions or any reverse relationship that may / may not occur.

This study did not investigate the result that Chiropractic treatment of the MFTP's may or may not have had on TMJD.

1.6 Conclusion

To achieve the aim and objectives of this study, Chapter Two will present an outline of the available literature with regard to the relevant anatomy of the TMJ and related musculature as well as the aetiology, pathophysiology, clinical presentation and implications for treatment and management of TMJD and MFTP's. The way in which this will be presented will illustrate the overlap that exists between the two dysfunctions. Chapter Three will then present the methodology employed in obtaining the aim and objectives of this study, with Chapter Four recording the results and presenting the discussion of those results in the context of the literature. Chapter Five will then conclude the dissertation and make recommendations for future studies.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides a review of the available literature on TMJD and MFTP's, particularly those in the head and neck regions, and attempts to highlight the areas of co-existence and correlation between the two. The information reviewed will provide a clearer understanding of the current concepts in the aetiology, incidence, pathophysiology, and treatment of both conditions and the similarities between the two.

2.1 Introduction to Temporomandibular Joint Dysfunction (TMJD)

TMJD or craniomandibular dysfunction refers to a group of non-specific related disorders: of the muscles of mastication and the TMJ (Lawrence, 1991; Jagger, Bates and Kopp et al,. 1994 and Okeson 1996), the structures related to the teeth (Lawrence, 1991) and associated structures which encompass the head and neck region (Camparis et al., 2006). As a result of this non specific definition, synonyms such as TMJ pain dysfunction syndrome, myofascial pain dysfunction and mandibular stress syndrome have often been utilized to refer to TMJD (Lawrence, 1991). This has caused some confusion in the literature as well as in the evaluation of clinical efficacy and effectiveness of different treatment protocols as no set standard definition exists (Broome, 2003), which is further complicated by the fact that all of the above listed "conditions" include symptoms such as decreased or limited mouth opening and pain (Salvinelli, Casale, Paparo, Persico and Zini, 2003).

2.2 Anatomy of the Temporomandibular Joint

The temporomandibular joint or TMJ is a ginglymoarthrodial synovial joint (Moore and Dalley, 1999 and Broome, 2003). Unlike the usual hyaline cartilage that normally lines synovial joints; the articular surfaces (see figure 2.1a) of the TMJ are lined with fibrous connective tissue (Moore and Dalley, 1999 and Broome, 2003).

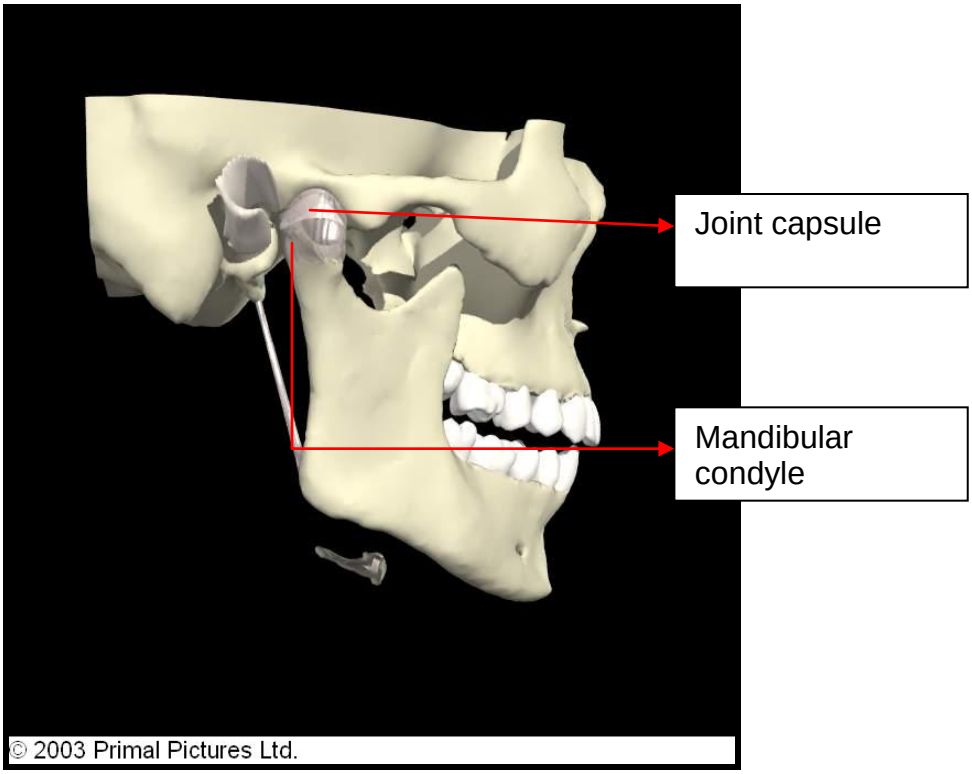

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Figure 2.1a Articular surfaces TMJ

The structure of the TMJ allows the TMJ to be less vulnerable to degeneration and more capable of regeneration, which is important due to repetitious compressive forces e.g. opening and closing the mouth (Good, Proctor, McCarthy, Hill and Lane, 2000). There is an articular disc which is made up of dense, fibrous collagen tissue with two articulating surfaces within the joint (see figure 2.1b). The first surface is the superior surface which articulates with the temporal bone (mandibular fossa), permitting sliding and translatory movements with the mandibular

condyle, whilst the other surface is the inferior surface permitting rotary movement of the condyle around a horizontal axis (Carson, 1986; Lawrence, 1991and Good et al., 2000).

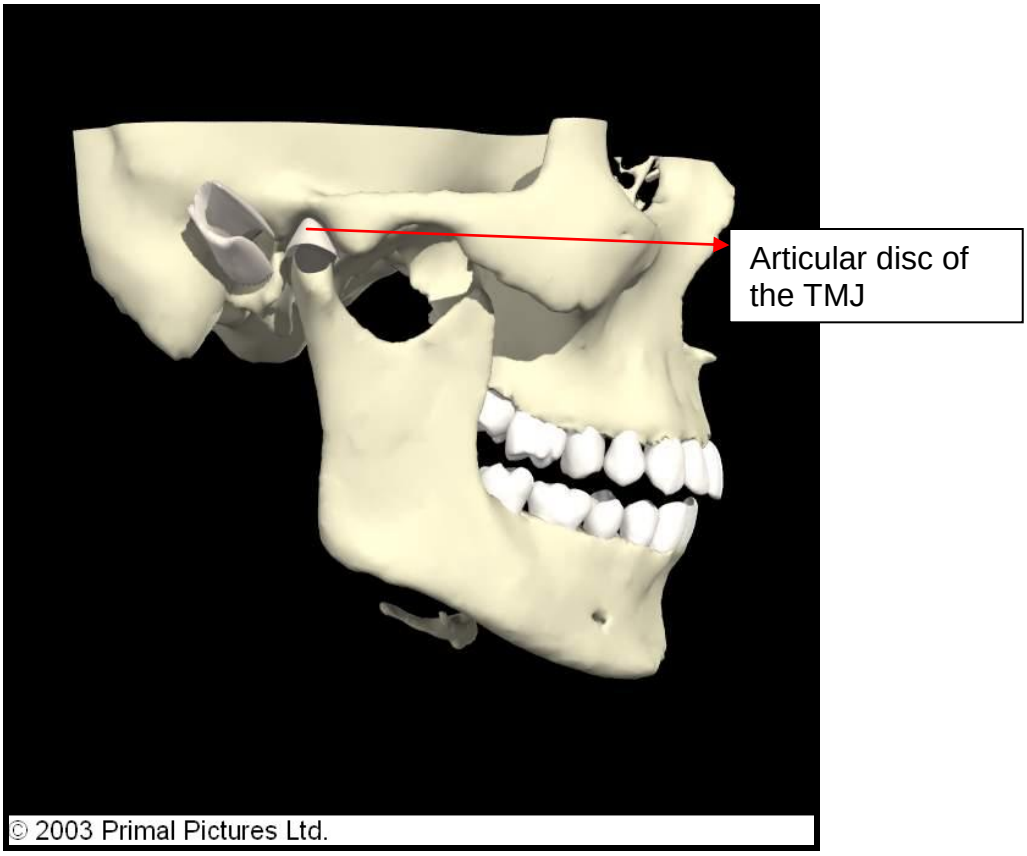

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Figure 2.1b Disc of the TMJ

The TMJ and its periosteum, muscles and tendons receive blood supply from the small branches of the superficial temporal and deep auricular arteries with blood (see figure 2.2a). The deep auricular artery supplies the anterior border of the capsule, and the mandibular condyle through the nutritional foramina (Jagger, Bates and Kopp et al., 1994 and Moore and Dalley, 1999).

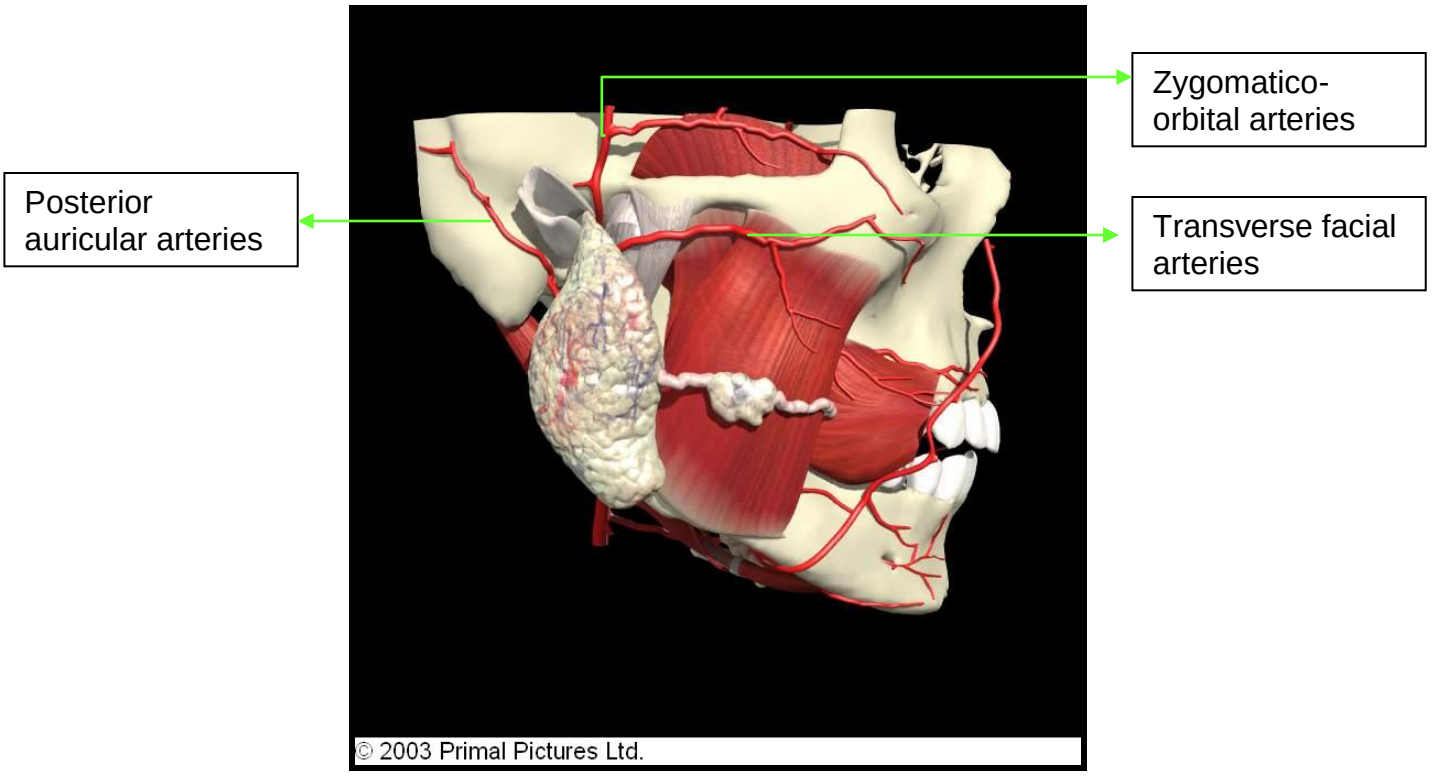

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Figure 2.2a Blood supply of TMJ

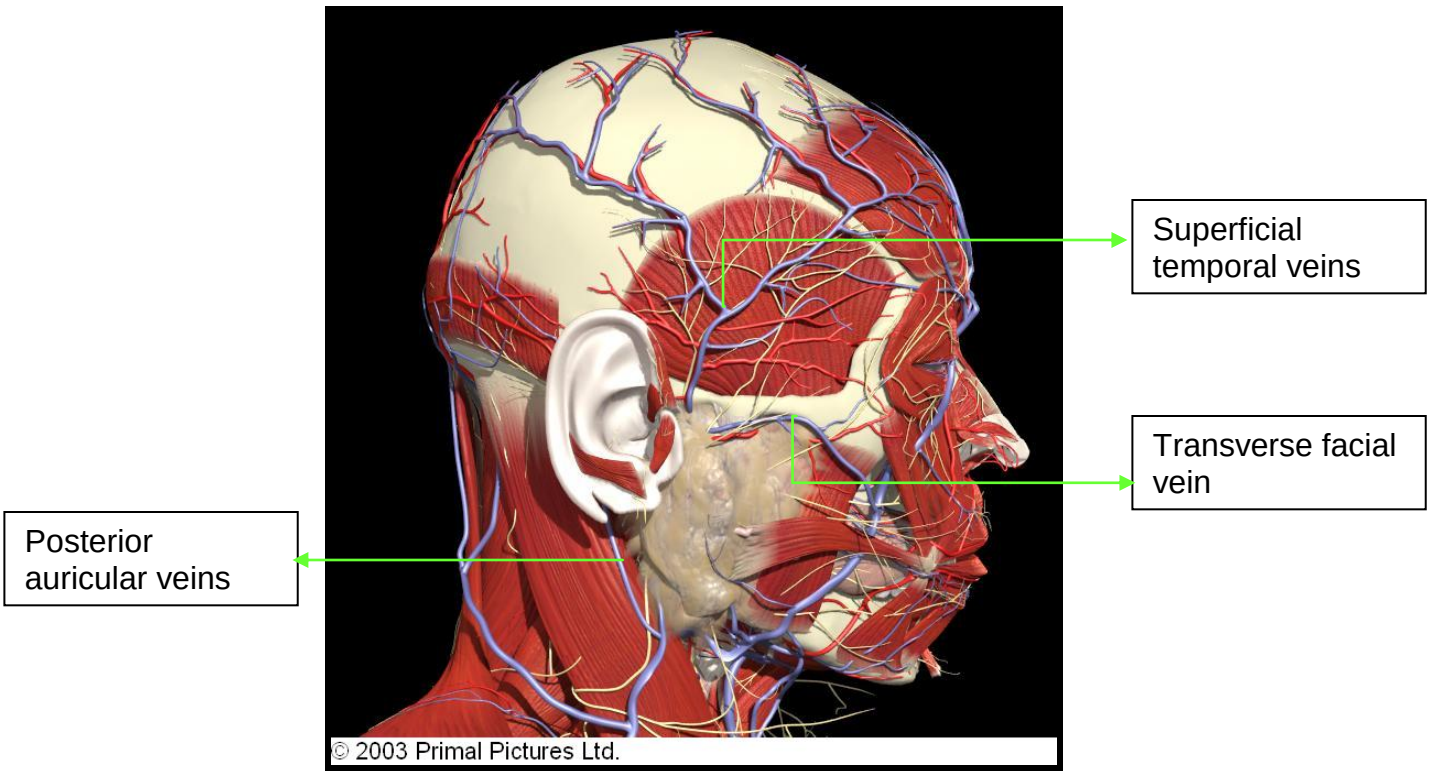

Figure 2.2b Venous drainage of TMJ

The TMJ is innervated by the auriculotemporal nerve which is a branch of the posterior trunk of the mandibular nerve which originates from the trigeminal nerve; and the posterior deep temporal nerve (Kraus, 1994) (see figure 2.3).

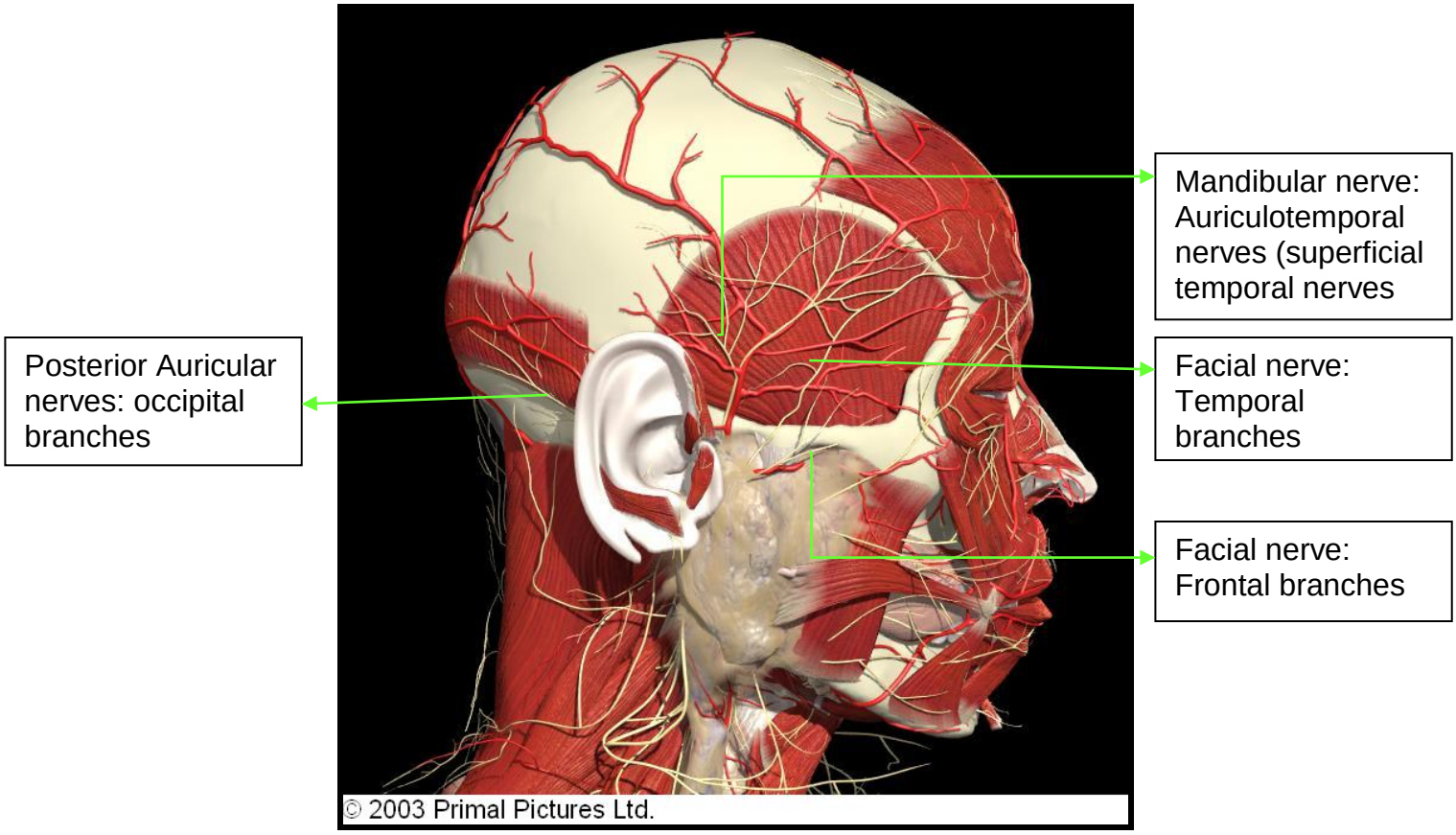

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Figure 2.3 Nerves to TMJ

The temporalis, masseter and the medial and lateral pterygoid muscles are the primary muscles of mastication (Jagger et al., 1993). Table 2.1 as taken from Moore and Dalley (1999) below details each muscle's attachments, innervation and main action and figures 2.4a to 2.4c illustrate the muscles *in situ*.

Table 2.1 Attachments, Innervation and Main Action of Muscles of Mastication

Muscle	**Proximal Attachment**	**Distal Attachment**	**Innervation**	**Main Action**
Temporalis	The temporalis muscle attaches to the floor of temporal fossa and to the deep surface of the temporal fascia	The temporalis inserts onto the tip and the medial surface of the coronoid process and to the anterior border of the ramus of the mandible	The temporalis is innervated by the deep temporal branches of the mandibular nerve	The temporalis elevates the mandible, closing the jaw; its posterior fibers retrude the mandible after protrusion
Masseter	The masseter attaches to the inferior border and to the medial surface of the zygomatic arch	It inserts into the lateral surface of the ramus of the mandible and to its coronoid process	The masseter is innervated by the mandibular nerve via the masseteric nerve, which enters its deep surface	The masseter elevates and protrudes mandible, thus closing the jaw; the deep fibers of the masseter retrude the jaw

Muscle	**Proximal Attachment**	**Distal Attachment**	**Innervation**	**Main Action**
Lateral Pterygoid	The superior head of the lateral pterygoid attaches to the infratemporal surface and infratemporal crest of the greater wing of the sphenoid bone The Inferior head of the lateral pterygoid attaches to the lateral surface of the lateral pterygoid plate	The lateral pterygoid attaches to the neck of the mandible (Pterygoid fovea); and to the articular disc and to the capsule of the temporomandibular joint	The lateral pterygoid is innervated by the mandibular nerve via the lateral pterygoid nerve from the anterior trunk, which enters deep surface of the lateral pterygoid	Both lateral pterygoids acting together, protrude the mandible and depress the chin; acting alone and alternately, the lateral pterygoids produce side-to-side movements of the mandible

Muscle	**Proximal Attachment**	**Distal Attachment**	**Innervation**	**Main Action**
Medial Pterygoid	The deep head of the medial pterygoid attaches to the medial surface of the lateral pterygoid plate and to the pyramidal process of the palatine bone The superficial head attaches to the tuberosity of the maxilla	The medial pterygoid attaches to the medial surface of the ramus of the mandible, inferior to mandibular foramen	The medial pterygoid is innervated by the mandibular nerve via the medial pterygoid nerve	Acting together bilaterally, the medial pterygoid muscles help to elevate mandible, closing the mouth and they help to protrude the mandible; acting alone, they protrude the side of the jaw; acting alternately, they produce a grinding motion

(As taken from Moore and Dalley 1999)

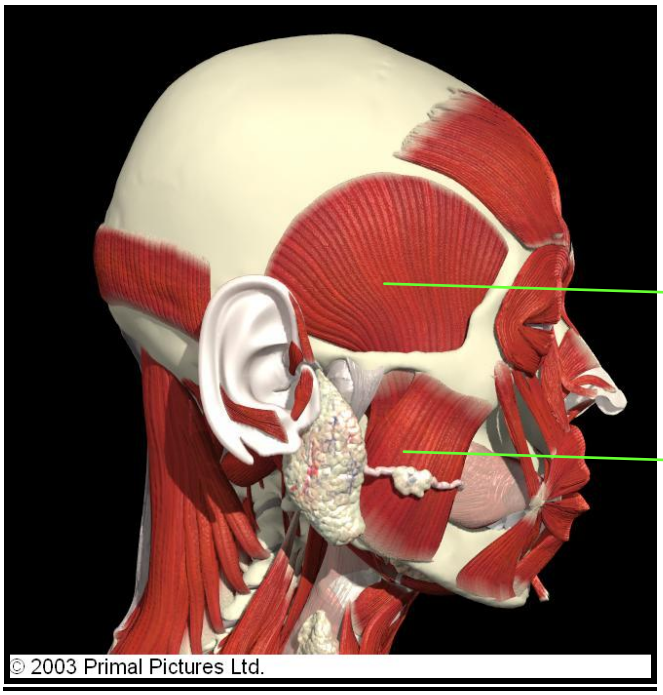

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Figure 2.4a Muscles of mastication

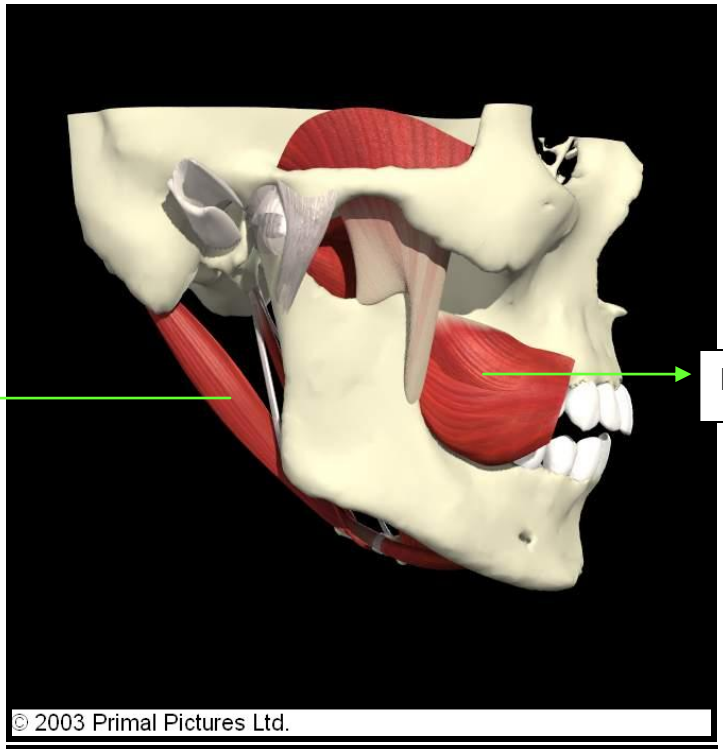

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Figure 2.4b Muscles of mastication

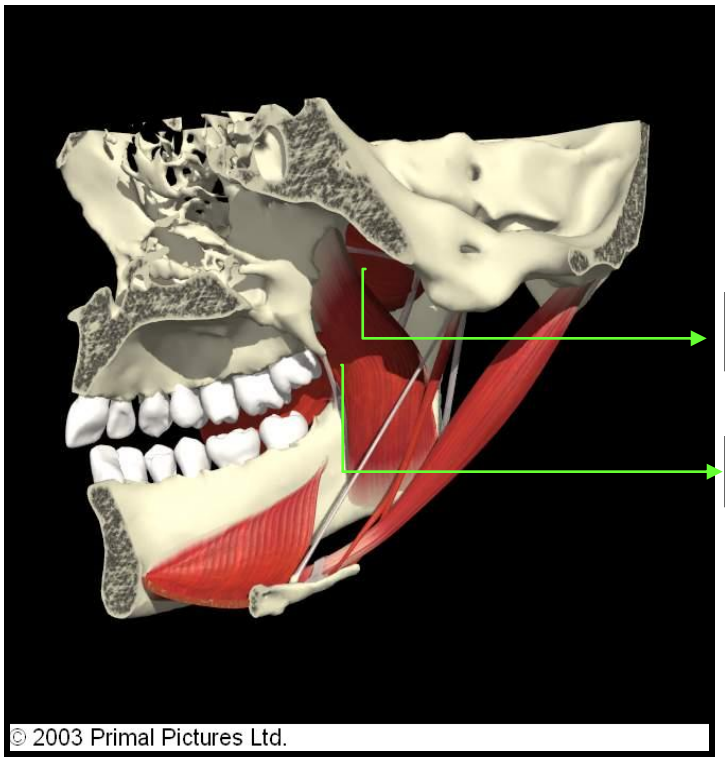

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Figure 2.4c Muscles of mastication

2.3 Aetiology

The aetiology of TMJD as well as its diagnosis is still controversial (Broome, 2003) although, there has been some progress in developing insight into factors both local (anatomically surrounding the TMJ) and systemic (anatomically separate from the TMJ) which cause or perpetuate this dysfunction (Lawrence, 1991 and Camparis, Formigoni, Teixeira, Bittencourt, Turik and Tesseroli de Siqueira, 2006). TMJD can be classified as follows:

1. The most recent is that of environmental, behavioral and physiological causes (Ramirez, Sandoval and Ballesteros, 2005a; Ramirez, Sandoval and Ballesteros, 2005b).
2. The older classification is related to macrotrauma (direct trauma), microtrauma (repetitive microscopic trauma), arthritis, abnormal biomechanical loading and stress induced muscle tension of the masticatory muscles (which could be linked to an emotional component (Travell and Simons, 1999 and Davies, 2001)). This classification is based on the changes

within the TMJ causing the symptoms of TMJD (Lawrence, 1991 and Rachlin and Rachlin, 2002).

The most comprehensive classification seems to be that of Broome (2003), which indicates that there are:

1. Musculo-mechanical causes,
2. Psychophysiological causes and
3. Occlusal mechanical dysfunction.

Thus the literature will be discussed in these categories:

1. Musculo-mechanical causes,

Despite this perceived controversy, consensus is that microtrauma is a cause of TMJD. This microtrauma may be due to repetitive activities e.g. bruxism (teeth grinding) (Camparis et al., 2006), jaw clenching (Sipahi, Cehreli and Ozen, 2007), chewing gum, biting nails, and significant occlusal disharmony (Lawrence, 1991 and Travell and Simons, 1999).

Direct trauma to the TMJ itself and to the masticatory muscles causes muscle injury. Dysfunction in TMJ motion may be a result of direct trauma. Sports injuries, violent blows to the face and/or jaw and unexpected biting on hard food are examples of trauma that could cause TMJD (Gibilisco et al., 1994; Okeson, 1996). Whiplash injuries, even though there is no direct impact to the TMJ may produce TMJD in addition to cervical symptoms due to direct trauma and/or referred pain from damaged cervical nerves (Jagger, Bates and Kopp, 1993; Foreman and Croft, 1995 and Okeson, 1996).

Musculo-mechanical causes are seen as the most common and most easily defined causes of TMJD (Broome, 2003). Electromyography findings provide evidence of increased activity (spasm) of the masseter muscle which is postulated to cause TMJD. The increased masticatory function that causes pain and bruxism is associated with muscle overuse which is a common

aspect of TMJD (Ieremia, Podoleanu, Balas-Chirila and Kovacs, 1990 and Tversky, Reade. Gerschamn, Holwill and Wright, 1991).

2. Psychophysiological causes

Stress, depression and anxiety are also thought to contribute significantly to TJMD (Okeson, 1996; Davies, 2001). For example, increases in muscle tension due to stress have been implicated in the development of myofasical pain, and hyperactivity of the masticatory muscles due to stress is also implicated in the development of TMJD (Travel and Simons, 1999; Yoshihara et al., 2005).

Psychophysiological cause as an agent in TMJD is less supported although there is some evidence in its favour including, but not limited to nocturnal electromyographic activity (Kreisberg, 1986) and due to the fact that TMJD patients generally seem to be good placebo responders which indicates a psychological component (Muller, 1989; Parasido and Scott, 1989; Broome, 2003).

3. Occlusal mechanical dysfunction

Another cause of TMJD can be displacement of the articular disc of the TMJ (Lawrence, 1991). The aetiology is unclear, however it is agreed that the disc becomes displaced due to lengthening of or torn ligaments between the disc and the condyle (Okeson, 1996).

Although studies have shown that occlusal mechanical dysfunction is a less common cause of TMJD than musculo-mechanical causes, it is rated the same as psychophysiological causes because of the limited evidence that exists. This includes night splints normalising muscle activity. Condylar displacement results in increased muscle activity and displacement of the disc is seen to cause a restriction in movement (Rocabado, 1983; Curl, 1989 and Broome, 2003).

Therefore when considering TMJD, it is imperative to consider these various aspects as they are the foundation for multifactorial assessment and related multidisciplinary treatment and

management approaches (Dolwick, Hendler and Kraus, 1984; Chase, Hendler and Kraus, 1988; Lawrence, 1991 and Broome, 2003). Currently, treatment is based on aetiology; however no agreed consensus has been reached regarding aetiology due to complexity of the TMJ (Svensson, Arendt-Nielsen and Houe, 1995).

2.4 Epidemiology

Patients between 20-40 years of age are predominantly affected by TMJD (Speculand, Goss, Hughes, Spence and Pilowsky, 1983; Hertling and Kessler, 1996 and Rachlin and Rachlin, 2002). It is estimated that from 20% to 90% of the population will develop some symptoms of TMJD in this form at some stage during their life (Speculand et al., 1983; Blood, 1986 and Souza, 1997). It seems that of the 60-70% of the general population that have at least one sign of TMJD, very few actually request treatment. The reason for this is that only one in four of these members of the population are actually even aware that they have TMJD. (Salvinelli et al, 2003). Of these; 3:1 to 9:1 will be females rather than males seeking treatment (McNeill 1993 and Lawrence, 1991)).

In a recent study it was found that the most common indicators of orofacial pain were first pain on mouth-opening at 21%-49%, then muscle tenderness at 17 to 97% and lastly joint pain at 5%-31% (Macfarlane, Glenny and Worthington, 2001). This becomes illuminating when it is documented that of all chronic pain problems, facial pain accounts for 40% (Mongini, Ciccone, Ceccarelli, Baldi and Ferro, 2007).

2.5 Signs and Symptoms

TMJD is indicated by signs and symptoms such as articular disc displacement or due to masticatory muscle disorders or both (Okeson, 1996). The signs and symptoms are: clicking in the TMJ (painful or painless) (Solberg and Clark, 1980; Lawrence, 1991 and Broome, 2003), localized pain over the TMJ (Curl and Saghafi, 1995 and Saghafi and Curl, 1995), external auditory meatus, teeth and zygoma (Nykoliation and Cassidy, 1984). Referred or localized pain also occurs in the mandible and teeth, ear and zygoma (Nykoliation and Cassidy, 1984; Tanaka,

1984; Gatterman, 1990; Jagger, et al, 1994; Okeson, 1996 and Travell and Simons, 1999). There is also often limitation of mandibular movement and pain on opening (Lawrence, 1991; Bergman, 1995; and Broome, 2003). Crepitus is also sometimes present when degeneration becomes the norm with increases in the resultant deviation, which can be felt, and or seen (Nykoliation and Cassidy, 1984 and Tanaka, 1984).

In terms of the clinical picture, patients often experience a sensation of muscle stiffness or muscle fatigue (Wanman and Agerberg, 1986). This is usually confirmed by taut bands which can be palpated in the muscle tissue in the masticatory muscles (Travell and Simons, 1999). Masseter discomfort usually predominates over the other muscles of mastication (Rachlin and Rachlin, 2002). In other instances patients also present with headaches (tension type or migraine headaches) in up to 30% of patients (Reik and Hale, 1981; Proctor, 2002 and Rook, 2003). Patients often experience vertigo, tinnitus and deafness (Guralnick, Kaban and Merrill, 1987; Bush, 1987 and Broome, 2003). In addition to the above patients may also present with dental disease resulting in the TMJD or they present with periodontal changes as a result of the TMJD (Rachlin and Rachlin, 2002; Rook, 2003).

2.6 Differential Diagnosis

Orofacial pain can be caused by both intracranial (structures within the cranium) and extracranial (structures external to the cranium) structures as well as neurovascular and neuropathic pain disorders and it can also be psychogenic in nature (Jagger, Bates and Kopp, 1993). Intracranial structures are associated with the most severe differential diagnoses; these include neoplasm or other causes of raised intracranial pressure. Usually they are associated with abrupt onset or extremely severe pain which points to these differentials (Jagger, Bates and Kopp, 1993 and Okeson, 1996).

The extracranial structures that are associated with or should be considered when TMJD presents are cervical disorders and musculoskeletal disorders of the cervico-thoracic junction and superior ribs (Jagger, Bates and Kopp, 1993) Musculoskeletal disorders are most predominantly those associated with orofacial pain (MacFarlane et al., 2001).

Neurovascular disorders (including migraines and cluster headaches) are another common cause of orofacial pain. The character of this pain is however usually a distinctive throbbing or pulsating pain. Neurovascular disorders also tend to affect vision and are associated with nausea and vomiting. The site of pain for migraines and cluster headaches are also associated with the periorbital or temporal regions (Jagger, Bates and Kopp, 1993). This is in contrast to the pain of TMJD which is more localized over the TMJ, temporalis and auricular regions and also to the teeth (Clark and Solberg, 1987).

The neuropathic pain disorders can be divided into those that are continuous and those that are paroxysmal or intermittent. The first are characterized by burning pain and dysaesthesias (e.g. peripheral post-herpatic neuralgia) (Edwards and Bouchier, 1991; Patten, 2000 and Haslett, Chilvers, Hunter and Boon, 2001). The second are intermittent and are characterized by sharp, shooting pain e.g. trigeminal neuralgia (Jagger, Bates and Kopp, 1993; Okeson, 1996 and Patten, 2000).

In addition to the above, patients who are anxious depressed and experience high levels of stress are more likely to develop TMJD and chronic pain (Okeson, 1996 and Diatchenko, Nackley, Slade, Fillingim and Maixner, 2006). Although psychogenic factors do increase risk of developing TMJD, it must not be assumed that there are no other causes of orofacial pain without further investigation as a more life threatening cause could exist (Jagger, Bates and Kopp, 1993).

Soft tissue pathology to the gums, eyes, ears, nose and throat also need to be excluded as these can also cause orofacial pain (Clark and Solberg, 1987). In addition muscle pathology such as fibromyalgia, myositis, myospasm, local myalgia and muscle contracture also need to be excluded (Rachlin and Rachlin, 2002).

2.7 Treatment

2.7.1 Pharmacological

Analgesics prescribed for treatment of TMJD include both nonnarcotic drugs e.g. nonsteroidal anti-inflammatory drugs and narcotic drugs for acute pain treatment. Antidepressants are used for management of patients with chronic pain and tranquilizers and sedatives are used as anxiolytics. (McNeill, 1991 and Jagger, Bates and Kopp, 1993)

2.7.2 Interocclusal Appliances

The dental profession widely accepts the use of interocclusal appliances i.e. splints to reduce pain associated with TMJD. They are used to decrease malocclusion, reduce wear and tear and decrease bruxism (Pettingill, Growney Jr, Schoff and Kenworthy, 1998). These appliances are made of acrylic resin and cover the teeth. Appliances are also used to redistribute occlusal forces and to alter structural relationships in the TMJ (Jagger, Bates and Kopp, 1993). Although patients initially respond well to the insertion of an appliance, i.e. pain is decreased, after a period of using an appliance, muscle activity returns to previous levels. The patient returns to learned habits despite the splint (McNeill, 1991).

2.7.3 Restorative Dentistry and Surgery

Restorative dentistry is used as a means to irreversibly correct malocclusion. It is occasionally performed as a preventative measure (McNeill, 1991). However, conservative treatment is proving to be more affective therefore restorative dentistry should not be considered for primary treatment and should only be performed after the TMJ is stable (Okeson, 1996).

Surgery is performed for specific articular disorders and should only be used in selected cases. Surgery depends on the degree of anatomic derangement within the joint and failure to previous nonsurgical therapy (Jagger, Bates and Kopp, 1993).

Any surgery to the TMJD should only be attempted after normal jaw function has returned for a reasonable period of time as treatment should initially be non-invasive (Clark 1987).

2.7.4 Summary

Masticatory muscle disorders and myofascial pain are listed and discussed by Okeson (1996), Jagger et al., (1993), and Clark and Solberg (1987). Therefore the importance of assessing involved muscles is documented. However, treatment specifically of the MFTP's associated with TMJD is not documented except as an adjunct to other treatment (Okeson 1996)

Clark drew up a table that is still accepted as one of the best summaries detailing treatment for TMJD (Greene, 2001). This table includes treatments such as pharmacologic treatment, behavioral treatment, appliances and surgery. However, not even this table mentions treatment of the Masticatory muscle disorders and myofascial pain directly. He does mention physical therapy (i.e. ultrasound which is effective in treating TMJD predominantly caused by muscle disorders (Gray, 2002)). Physical therapy relieves pain, restores normal function and promotes repair and regeneration (Okeson, 1996).

2.8 Introduction to Myofascial Trigger Points

A MFTP is a hyperirritable spot within a taut band of muscle and / or its fascia that is tender to palpation and can give rise to referred pain, tenderness and autonomic phenomena (Gatterman, 1990 and Davies, 2001). The MFTP is usually a discrete, tender area within the muscle and the referred pain is pain that is felt distant to the site of the MFTP and is reproducible and consistent (Clark and Solberg, 1987 and Rachlin and Rachlin, 2002). MFTP's also cause shortening of the muscle and can give rise to motor dysfunction i.e. muscle weakness (Travell and Simons, 1999). In addition to changes in function of the muscles themselves, MFTP's are a source of musculoskeletal disorders; therefore they should be included as a differential diagnosis (Simons, 2004)

2.9 Anatomy of related Muscles

The temporalis muscle (see figure 2.5) attaches superiorly to both the temporal fossa and the temporal fascia. It attaches inferiorly to the coronoid process of the mandible. The temporalis muscle primarily closes the TMJ. The posterior and middle fibres of the temporalis muscle assist retrusion when acting bilaterally, but when acting unilaterally they cause the mandible to deviate to the same side (Kraus, 1994; Travell and Simons, 1999 and Rachlin and Rachlin, 2002).

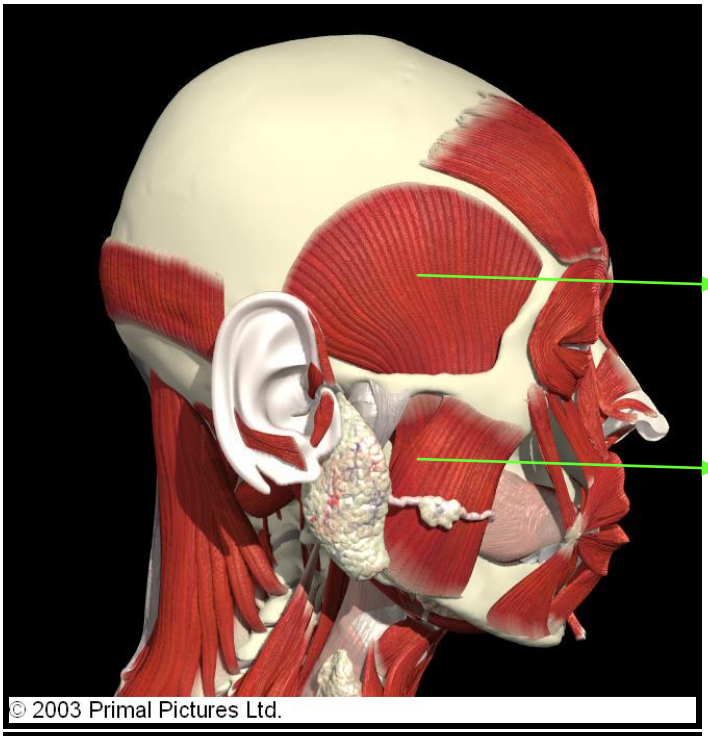

Figure 2.5 Muscles of mastication – temporalis and masseter muscles

The masseter muscle (see figure 2.5 above) attaches superiorly on the zygomatic arch and zygomatic process of the maxilla, and inferiorly on the exterior surface of the ramus and angle of the mandible. Its primary function is to elevate the mandible, while its deep posterior fibres help retrusion (Travell and Simons, 1999).

The medial pterygoid muscle (see figure 2.6) runs between the angle of the mandible and the lateral pterygoid plate, and then forms a sling with the masseter muscle on the outside of the jaw. This muscle causes lateral deviation of the mandible to the opposite side on unilateral

contraction, and it also assists in elevation and protrusion of the mandible on bilateral contraction (Travell and Simons, 1999).

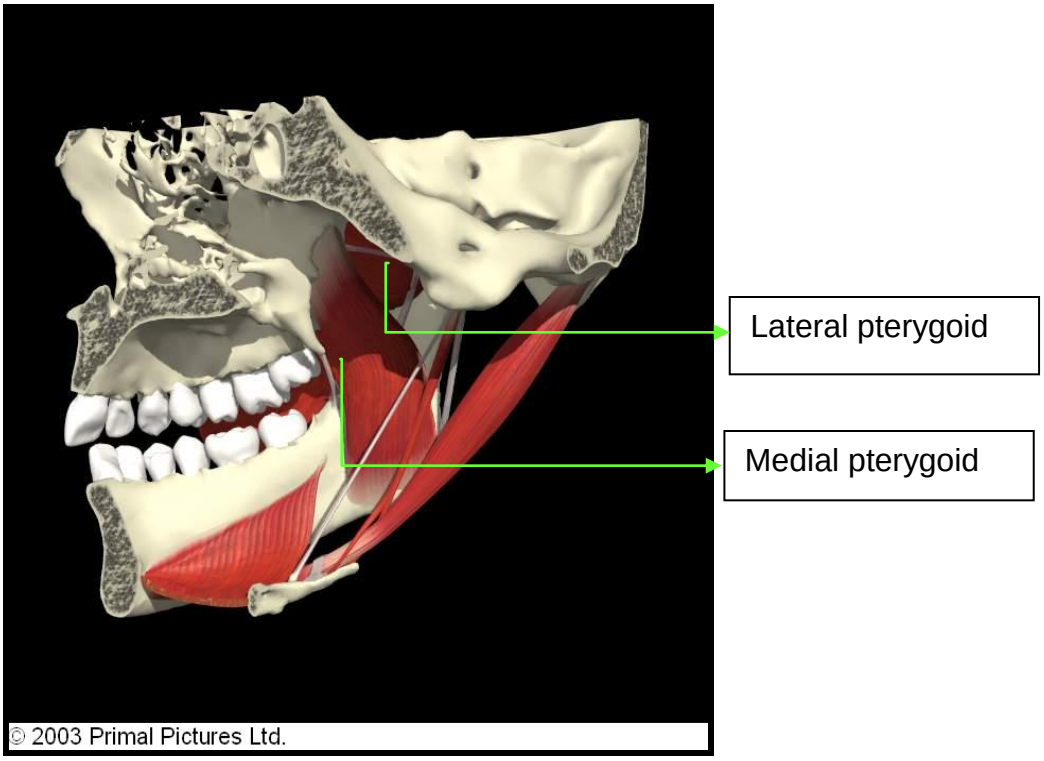

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Figure 2.6 Muscles of mastication – medial and lateral pterygoid

The lateral pterygoid (see figure 2.6) muscle has a superior division which attaches to the sphenoid bone anteriorly, and to the medial surface of the neck of the mandible just below the articular disc posteriorly. Its inferior division attaches to the lateral pterygoid plate anteriorly, and to the mandible neck next to the superior division posteriorly (Travell and Simons, 1999). The major function of the lateral pterygoid muscle is protrusion with or without opening through the use of the inferior fibres. The superior fibres act as a stabilizing force to the joint capsule and articular disc as the condyle moves during full opening (Kraus, 1994).

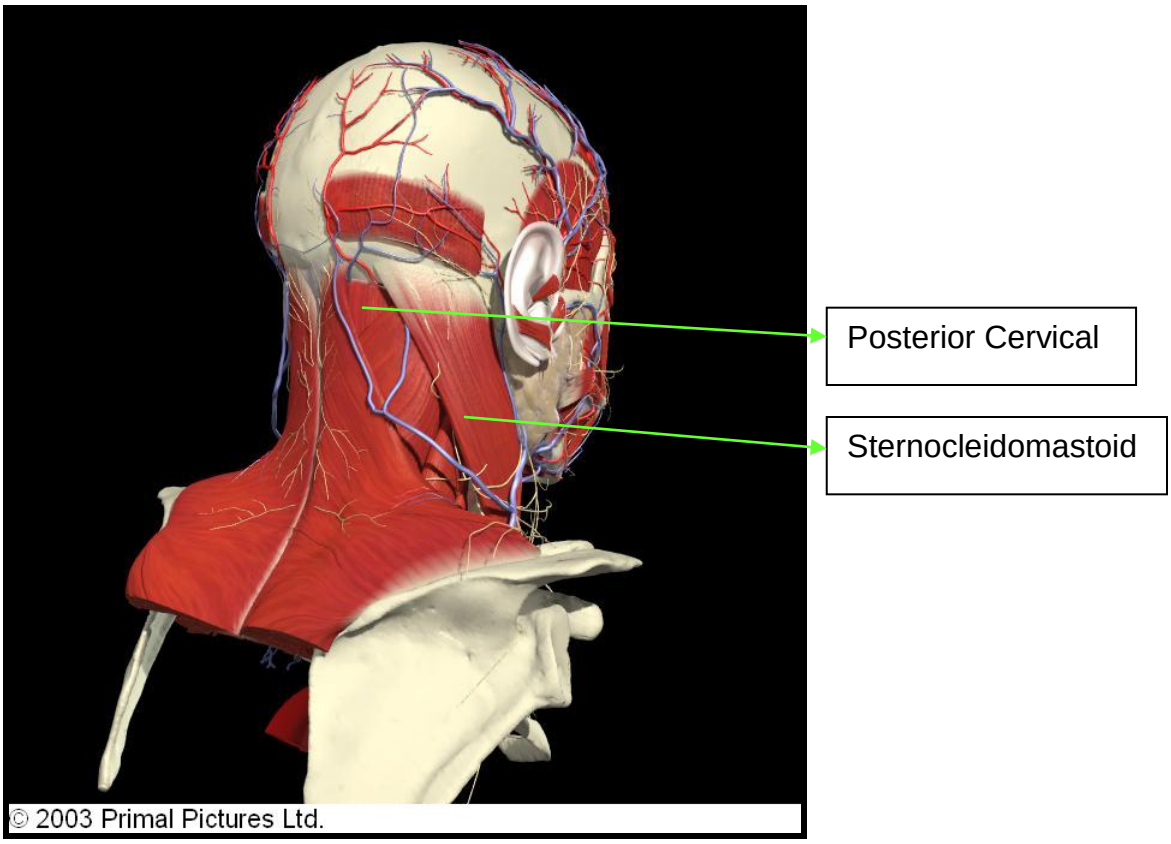

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Figure 2.7 Muscles of mastication – Sternocleidomastoid and the Posterior Cervical Muscles

The Sternocleidomastoid Muscle (SCM) (see figure 2.7) has two divisions. The first is more superficial, anterior and diagonal. This is the sternal division. The other is the clavicular division. Both divisions attach to the mastoid process and along the superior nuchal line superiorly. Inferiorly, the sternal division attaches to the sternum and the clavicular division attaches more posteriorly and laterally onto the clavicle. The accessory nerve innervates the SCM. Functionally, acting individually, the divisions rotate the face to the opposite side and tilt it toward the ceiling. Acting together they flex the head and neck and assist inhalation. They also assist in controlling neck extension (Travel and Simons, 1999).

The Posterior Cervicals (PC) muscles (see figure 2.7) are made up of the Upper Trapezius, Splenius Capitis, Semispinalis Capitis, Longissimus Capitis, the Semispinalis Cervicis, Multifidi

and Rotatores. The palpable Muscles are the Upper Semispinalis Capitis and the Middle Semispinalis Capitis. The Semispinalis Capitis muscle attaches inferiorly to the articular processes of Cervical Vertebrae C4 to C6 and then to the transverse processes of the T1 to T6/7 Thoracic Vertebrae. It attaches superiorly to the occiput. The Multifidi attach superiorly to the spinous processes of the C2 to C5 vertebrae and inferiorly to the articular processes of C4 to C7. Each fibre crosses two to four vertebrae. All PC muscles are innervated by divisions of the Cervical Spinal Nerves. The Semispinalis Capitis muscle's main function is head extension and Multifidis contributes to lateral flexion of the spine although they may be more integral to stability (Travell and Simons, 1999).

2.10 Aetiology

According to Travell and Simons (1999), MFTP's can be caused by either direct or indirect stimuli. Both Latent MFTP's and Active MFTP's can be caused by the same stimuli. Travell (1999) postulates that an active MFTP is an aggravated, latent MFTP.

2.10.1 Direct Stimuli

The primary triggers for the development of MFTP's are acute overload of the muscle concerned, overwork fatigue due to repetition or sustained use, leaving the muscle in a shortened position, contracting a muscle while in a shortened position, direct trauma and nerve compression or radiculopathy (Travell and Simons, 1999).

2.10.2 Indirect Stimuli

A MFTP can be caused by referred pain from an existing active MFTP (Manolopoulos et al., 2008). In this case, treatment of the causative or initial MFTP will instigate relief of the presenting or secondary MFTP (Travell and Simons, 1999).

Visceral disease can cause MFTP's due to referral of pain within that zone to which the pain refers. An example of this is pain due to myocardial infarction which is felt in the left arm and

neck (Edwards and Bouchier, 1991; Moore and Dalley, 1999; Travell and Simons, 1999; Haslett et al., 2001 and Rachlin and Rachlin, 2002).

Other causes include joint dysfunction and emotional distress (Travell and Simons, 1999), mechanical stress, metabolic or endocrine deficiencies and chronic infections (Hong, 2002). It is postulated that joint dysfunction, arthritis and disc disease contribute to development of TMJD due to reflex muscle splinting (Manolopoulos et al., 2008). Psychological or emotional states can alter muscle tone (Okeson, 1996).

2.10.3 Neuromuscular disease

It is postulated, although not yet demonstrated that MFTP's should be classified or recognized as a neuromuscular disease. The belief is that excessive acetylcholine is released within the muscle fibers causing shortening of the sarcomere, a positive-feedback loop then occurs, which continues until it is interrupted (Simons, 2004).

2.11 Epidemiology

Physicians reported as early as in the 1950's that MFTP's were one of the most common frequent problems seen by physicians (Sola, Rodenberger and Getty, 1955). Pain due to MFTPs occurs in both females and males but appears to be more prevalent in females (2:1) (Han and Harrison, 1997). Travell and Simons (1999) and Han and Harrison (1997), suggested that patients aged 30-49 are more likely to suffer pain from active MFTP's and as patients become older, they are more susceptible to the stiffness and restricted motion that is the result of latent MFTPs. However, recent research indicates a peak in incidence of active MFTP's between 40 and 50 years of age (Manolopoulos et al., 2008). It has been found that all individuals have latent MFTP's as early as six months of age (Hong, 2002).

Studies have shown the historical interest in MFTP's (Sola, Rodenberger and Getty, 1955; Travell and Simons, 1999), and although clinicians believe that MFTP's are important in the

development of TMJD, there has been a paucity of literature with clinical research (Simons, 2004).

The TMJ region is a high frequency area for developing MFTP's and long-standing MFTP's can become one of the primary causes of functional disability (Manolopoulos et al., 2008).

2.12 Pathophysiology

The essential difference between latent and active MFTP's is that active trigger points produce referred pain spontaneously and in a familiar pattern when compressed or irritated (Travell and Simons, 1999). Active MFTP's cause pain during muscle use and at rest. Long term effect of active MFTP's can be muscle degeneration. Latent MFTP's may not produce pain unless palpated/compressed, but they shorten the muscle, cause stiffness and fatigue and predispose muscular malfunction. A latent MFTP may remain for an extended period resulting in recurrent pain episodes (Manolopoulos et al., 2008).

2.12.1 Symptoms of MFTP's

Patients may complain of a dull, aching pain in the affected region, often aggravated by function e.g. in TMJD, pain would be aggravated by mastication. This pain is often accompanied by stiffness (Okeson, 1996). The specific area of pain relating to investigated muscles is detailed in Table 2.1 below.

SCM	Temporalis	Masseter	Medial Pterygoid	Lateral Pterygoid	PC
Pain in the cheek, temple and orbit	In the supraorbital ridge, mid-temporal area, teeth, maxilla, TMJ	Pain in the jaw, cheek, maxilla, temple, over the eyebrow, ear, TMJ.	Pain in the ear and TMJ and throat, tongue and front of neck pain	Pain in the ear and TMJ	Periorbitally, over the temporal region, around the ear and angle of the jaw

Table 2.1: Comparison of pain patterns in muscles of mastication and in the head and neck (Gatterman, (1990); Jagger, Bates and Kopp, (1994); Travell, et al., (1999); Rachlin and Rachlin, (2002)).

Referred pain is pain that is felt remote to the area that is being investigated and in an active MFTP; this pain is sometimes recognized as familiar (Travell and Simons, 1999). Compression of the MFTP's illicit well documented patterns of referral (Okeson, 1996). The involved muscles are often fatigued and stiff with weakness and decreased range of motion (Rachlin and Rachlin, 2002). Table 2.2 illustrates the normal referred pain patterns relating to the specific muscles investigated.

SCM	Temporalis	Masseter	Medial Pterygoid	Lateral Pterygoid	PC
Pain in the mandible and teeth TMJ joint pain Ear Pain	Pain is referred Into the cheek, maxilla, over the supraorbital ridge, deep into the orbit, occipital ridge behind the ear, to the vertex of the skull, frontal skull and into the ear.	Pain is referred to the temple, eyebrow, behind the eye, upper teeth, maxilla and over the TMJ.	Pain is felt in the lower jaw, teeth, gums, maxilla, mandible, temple, above the eyebrow, mid-cheek, over the TMJ and to the ear.	A slight ache in the back of the mouth and pharynx, below and behind the TMJ and deep in the ear.	Pain is felt strongly in the maxilla and in the TMJ region

Table 2.2: Comparison of referred pain patterns in muscles of mastication and the head and neck (Gatterman, (1990); Jagger, Bates and Kopp, (1994); Travell, et al., (1999); Rachlin and Rachlin, (2002))

MFTP's can illicit symptoms of an autonomic or proprioceptive nature. These include abnormal sweating, coryza (fluid discharge from the nose) and increased production of saliva. Involvement of the muscles related to the TMJ can also cause imbalance, tinnitus, deafness and dizziness (Okeson, 1996 and Travell and Simons, 1999). Davies (2001) suggests that the abnormal symptoms experienced due to MFTP's including numbness, tingling and hypersensitivity are because of the compression of affected muscles on nerves as these muscles are shortened and enlarged by MFTP's (2001). Table 2.3 demonstrates what autonomic or proprioceptive disturbances are most often linked to the relevant muscles:

SCM	Temporalis	Masseter	Medial Pterygoid	Lateral Pterygoid	PC
Postural dizziness Tearing of the eye, blurring and dimming of vision				Excessive secretion from the maxillary sinus	Blurring of vision

Table 2.3: Comparison of autonomic and proprioceptive symptoms in muscles of mastication and of the head and neck (Gatterman, (1990); Jagger, Bates and Kopp (1994); Travell, et al., (1999); Rachlin and Rachlin, (2002))

Frontal and or temporal, tension-type headaches including or excluding the peri-orbit are common symptoms due to MFTP's in the SCM, Temporalis, Masseter and PC muscles (Gatterman, 1990; Jagger et al. 1994; Okeson, 1996 and Travell and Simons, 1999). Table 2.4 illustrates all other signs/symptoms that may be present in any one patient.

SCM	Temporalis	Masseter	Medial Pterygoid	Lateral Pterygoid	PC
Tinnitus Nausea	Toothache	Tinnitus Earache	Difficulty swallowing and restricted mouth opening	Tinnitus and dysfunction in chewing	Marked restriction of head and neck flexion.

Table 2.4: Comparison of further signs and symptoms (Gatterman, (1990) Jagger, Bates and Kopp. (1994), Travell, et al., (1999); Rachlin and Rachlin, (2002))

2.12.2 Signs of MFTP's

The most reliable signs of MFTP's are spot tenderness as elicited on palpation during examination; a palpable taut band discovered on palpation; a jump sign or withdrawal from pressure on the MFTP; and a transient contraction of the palpable taut band that is seen or felt through the skin of the patient when stimulated (Al-Shengiti, 2005) The jump sign is distinguished from the twitch response as the first is a behavioral response and the second is a motor effect elicited by palpating the taut band at the location of the MFTP (Rachlin and Rachlin, 2002). When MFTP's are superficial, a slightly raised temperature may be felt over the MFTP. This increase in temperature is due to increased metabolic activity in the affected area (Travell and Simons, 1999; Davies, 2001).

2.12.3 Correlations, similarities and the relationship between TMJD and MFTP's of the head and neck

According to Travell and Simons (1999), most patients with TMJD also suffer from a muscular disorder caused by MFTP's in masticatory and related muscles. This concurs with the findings that functional disorders of masticatory muscles are probably the most common complaint of TMJD patients seeking treatment in the dental office (Okeson, 1996). Thus when performing a diagnostic evaluation of patients with TMJD it is important to inspect the sternocleidomastoid (SCM), posterior cervical (PC) and upper trapezius muscles amongst others as there are a high percentage of orofacial pain patients who also have craniocervical disorders related to TMJD (McNeill, 1993). Simons (2004) also stated that the symptoms produced by MFTP's can be confusingly similar to those of articular dysfunction.

In addition, the biomechanics of the muscles of the head and neck work together forming an integrated system to bring about movements of the mandible, cervical movements and postural changes e.g. anterior head carriage (Foreman and Croft, 1995). The muscles of the anterior neck must balance the muscles of the posterior neck for correct function. Any alteration in these muscles will change this relationship. Thus the TMJ system is affected by disturbances in this balance which may result in derangement and dysfunction (Curl, 1994 and McNeill, 1991).

Considering the above and considering the similarities between the signs and symptoms of the TMJ and of MFTP's in the head and neck region it has been suggested that there is a link between MFTP's in the head and neck and TMJD. MFTP's in cervical musculature refer pain into the face and can even cause satellite MFTP's (MFTP's caused by the original MFTP, but in a site remote to the original MFTP). If the original MFTP's are not treated, they will not recover fully (Rachlin and Rachlin, 2002 and Manolopoulos et al., 2008). Accordingly Manolopoulos et al (2008) states that it is difficult to distinguish which is the factor and which is the cause e.g. does TMJD cause MFTP's or visa versa.

CHAPTER THREE

Research Methodology

3.0 Introduction

This chapter outlines the design of this research including recruitment of participants, data collection and processing of that data.

3.1 Design

This was an exploratory, quantitative observational study (Mouton, 1996). In this context, the study was approved by the Durban University of Technology, Faculty of Health Sciences Research Committee and the Ethics Review Board (Appendix L). This approval declared that the research conformed to the standards set by the Helsinki Declaration of 1975.

3.2 Advertising

For the purpose of this study, advertisement was through posters, newspapers and word of mouth (Appendix H).

3.3 Sampling method

In terms of the participants' responses to the advertisements, the response was categorized as patient self selection (Mouton, 1996), based on the information that was available on the advertisements. Thereafter, a consecutive convenience sampling (Mouton, 1996) technique was employed for all presenting participants that met the inclusion and exclusion criteria for the study.

3.4 Sampling size

Twenty five (25) participants that fitted the inclusion criteria and were not excluded by means of the exclusion criteria were included in the study. There were no group subdivisions as would have been evident in a clinical trial as only one group was used as a cohort for analysis.

3.5 Sampling Characteristics

3.5.1 Inclusion criteria

Participants were included if they were between 20-50 years of age (Gray, 2002).

And presented with one of the following signs or symptoms as outlined by Jagger, Bates and Kopp. (1994) and Okeson (1996):

- Pain over the side of their face extending from the temporalis region superiorly, to the angle of the mandible inferiorly; to the zygomatic arch medially and the external auditory meatus laterally.
- Any clicking or crepitus of their TMJ.
- Observed limitation or deviation of their TMJ movement by means of the Visual Range of Motion (VROM) and functional measurements of their mouth opening measured according to the number of Proximal Interphalangial Joints (PIPs) an individual could insert comfortably between their teeth horizontally while the hand is forming a fist.
- Any or all ear symptoms including but not limited to earache, tinnitus, dizziness, vertigo, a blocked feeling and itching.
- Bruxism or other habitual jaw clenching activities.
- Pain aggravated by chewing or other jaw function.

Based on the inclusion criteria as above, participants falling within these criteria were deemed to be presenting with TMJD.

3.5.2 Exclusion criteria:

If any of the following were present or suspected then the patient was excluded from this study.

- Neurological deficits including Bell's palsy, previous or present symptoms of cardiovascular accidents (CVA), Trigeminal neuralgia (Dippenaar, 2003). Although these are unlikely to mimic TMJD directly, they do on occasion present with minor forms of neuralgias and headaches which could clinically be a differential diagnosis for TMJD and thus cause confusion (Jagger et al., 1994) or decrease the of diagnosis as required in this study.
- Infections affecting the head and neck (including ear, nose and throat infections), meningitis, encephalitis, malaria were excluded as they can produce signs and symptoms similar to TMJD, but are not of TMJ origin (Jagger et al., 1994).
- Recent Trauma to the TMJ, head and / or neck (Foreman and Croft, 1995).
- Neoplasm's, which although uncommon in the region of the TMJ, which may present with signs and symptoms similar to TMJD (Jagger et al., 1994).
- Patients undergoing treatment for TMJ disorders (Gray, 2002).
- Patients who are pregnant or breastfeeding (Kannus et al., 1999). The hormones relaxin and oestrogen secreted during pregnancy act to relax the ligaments of the body (Guyton and Hall, 2000). This may result in increased ligament laxity and /or instability and compound the clinical picture with which the patient presents.
- Patients who have had or are using any functional appliances in their mouths (e.g. dentures, braces or bite appliances) which have been altered or prescribed and fitted within 12 weeks prior to their participation (Melson, 1991) in the study. Melson (1991) states that there is a stimulation of the orofacial musculature following the use of functional appliances and an adaptive response occurs with

return to normal muscle activity within 12 weeks, which could blur the clinical picture with which the patient presents.

3.6 Patient screening

3.6.1 Telephonic

On responding to the advertisements either telephonically or by presentation, the potential participants were assessed by means of a telephonic interview to ensure that they met the necessary requirements (Appendix E).

If the potential patient met the telephonic criteria, the patient was scheduled to see the researcher at a mutually convenient time. The patient was further told that the consultation would last one hour and that they would be required to be present for the duration of the consultation.

3.6.2 Clinical Assessment and Measurement

At the beginning of the consultation, the participants were given a Letter of Information (Appendix I) and an Informed Consent Form (Appendix J), which they were required to read and sign. If the patient had any questions, they were able to ask at this point.

During the scheduled appointment, the participants were then evaluated for compliance with the inclusion criteria by means of

- A case history (Appendix A)
- A physical evaluation (Appendix B) and
- An evaluation of the relevant regions (Appendices C and D).

Participants who fulfilled the inclusion criteria were included on the assumption that they had TMJD.

At this point, the severity of their TMJD was determined by means of the TMJD Disability Index (hereafter referred to as the TDDI - Appendix F). This questionnaire was handed to the patient to complete based on the symptoms that they experienced at the time of the consultation. This questionnaire is similar to the Oswestry Low Back Pain Questionnaire or the Neck Disability Index as it records the symptoms and noted limitations with which the patient presents and scores to obtain clinically useful information (Yeomans, 2000).

Questions pertaining to ability to live a normal life were incorporated into the TDDI questionnaire. These included questions about the following: - communication (talking); normal living activities (brushing teeth, flossing, eating, chewing); social / recreational activities (singing, playing musical instruments, cheering, laughing, social activities, playing amateur sports/hobbies, and recreation); non-specialized jaw activities (yawning, mouth opening and opening my mouth wide); sleep (restful, nocturnal sleep pattern); effects of any form of treatment (including, but not limited to, medications, in-office therapy, treatments, oral orthotics (e.g. splints, (mouthpieces) and ice/heat); tinnitus, or ringing in the ear(s); dizziness (light-headed, spinning and/or balance disturbance (Yeomans, 2000).

Whilst the patient completed the above, the researcher completed Appendix G. This required the researcher to extract from the history and examination findings information on malocclusion mandible on the maxilla, functional opening of the mouth, auscultation parameters of the TMJ as well as the absence or presence of crepitus in the TMJ (the ratings are indicated as per Table 3.1 below).

	None = 0	**Mild = 1**	**Moderate = 2**	**Severe = 3**
Malocclusion	None	Slight	Obvious	Markedly Obvious
Functional Opening	3 flexed PIP joints	2 flexed PIP joints	1 flexed PIP joint	Less than 1 flexed PIP joints
Auscultation	No audible clicking	Audible on auscultation	Audible without auscultation	Audible and visible without auscultation
Crepitus	None	Slight	Obvious	Markedly Obvious

Table 3.1: TMJ Regional Ratings

The participants were then screened for MFTP's in the head and neck regions. Locations of the MFTP's were determined by flat palpation. The most reliable indicators of MFTP's according to Davies (2001), Al-Shengiti (2005) and Manolopoulos et al, (2001) are:

- presence of a palpable taut band – this was a semi hard, tightly stretched, strand of muscle that felt like a cord or cable and could have been mistaken for a tendon
- spot tenderness – the patient complained of pain when the MFTP was compressed,
- jump sign – when a MFTP was compressed, it caused pain and the reaction if severe enough was a visible reaction i.e. the patient startled, winced and pulled away,
- pain recognition – the patient recognized the pain as familiar, when this pain was felt remote to the MFTP, it was referred pain, and may have been accompanied by autonomous phenomena.

These indicators were recorded and ratings were given to each patient according to their responses. The recordings were done according to an adaptation of the myofascial diagnostic scale (Chettiar 2001) (Appendix G).

Each patient was seen and evaluated only once.

3.7 The procedure for statistical analysis was as follows:

SPSS version 15.0 was used to analyse the data (SPSS Inc., Chicago, Illinois, USA). A p value <0.05 was considered as statistically significant. Quantitative variables were summarized using median, inter-quartile range and range due to skewness of distribution, while categorical variables were described using frequency distributions and bar charts. Spearman's nonparametric correlation analysis, and curve estimation were used to determine the existence and extent of a relationship between TMJ severity and MFTP severity. A scatterplot was used to graphically assess the relationship.

CHAPTER FOUR

RESULTS AND DISCUSSION OF RESULTS:

4.0 Introduction

This chapter presents the results and discussion based on the outcomes of this study. Although it is acknowledged that it is not the conventional norm, it was considered expedient to discuss the findings in this chapter.

4.1 Objectives of the study

As outlined in Chapter One, the objectives are as follows:

- Objective one was to determine the existence of TMJD in the participants.
- Objective two was to determine the severity of the TMJD.
- Objective three was to determine the specific location of the MFTP's within the superficial muscles of mastication.
- Objective four was to determine the severity of the MFTP's.
- Objective five required that the research confirms the possibility/type of relationship between the MFTP's and TMJD.

4.2 The data

4.2.1 Primary data

The primary data was collected using the following questionnaires and data sheets:

- Temporomandibular disorder disability index (TDDI) (as adapted from Yeomans (2000)).
- TMJ regional ratings.
- Myofascial diagnostic scale (MDS) (as adapted from Chettiar (2001)).

4.2.2 Secondary data

Literature search required data from the following sources:

- Books
- Journal Articles
- Other printed media

4.3 Key or abbreviation of terms for chapter four

n = The sample number

% = Percentage

p = Level of significance (set at 0.05)

R^2 = Correlation coefficient (outlined as the Spearman's correlation coefficient)

4.4 Results

Twenty-five participants were recruited into the study for purposes of completing this study.

4.4.1 Demographics

4.4.1.1 Age

The mean age of the participants was 31.4 years with a standard deviation of 7.8 years and a range from 21 to 49 years. This conforms to literature norms, where patients have been recorded to vary between 20-40 years of age according to Speculand et al., (1983), Hertling and Kessler (1996), Rachlin and Rachlin (2002).

Therefore it could be stated that the patients that were recruited into this study were representative of the normative patient with TMJD.

4.4.1.2 Gender

The majority of the participants were females 68% (17).

Table 4.1: Gender distribution of participants

		Frequency	Percent
Valid	Male	8	32.0
	Female	17	68.0
	Total	25	100.0

According to McNeill (1993) and Lawrence (2002), the literature concurs with the results of this study, where between 3:1 to 9:1 (female:male) have been recorded as female patients rather than male patients. It is however acknowledged that this trend may only represent an accurate reflection of patients presenting for care as opposed to those that actually have TMJD. This is principally because female patients tend to seek a form of health care earlier and more readily than male patients (Sawni and Thomas, 2007 and Heslop, 2008).

4.4.1.3 Ethnicity

88% of the participants in this study were of White ethnic origin (88%).

Table 4.2: Racial distribution of participants

		Frequency	Percent
Valid	White	22	88.0
	Indian	1	4.0
	Black	2	8.0
	Total	25	100.0

With respect to the demographic profile, it does not reflect the race distribution of South Africa, and in particular the province of Kwa-Zulu Natal (http://www.statssa.gov.za/census2001/digiAtlas/index.html, 2006). This lack of representativeness may be due to a number of different reasons, which may include one or more of the following:

Firstly, the Black population of KZN may not be as familiar with chiropractic treatment as the White or the Indian population groups (Rattan, 2007), which is derived from a western culture (Haldeman, 2005).

Secondly it should also be considered that in previous years the majority of the manual labourers (unskilled population) were Black, whereas the employers that have a higher mobility (e.g. vehicular transport) were more likely to be White or Indian (Manpower Report, 1995). This demographic has changed since this report was published. However the trends are still evident which is also evidenced by the Employment Equity Act (2005).

No literature comparisons were possible as no literature was found to have documented ethnicity.

In summary it could be stated that the participant population for this study reflected the norms in terms of the TMJD distribution and thus would adequately be representative of the TMJD population generally. This is important as homogeneity is crucial for comparison of results and generalisability of the data obtained (Mouton, 2002).

4.5 Objective One:

To determine existence of TMJD in the participants of this study.

To ensure that a correlation could be executed with respect to TMJD and myofascial trigger points, it was necessary to ensure that all participants in the study actually had TMJD (i.e. the independent variable (Mouton, 2002)). So to achieve this outcome, all prospective participants

were screened for TMJD to meet the inclusion criteria. Each of the 25 prospective participants met the inclusion criteria and none dropped out.

It must be noted that some inherent limitations were present in the TMJD population in this study, these included:

1. The presence of TMJD was based principally on the age of the patient. It is assumed that the literature norms (Speculand et al., 1983; Hertling and Kessler, 1996; Rachlin and Rachlin, 2002) are valid and reliable and that they represent the norm for TMJD sufferers, even though the documented data only represents those patients that have sought treatment.

2. Another limitation is the combination of signs and symptoms with which patients presented with. Based on the fact that the TMJD does not have a commonly agreed to aetiology (Lawrence, 1991; Broome, 2003; Camparis et al., 2006), it is difficult to ascribe any one or combination of signs or symptoms to TMJD. Therefore, for the purposes of this research the inclusion and exclusion criteria where not restrictive in terms of severity of presentation, signs and symptoms and may have resulted in a varying degrees of pathogenesis development between the participants in the study. The result of this could be that there is a degree of limitation in terms of linking the severity of TMJD to MFTP presence although the severity of the MFTP may be similar to the TMJD.

4.6 Objective Two

This objective was to quantify the severity of the TMJD. This was accomplished by utilising the Temporomandibular Disorder Disability Index (TDDI) and the TMJ regional ratings scale.

4.6.1 TDDI score

The TDDI represented a rating system that had individual scores which ranged from 0 to 4 for each of 9 items, which when totalled, formed a score out of a maximum of 36 points. The interpretation indicated that the higher the score, the more severe the TMJD (Yeomans, 2000).

The results of this study indicated that the TDDI scores ranged from 0 to 16, with a median score of 3 and an inter-quartile range of 1 to 5.5. Only 2 participants scored above 10. As the histogram in Figure 1 shows, the scores displayed a highly skewed distribution, with the peak of the curve (mode) being at the score of 1.

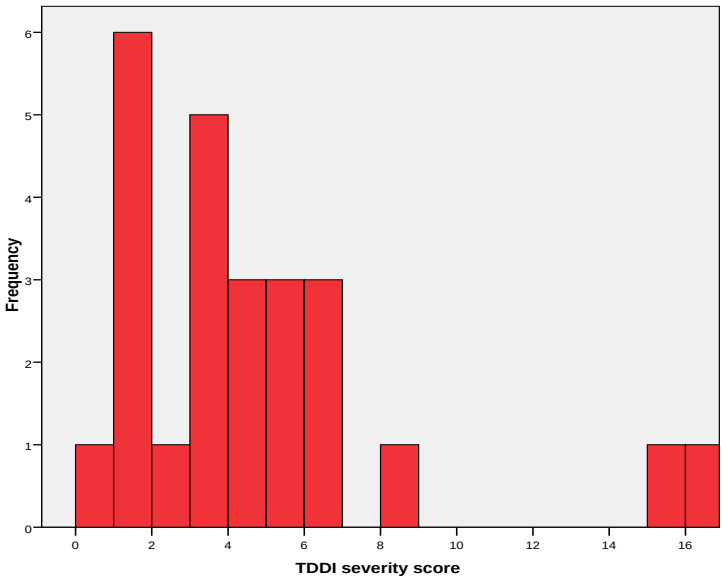

Figure 4.1: Histogram of TDDI score distribution

The results of the TDDI indicate that the level of dysfunction for the participants was for the most part mild to moderate (the highest score was 16 out of a possible 36), none of the participants experiencing severe symptoms. This concurs with the previous assertion that the inclusion criteria as a combination of signs and symptoms represented a non restrictive pattern which may have resulted in varying degrees of pathogenesis development between the participants in the study.

The result of this could be that there is a limitation in terms of linking the severity of TMJD to MFTP presence although the severity of the MFTP may be similar to the severity with which TMJD presents, therefore yielding a positive outcome to the study. Thus the researcher would be able to ascertain the severity of both TMJD and MFTP and possibility which aetiology may be more likely (Lawrence, 1991; Broome, 2003; and Camparis et al., 2006), but not conclusively so.

4.6.2 TMJ regional rating scale:

Table 4.3: TMJ regional ratings

		Count	%
Malocclusion	None	21	84%
	Slight	3	12%
	Obvious	1	4%
	Markedly obvious	0	0%
Functional Opening	3 flexed PIP joints	15	60%
	2 flexed PIP joints	10	40%
	1 flexed PIP joint	0	0%
	Less than 1 flexed PIP joint	0	0%
Auscultation	No audible clicking	8	32%
	Audible on auscultation	11	44%
	Audible without auscultation	3	12%
	Audible and visible without auscultation	3	12%
Crepitus	None	14	56%
	Slight	9	36%
	Obvious	2	8%
	Markedly obvious	0	0%

With respect to Table 4.3, it reflects that 84% of participants had no malocclusions, 12% had slight malocclusions and 4% had obvious malocclusions. These results compare with the literature (Nykoliation and Cassidy, 1984; Tanaka, 1984; Lawrence, 1991; Okeson, 1996;

Broome, 2003 and Salvinelli et al., 2003), in which malocclusions have been noted and in some instances linked with the presence of changes in head carriage (Lawrence, 1991). It would be of interest to note, which muscles have signs of MFTPs, which will be discussed in section 4.7, as these would naturally be affected with altered head carriage (Travell and Simons, 1999).

Furthermore it was noted that in terms of functional opening 60% of participants had enough jaw opening to house three flexed PIP joints (expected norm), while 40% of participants had space for two flexed PIP joints. These results support the lack of malocclusion problems noted above and also concur with the literature which indicates that for the most part malocclusions are rarely severe in nature (Salvinelli et al., 2003). This also indicates that it is unlikely that the patients in this study had TMJ malocclusion problems in nature and that they had some flexibility even though the mouth cannot be opened fully by the patient (Lawrence, 1991). This evidence goes further to suggest that participants are more likely to have a functional disorder in terms of the musculokeletal mechanics rather than something more serious (Lawrence, 1991, Rachlin and Rachlin, 2002) and therefore an increased likelihood of myofascial dysfunction (Travell and Simons, 1999 and Rachlin and Rachlin, 2002).

In terms of the most noted sign – clicking (Speculand et al., 1983; Lawrence, 1991; Rachlin and Rachlin, 2002), the participants presented as follows:

- 32% of participants had no audible clicking,
- 44% participants had clicking that was audible on auscultation,
- 12% were audible without auscultation and
- 12% were audible and visible without auscultation.

These results seem to emphasise again that the symptoms in this patient group were only of a mild / moderate nature and that they were more likely to arise from a biomechanical dysfunction than a more serious pathology e.g. neoplasm.

To support the increased likelihood of biomechanical dysfunction, these participants presented 56% of the time without crepitus; with 36% having slight crepitus and only 8% presenting with obvious crepitus. These findings concur with Lawrence (1991) and Bergman (1995). This is

particularly true as more severe patient presentations usually include painful clicking (Solberg and Clark, 1980; Lawrence, 1991; Broome, 2003), with localized pain over the TMJ (Curl and Saghafi, 1995; Curl and Saghafi, 1995), external auditory meatus, teeth and zygoma (Nykoliation and Cassidy, 1984).

With the clinical picture lending support to the fact that the participants in this study have a tendency to biomechanical dysfunction, it seems likely that these participants should also have experienced a sensation of muscle stiffness or muscle fatigue (Wanman and Agerberg., 1986); accompanied by taut bands which can be palpated in the muscle tissue in the masticatory muscles (Travell and Simons, 1999; Al-Shengiti, 2005). Thus it would seem it that is highly likely to expect these participants to have some form of MFTP presentation within the muscles of mastication and / or cervical spine (Lawrence, 1991 and Travell and Simons, 1999).

4.7 Objective Three:

The third objective was to determine the specific location of the MFTP's within specific muscles of the head and neck region.

Figure 4.2 shows that the prevalence of trigger points in each site was high. All participants had trigger points in the trapezius muscle, while 92% had trigger points in the posterior cervical muscles, 80% in the temporalis muscle, 76% in the masseter muscle and SCM muscle and 64% in the medial and lateral pterygoid muscles.

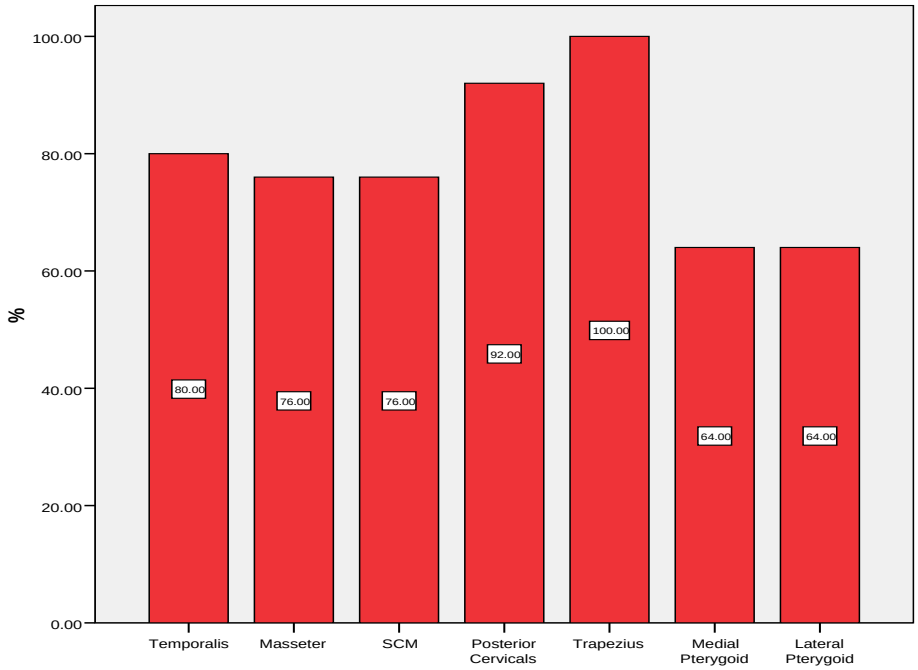

Figure 4.2: Percentage of participants with MFTPs in each muscle

From the results some participants presented with MFTPs in muscles that are usually associated with the neck and the upper back i.e. trapezius and posterior cervical muscles as opposed to the TMJ. However, the muscles of mastication were involved only marginally less.

This makes for an interesting observation as it would have been more logical for the participants to have had more severe MFTPs in muscles more closely associated with the TMJ dysfunction for which they had presenting symptoms (Gatterman, 1990; Travell and Simons, 1999; Bergman et al., 1995; Davies, 2001 and Leach, 2004). This premise is based on the fact that a compromised joint will inevitably be associated with kinesiopathology in the compromised joint, myopathology in the muscles surrounding this joint, neuropathophysiological changes around this joint accompanied by histopathological and biochemical changes within and around the compromised joint (Gatterman, 1995 and Leach, 2004).

Lawrence (1991) suggests that this relationship may be related to the biomechanics of the head, TMJ and upper cervical spine. He suggests that the dysfunctional TMJ results in a change in the head posture of patients, whereby the cranium is extended on the occipital condyles in order to allow for more compensatory movement in the TMJ. This is further supported by Foreman and

Croft (1995) who speculate that TMJ dysfunction in the context of whiplash is not uncommon. This is based on the anatomical relationship between the teeth, the opposite TMJ, the muscles of mastication, the hyoid bone and related structures, the shoulders (via the omohyoid muscle (Moore and Dalley, 1999)) and the spine (vertebral bodies and related musculature (Foreman and Croft, 1995)). This is supported by Rachlin and Rachlin (2002) and Manolopoulos et al., (2008), who indicate that one of two possibilities exist (Manolopoulos et al, 2008): -

- Either the TMJD is a causative agent for neck pain, by virtue of the changed / altered biomechanics as proposed/indicated to by Lawrence (1991), which allows for a compensatory head position to allow for maximal TMJ utilisation under less than optimal conditions;
- Or that the presence of hypertonic muscles in the cervical spine result in altered head position which then results in altered jaw biomechanics, predisposing to myopathic changes and thus joint dysfunction.

Either of these options assumes that there is a cause effect relationship between TMJ and the upper cervical spine (head and neck region) (Foreman and Croft, 1995).

In addition to this is the presence of referred pain associated with active MFTPS which complicates the clinical picture even more. Thus all the muscles that were considered for this study included muscles with MFTPs that had referral (when active) pain patterns over, around or to the TMJ region (Travell and Simons, 1999). However, the only manner in which the referred pain patterns can be excluded in patients is to establish whether they play a role in the clinical presentation, is to assess MFTPs in patients that have predominantly TMJD clinical features (as in this study).

In this context, this research seems to support and confirm that the suggestions made in the literature. It allows for the suggestion that future research should look into the development of longitudinal trials following patients over time to determine the cause – effect relationship between the upper cervical spine, shoulder(s) and the TMJ(s) and the degree to which they cause kinematic problems for each other.

4.8 Objective Four:

In order to ensure that the MFTPs did not confound the relationship assumed up to this point in the research, the only manner in which the MFTPs could be included or excluded from the equation was to determine the severity of the MFTP's

Table 4.4 shows the distribution (count and percentage) of severity scores for each trigger point.

Table 4.4: Frequency and percentage of scores for each location of MFTP

Location		Score / Rating					
		0 – No MFTP	1 – Tenderness no flinch	2 – Tenderness with flinch	3 – Jump sign	4 – Either withdrawal or twitch or taut band	5 – Pain referral recognition
Posterior cervicals	(n)	2	8	3	3	3	6
Posterior cervicals	(%)	8	32	12	12	12	24
Trapezuis	(n)	0	3	6	5	4	7
Trapezuis	(%)	0	12	24	20	16	28
SCM	(n)	6	5	7	0	2	5
SCM	(%)	24	20	28	0	8	20
Temporalis	(n)	5	8	5	3	0	4
Temporalis	(%)	20	32	20	12	0	16
Masseter	(n)	6	5	6	2	2	4
Masseter	(%)	24	20	24	8	8	16
Medial pterygoid	(n)	9	11	4	0	0	1
Medial pterygoid	(%)	36	44	16	0	0	4
Lateral pterygoid	(n)	9	10	6	0	0	0
Lateral pterygoid	(%)	36	40	24	0	0	0

Based on the above presentation of the MFTPs, it would seem that the posterior cervical muscles and the trapezius muscles are more clinically active (i.e. pain producing) than the TMJD. Therefore in terms of this discussion that has been presented to this point it would seem evident that:

- The clinical condition of TMJD may have been a “pseudo- presentation” of a MFTP condition of the upper cervical spine. This is possible because
    - Pain was not an inclusion criterion for the TMJD and thus aided in not confusing the TMJD with the MFTPs.
    - The muscles of the TMJ particularly would have shown higher rating levels in terms of the severity of the MFTPs.

Therefore it would seem that the participants in this study were:

- Chronic TMJD suffers.
- Had mild to moderate TMJD.
- Had mild to moderate MFTPs of the muscles of mastication.
- Had moderate to severe MFTPs of the posterior cervical spine / trapezius muscles (also see Figure 4.3).

In Figure 4.3, those with temporalis, medial and lateral pterygoid muscle MFTPs had a median score of 1, those within the masseter muscle and SCM muscle tended to have a score of 2, while posterior cervical muscle and trapezius muscle MFTPs scored a median of 3. (The total MDS score was generated for each participant by summing up their 7 individual location scores. A higher score indicated more severe trigger points). The median score was 15 with a range from 1 to 24 and an inter-quartile range from 10.5 to 17.5. A histogram of the distribution of scores as shown in Figure 4.4.

These would suggest that the participants were actually chronic neck pain suffers that developed TMJD over the long term as a result of the chronic neck pain (Foreman and Croft, 1995).

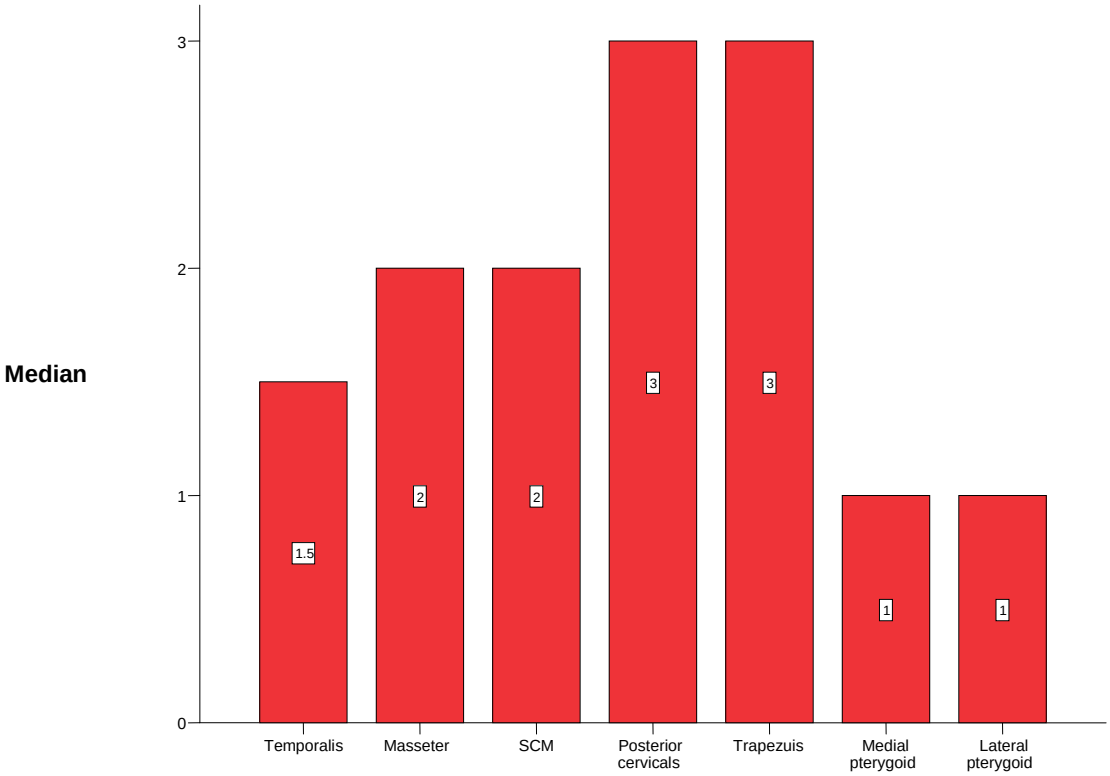

Figure 4.3: Median MDS score for each MFTP site

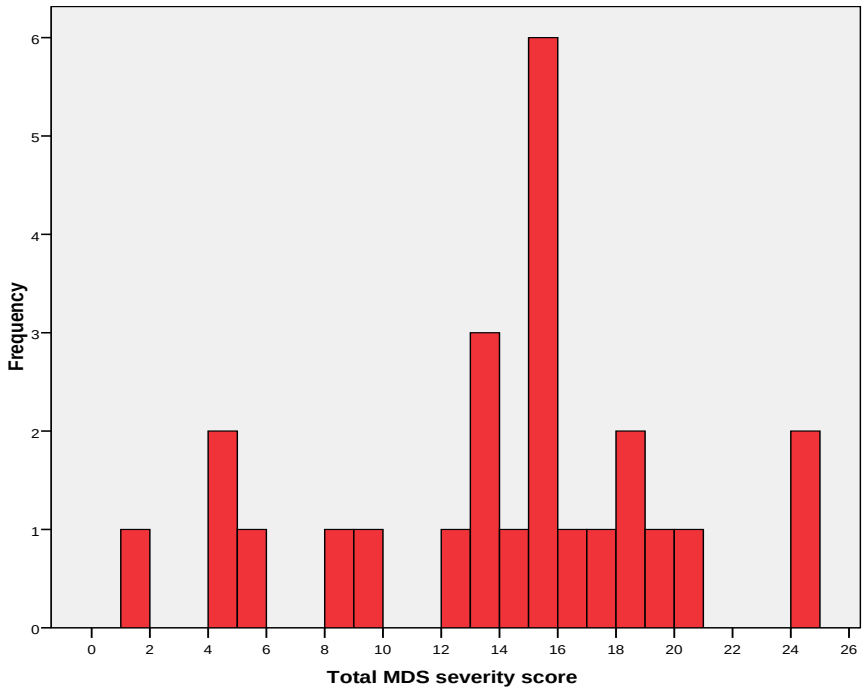

Figure 4.4: Histogram of total MDS scores

4.9 Objective Five:

The fifth objective was to confirm the possibility / type relationship between the MFTP's and TMJD.

Figure 4.5 shows the scatterplot of the severity of MFTPs by the severity of TMJ.

There did not appear to be a linear relationship, there were also two outliers with higher than usual TDDI scores and average MDS scores. The Spearman's correlation coefficient rho was 0.160, p=0.444, indicating the lack of a linear relationship.

Even when the two outliers were removed from analysis the coefficient did not improve. Using curve estimation analysis, it was determined that the best fit for these data was a quadratic equation but even this was not a good fit, (R^2= 0.067, p = 0.469). There was therefore only a weak relationship if any.

It was concluded that there was no linear relationship between the severity of MFTPs and the severity of TMJ; however, the quadratic equation presented the possibility of a weak link.

The severity of the one did not necessarily determine or predict severity of the other.

This could be due to most participants having low TDDI scores while the range of MDS scores was quite wide. This would possibly support the researcher's assertion that the participants were actually chronic neck pain suffers that developed TMJD over the long term as a result of the chronic neck pain (Foreman and Croft, 1995). However this relationship is non-linear in that it could have been modified by factors related to interjecting whiplash (acceleration-deceleration syndromes), other trauma, periodontal pathology and many other factors (Lawrence, 1991; Foreman and Croft, 1995; Rachlin and Rachlin, 2002 and Manolopoulos et al., 2008).

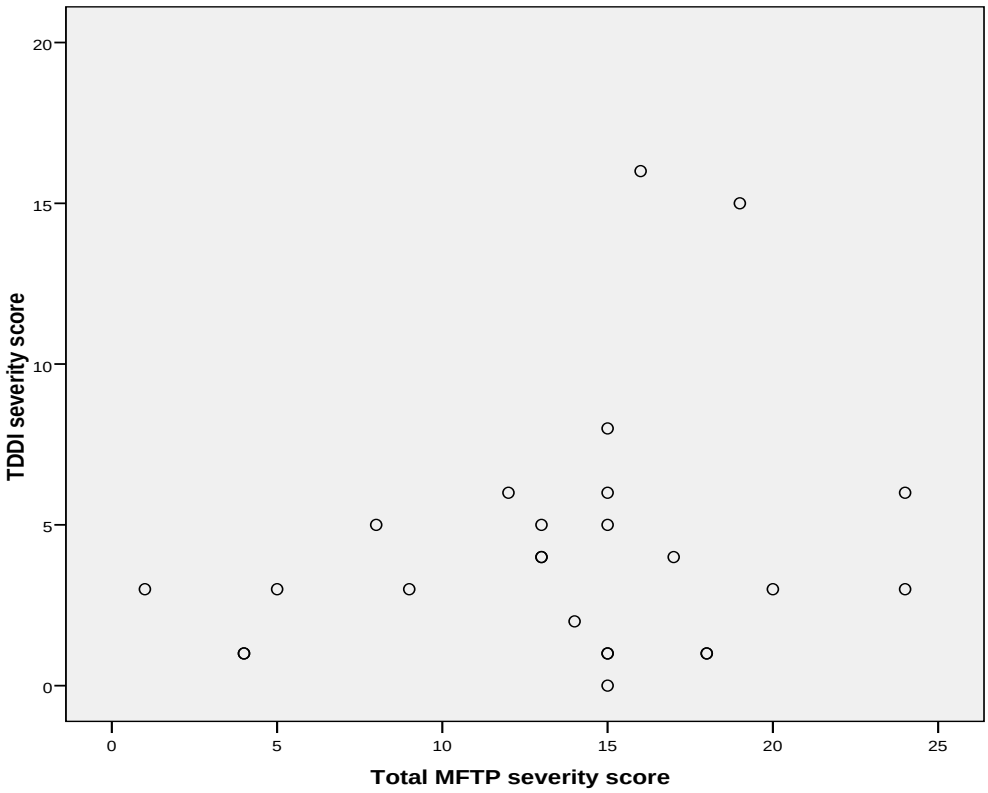

Figure 4.5: Scatter plot of the total MDS severity score by TDDI severity score

4.10 Summary of objectives

As outlined in Chapter One, the objectives are as follows:

- Objective one was to determine existence of TMJD in the participants.
    - This was determined by clinical criteria that did no include pain (not participant response) as a criterion.

- Objective two was to determine the severity of the TMJD.
    - This was measured by the use of functional questionnaires and determined that the TMJD was mild to moderate in clinical severity.

- Objective three was to determine the specific location of the MFTP's within the superficial muscles of mastication.

- This was measured by researcher clinical assessment of the MFTPs (not participant response); this found that the MFTPs were mild to moderate for all muscles of mastication controlling the TMJ.

- Objective four was to determine the severity of the MFTP's.
  - This was measured by researcher clinical assessment of the MFTPs (not participant response); this found that the MFTPs were moderate to severe, with the trapezius and posterior cervical muscles having the most MFTPs.

- Objective five required that the research assesses the correlations between the documented clinical findings in Objectives one to four.
  - It was found that there was no linear relationship the TMJD presentation and the presentation of MFTPs – either in the muscles of mastication or the muscles of the posterior cervical spine.

4.11 Conclusion

Within the limitations of this study, it seems that there is only a week correlation between severity of TMJD and severity of MFTP's. The above results would suggest that the participants were actually chronic neck pain suffers that developed TMJD over the long term as a result of the chronic neck pain changing the kinematic biomechanics or as a result of a completely different and independent event as suggested by Foreman and Croft (1995).

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the conclusions and recommendations of this study as they arise out of the methodology and statistical analysis of the results.

5.1 Conclusion

The results suggest that the participants were actually chronic neck pain suffers that developed TMJD over the long term as a result of the chronic neck pain changing the kinematic biomechanics or as a result of a completely different and independent event as suggested by Foreman and Croft (1995).

5.2 Recommendations

1. Methodological recommendations :

    a. It would be preferred that future studies consider researchers conduct a double blind assessment (i.e. one researcher to assess the TMJ and its subjective and objective clinical parameters and one researcher to assess the cervical spine and shoulders and their subjective and objective clinical parameters) and then only to compare and contrast the results obtained. It may even be considered that a third researcher assess the myofascial component of the head and neck independent of the assessors of the cervical spine / shoulder and TMJ.
    b. It would be suggested that future studies expand the clinical measures to include a balance of objective and subjective measures for all clinical parameters (shoulder,

neck and TMJ). An example would be the inclusion of the algometer to assess muscle tenderness in order to correlate subjective pain with muscle tenderness.

c. It would be suggested that future studies should include the history of the patient's complaint in to determine more accurately the causative agent of presenting pain / condition, chronicity of the condition and other factors that may modify or alter the relationship between the TMJ and the cervical spine and shoulder girdle complex.
d. An increased sample size would allow for greater ability to use correlational statistics more effectively and allow for more convincing statistical bases on which decisions can be made in favour of or against particular arguments currently in the literature.
e. Due to the anatomical location of the pterygoid muscles, the evaluation poses a clinical conundrum. Development of more affective clinical assessments would facilitate more accurate recording.
f. The experience of the researcher who is more adept at finding MFTPs in the posterior cervical muscles rather than in the muscles of mastication would have influenced the results. A researcher more adept at investigating the TMJ and muscles of mastication would have been more beneficial and would have facilitated more accurate recording.

2. Future studies :
    a. Clinical trials in which a cross over design may be considered where the patients are treated for
        i. Their cervical complaint / condition and the outcomes are measured in terms of TMJD improvement or
        ii. Their TMJD complaint / condition and the outcomes are measured in terms of cervical spine improvement or
        iii. Their cervical complaint / condition and the outcomes are measured in terms of myofascial improvement in the posterior cervical musculature as well as the TMJ musculature or
        iv. Their TMJD complaint / condition and the outcomes are measured in terms of myofascial improvement in the posterior cervical musculature as well as the TMJ musculature.

b. Longitudinal trials should also be considered such that patient conditions (cervical spine and TMJD) either independently or together can be tracked in terms of their pathogenesis.
c. To improve methodology it is recommended that another form of pressure threshold device (algometer) be manufactured for the accurate assessment of muscles such as the SCM which cannot be assessed by conventional means.
d. Future studies should consider developing more accurate measures to measure TMJD with particular reference to questionnaires or survey tools that measure activities of daily living.

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APPENDICES

Appendix A

DURBAN UNIVERSITY OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient_____ Date: _____

File # _____ Age: _____

Sex : _____ Occupation: _____

Intern _____Signature: _____

FOR CLINICIANS USE ONLY:

Initial visit

Clinician: Signature:

Case History:

Examination:

Previous:
Current:

X-Ray Studies:

Previous:
Current:

Clinical Path. Lab:

Previous:
Current:

CASE STATUS:

PTT:	Signature:	Date:

CONDUTIONAL: Reason for Conditional: --- --- --- Signature: Date:
Conditions met in Visit No: Signed into PTT: Date:
Case Summary signed off: Date:

Intern's Case History:

1. **Source of History:**

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

3. **Present Illness:**

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

4. **Other Complaints:**

5. **Past Medical History:**

< General Health Status

< Childhood Illnesses

< Adult Illnesses

< Psychiatric Illnesses

< Accidents/Injuries

< Surgery

< Hospitalizations

6. Current health status and life-style:

< Allergies
< Immunizations
< Screening Tests incl. x-rays
< Environmental Hazards (Home, School, Work) - Wearing of any type of headsets.
< Exercise and Leisure – scuba diving
< Sleep Patterns
< Diet
< Current Medication
Analgesics/week:
< Tobacco
< Alcohol
< Social Drugs

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

< General

< Skin

< Head

< Eyes

< Ears

< Nose/Sinuses

< Mouth/Throat

< Neck

< Breasts

< Respiratory

< Cardiac

< Gastro-intestinal

< Urinary

< Genital

< Vascular

< Musculoskeletal

< Neurologic

< Haematologic

< Endocrine

< Psychiatric

Appendix B

Durban University of Technology

PHYSICAL EXAMINATION: SENIOR

Patient Name : _____ **File no :**_____ **Date :**_____

Student : **Signature :**

VITALS:

Pulse rate:			Respiratory rate:	
Blood pressure:	R	L	Medication if hypertensive:	
Temperature:			Height:	
Weight:	Any recent change? Y / N		If Yes: How much gain/loss	Over what period

GENERAL EXAMINATION:

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

SYSTEM SPECIFIC EXAMINATION:

CARDIOVASCULAR EXAMINATION

RESPIRATORY EXAMINATION

ABDOMINAL EXAMINATION

NEUROLOGICAL EXAMINATION

COMMENTS

NEUROLOGICAL EXAMINATION: See Regional

Clinician: **Signature :**

Appendix C

DURBAN UNIVERSITY OF TECHNOLOGY
REGIONAL EXAMINATION - CERVICAL SPINE

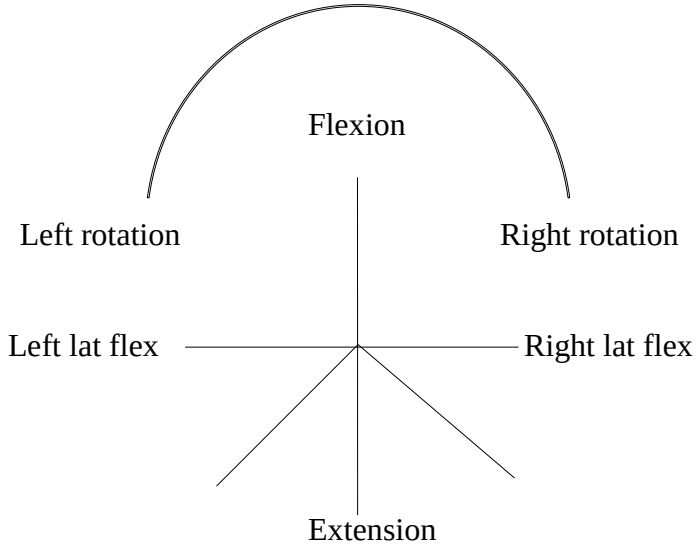
Patient: _____ File No: _____

Date: _____ Student: _____

Clinician:_____ Sign: _____

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

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



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

PALPATION:
Lymph nodes
Thyroid Gland
Trachea

ORTHOPAEDIC EXAMINATION:

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

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

NEUROLOGICAL EXAMINATION:

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

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

MOTION PALPATION & JOINT PLAY:

Left: Motion Palpation:
Joint Play:

Right: Motion Palpation:
Joint Play:

Upper Thoracics:
Motion Palpation:
Joint Play:

BASIC EXAM: SHOULDER:
Case History:

BASIC EXAM: THORACIC SPINE:
Case History:

ROM: Active:
Passive:
RIM:
Orthopaedic:
Neuro:
Vascular:
Observ/Palpation:

ROM: Motion Palp:
Active:
Passive:
Orthopaedic:
Neuro:
Vascular:
Observ/Palpation:

Appendix D

TMJ REGIONAL EXAMINATION

Patient: _____ **File no:** _____ **Date:** _____

Student: _____ **Signature:** _____

Clinician: _____ **Signature:** _____

.....

Observation

Posture of C-spine and head (bipupital, otic and occlusive lines parallel) _____

Facial symmetry _____ Paralysis _____

Malocclusion (cross bite or overbite) _____

Deviation of mandible on opening or closing mouth _____

Normal bulging of masseters when patient bites down _____

Normal movement of tongue _____

Palpation

		Right	Left
Cervical spine	Facet joints		
	Muscles		
	Lymph Nodes		
Mandibular condyles: Tenderness			
Mandible			
Hyoid bone (normal movement on swallowing)			
Mastoid processes			
Movement (palpate with fingers in EAM)	Smooth		
	Symmetrical		
	pain / tenderness		
Masseters			
Temporalis			

Thyroid cartilage and gland		
Parotid gland		
Teeth and gums		

Active Movements

Cervical spine: Flexion _____ Extension _____

Lateral flexion _____ Rotation _____

Opening the mouth: Deviation? _____

Functional opening (2-3 flexed PIP joints) _____

Closing the mouth: Deviation? _____

Resting position / Freeway Space (2-4mm) _____

Protrusion of mandible: _____

Retraction of mandible: _____

Lateral deviation of mandible: _____

Resisted Isometric Movements (perform with TMJ in resting position)

Opening (depression) _____

Closing (elevation, occlusion) _____

Lateral deviation _____

Joint Play Movements

Inferior distraction (tissue stretch) _____

Special Tests

Chovstek Test (facial nerve pathology) _____

Auscultation of TMJ's _____

Reflex

Jaw reflex (CN 5) _____

APPENDIX E

TELEPHONIC QUESTIONNAIRE

1. Name
2. Age
3. Are you healthy Yes/No
4. Do you experience pain over the side of your face, ear, temple or jaw? Yes/No
5. Do you experience any jaw clicking/cracking? Yes/No
6. Is your jaw movement limited in any way? Yes/No
7. Do you experience earache, ringing ears, dizziness or blocked or itching ears? Yes/No
8. Do you clench or grind your teeth habitually? Yes/No
9. Are you pregnant or breastfeeding? Yes/No
10. Have you recently been to a dentist or Maxillo Facial Surgeon? Did they fit a device? Yes/No

APPENDIX F

Temporomandibular Disorder Disability Index

Name: _____DATE:_____DOB:_____

Please check the one statement that best pertains to you (not necessarily exactly) in each of the following categories.

1. **Communication (talking).**
   - ( ) I can talk as much as I want without pain, fatigue or discomfort. 0
   - ( ) I talk as much as I want, but it causes some pain, fatigue and/or discomfort. 1
   - ( ) I can't talk as much as I want because of pain, fatigue and/or discomfort. 2
   - ( ) I can't talk much at all because of pain, fatigue and/or discomfort. 3
   - ( ) Pain prevents me from talking at all. 4
2. **Normal living activities (brushing teeth/flossing).**
   - ( ) I am able to care for my teeth and gums in a normal fashion without restriction, and without pain, fatigue or discomfort. 0
   - ( ) I am able to care for all my teeth and gums, but I must be slow and careful, otherwise pain/discomfort, jaw tiredness results. 1
   - ( ) I do manage to care for my teeth and gums in a normal fashion, but it usually causes some pain/discomfort, jaw tiredness no matter how slow and careful I am. 2
   - ( ) I am unable to properly clean all my teeth and gums because of restricted opening and/or pain. 3
   - ( ) I am unable to care for most of my teeth and gums because of restricted opening and/or pain. 4
3. **Normal living activities (eating, chewing)**
   - ( ) I can eat and chew as much of anything I want without pain/discomfort and/or jaw tiredness. 0
   - ( ) I can eat and chew most anything I want, but it sometimes causes pain/discomfort and/or jaw tiredness. 1
   - ( ) I can't eat much of anything I want, because it often causes pain/discomfort, jaw tiredness or because of restricted opening. 2
   - ( ) I must eat only soft foods (consistency of scrambled eggs or less) because of pain/discomfort, jaw fatigue and/or restricted opening. 3
   - ( ) I must stay on a liquid diet because of pain and/or restricted opening. 4
4. **Social/recreational activities (singing, playing musical instruments, cheering, laughing, social activities, playing amateur sports/hobbies, and recreation, etc).**
   - ( ) I am enjoying a normal social life and/or recreational activities without restriction 0
   - ( ) I participate in normal social life and/or recreational activities but pain/discomfort is increased. 1
   - ( ) The presence of pain and/or fear of likely aggravation only limits the more energetic components of my social life (sports, exercising, dancing, playing musical instruments, and singing). 2
   - ( ) I have restrictions socially, as I can't even sing, shout, cheer, play and/or laugh expressively because of increased pain/discomfort. 3
   - ( ) I have no social life because of pain. 4
5. **Non-specialized jaw activities (yawning, mouth opening and opening my mouth wide)**

( ) I can yawn in a normal fashion, painlessly. 0

( ) I can yawn and open my mouth fully wide open, but sometimes there is discomfort. 1

( ) I can yawn and open my mouth wide in a normal fashion, but it almost always causes discomfort 2

( ) Yawning and opening my mouth wide are somewhat restricted by pain. 3

( ) I cannot yawn or open my mouth more than two finger widths (2.8-3.2 cm) or, if I can, it always causes greater than moderate pain. 4

6. Sleep (restful, nocturnal sleep pattern).

( ) I sleep well in a normal fashion without any pain medication, relaxants or sleeping pills. 0

( ) I sleep well with the use of pain pills anti-inflammatory medication or medicinal sleeping aids.1

( ) I fail to realize 6 hours restful sleep even with the use of pills. 2

( ) I fail to realize 4 hours restful sleep even with the use of pills. 3

( ) I fail to realize 2 hours restful sleep even with the use of pills. 4

7. Effects of any form of treatment, including, but not limited to, medications, in-office therapy, treatments, oral orthotics (e.g. splints, mouthpieces), ice/heat, etc.

( ) I do not need to use treatment of any type in order to control or tolerate headache, face or jaw pain and discomfort. 0

( ) I can completely control my pain with some form of treatment 1

( ) I get partial, but significant, relief through some form of treatment. 2

( ) I don't get "a lot of" relief from any form of treatment 3

( ) There is no form of treatment that helps enough to make me want to continue. 4

8. Tinnitus, or ringing in the ear(s).

( ) I do not experience ringing in my ear(s) 0

( ) I experience ringing in my ear(s) somewhat, but it does not interfere with my sleep and/or my ability to perform my daily activities. 1

( ) I experience ringing in my ear(s) and it interferes with my sleep and/or daily activities, but I can accomplish set goals and I can get an acceptable amount of sleep. 2

( ) I experience ringing in my ear(s) and it causes a marked impairment in the performance of my daily activities and/or results in an unacceptable loss of sleep. 3

( ) I experience ringing in my ear(s) and it is incapacitating and/or forces me to use a masking device to get any sleep. 4

9. Dizziness (light-headed, spinning and/or balance disturbance.

( ) I do not experience dizziness 0

( ) I experience dizziness, but it does not interfere with my daily activities 1

( ) I experience dizziness which interferes somewhat with my daily activities, but I can accomplish my set goals 2

( ) I experience dizziness which causes a marked impairment in the performance of my daily activities. 3

( ) I experience dizziness which is incapacitating. 4

An adaptation from Yeoman's 2000: 543-544

Appendix G

TMJ Regional Ratings

	None = 0	**Mild = 1**	**Moderate = 2**	**Severe = 3**
Malocclusion	None	Slight	Obvious	Markedly Obvious
Functional Opening	3 flexed PIP joints	2 flexed PIP joints	1 flexed PIP joint	Less than 1 flexed PIP joint
Auscultation	No audible clicking	Audible on auscultation	Audible without auscultation	Audible and visible without auscultation
Crepitus	None	Slight	Obvious	Markedly Obvious

APPENDIX H

MYOFASCIAL DIAGNOSTIC SCALE

Location of MFTP	No Tenderness	Tenderness no Flinch	Tenderness with Flinch	Jump Sign	Withdrawal to non-noxious	Twitch Response	Taught Band	Pain Recognition	Totals
Temporalis	0	1	2	3	4	4	4	5	/5
Masseter	0	1	2	3	4	4	4	5	/5
SCM	0	1	2	3	4	4	4	5	/5
Posterior Cervicals	0	1	2	3	4	4	4	5	/5
Trapezius	0	1	2	3	4	4	4	5	/5
Medial Pterygoid	0	1	2	3	4	4	4	5	/5
Lateral Pteyrygoid	0	1	2	3	4	4	4	5	/5

Total _____/35

Other Muscles not listed above_____

Appendix I

Research is being conducted at the Durban University of Technology at the Chiropractic Clinic on:

Do you have Jaw Pains and/or clicking?

Are you 20-50 years

IF YES!

Please contact Michelle at the Chiropractic Clinic on 031-2042205

You will receive a **FREE treatment** once the assessment is complete.

Appendix J

LETTER OF INFORMATION

Title of Research:

An investigation into the relationship of myofascial trigger points in the head and neck region in association with temporomandibular joint dysfunction.

NAME OF RESEARCH STUDENT: Michelle Seagreen (083 3022954)
NAME OF RESEARCH SUPERVISORS: Dr Charmaine Korporaal M.Tech.C, CCSP, CCFC, ICSSD (031 3732611)

Dear Patient

Welcome to my research project. You have been selected to take part in a clinical trial assessing the role and extent of myofascial trigger points in temporomandibular joint dysfunction.

The aim of this study:

To determine the relationship between Temporomandibular Joint (Jaw Joint) Dysfunction and Myofascial Trigger Points in muscles in the head and neck

What will happen during the study period?

You will come into the Chiropractic Clinic for one 60 minute visit during which time we will take a medical case history, complete a full physical examination and do regional examinations of your Jaw and Neck during which time I will rate my findings. You will also be required to fill in forms and answer questions about your pain and discomfort and also your acts of daily living. All this information will be collected and will be collated. Patient information is confidential and the results of the study will be made available in the Durban University of Technology library in the form of a mini-dissertation.

What do you need you to do?

You will need to be honest when supplying answers both verbally and in the questionnaires that you will be required to fill in.

Risks:

There are no risks to you in being involved in this study.

Costs / Remuneration:

You will be entitled to one free treatment within one week of assessment at the DUT if you participate in the study.

Questions and Queries:

Please don't hesitate to ask questions on any aspect of this study. Your full co-operation will assist the Chiropractic profession in expanding its knowledge of this condition and the treatment thereof.

Thank you,

Michelle Seagreen
(Research student)

Dr. Charmaine Korporaal
(Research supervisor)

APPENDIX K
INFORMED CONSENT FORM **Date:**

TITLE OF RESEARCH

An investigation into the relationship of myofasical trigger points in the head and neck region in association with temporomandibular joint dysfunction.

NAME OF RESEARCH STUDENT: Michelle Seagreen (0833022954)
NAME OF RESEARCH SUPERVISOR: Dr Charmaine Korporaal (031 3732641)
PLEASE CIRCLE THE APPROPRIATE ANSWER:

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

Please ensure that the researcher completes each section with you. If you have answered NO to any of the above, please obtain the necessary information before signing

PATIENT/SUBJECT
Name_____ Signature_____

WITNESS
Name_____ Signature_____

RESEARCH STUDENT
Name_____ Signature_____

DURBAN UNIVERSITY of TECHNOLOGY

Faculty of Health Sciences

ETHICS CLEARANCE CERTIFICATE

Student Name	**Michelle. M Seagreen**	**Student No**	**20000691**
Ethics Reference Number	**FHSEC 037/07**	**Date of FRC Approval**	**28/08/2007**
Research Title:	**An investigation into the relationship of myofascial trigger points in the head and neck region in association with temporomandibular joint dysfunction.**		

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

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

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

SIGNATURE OF STUDENT/RESEARCHER — DATE 4/3/08

SIGNATURE OF SUPERVISOR/S — DATE 4/3/08

SIGNATURE OF HEAD OF DEPARTMENT — DATE 4/12/08

SIGNATURE: CHAIRPERSON OF RESEARCH ETHICS COMMITTEE — DATE 11/12/08