Chronic Temporomandibular Joint Dysfunction: A Condition for a Multidisciplinary Approach

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Chronic temporomandibular joint dysfunction is a common pathological condition affecting the joint(s) and the associated muscles of mastication. It may be clinically expressed as unilateral or bilateral pain of the related area, diminished mouth opening, various sounds of the joints and occasionally ear symptoms. The etiology constitutes the radix of the treatment. Therefore, education and assessment of a broad spectrum of predisposing and promoting factors would lead to a more specific treatment plan. The management of the chronic temporomandibular joint dysfunction could be simple or complex. The choice of the treatment, based on the etiology, may be characterized as psychological or operational. The conservative treatment is beneficial in most of the cases. This literature review focused on the pathogenesis and the management of this complex clinical entity.

Key words: TMD, pathogenesis, management

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INTRODUCTION

Temporomandibular joint dysfunction (TMD) is a common condition affecting up to 33% of the population (Dworkin et al., 1990). It is characterized as a unilateral or bilateral pain in the temporomandibular joint (TMJ) and its associated craniofacial musculature in addition to other symptoms such as tinnitus, ear fullness and popping (Harris et al., 1993; Feinmann and Harrison, 1997). Lack of tenderness of the joint palpation via the external ear could be an extra diagnostic feature of the pain syndrome (Klineberg, 1991). The most common symptoms are pain upon palpation of the joint or muscles of mastication, diminished mouth opening, restriction in excursive jaw movement and clicking or grating sounds in the joint upon movements of the mandible (Drangsholt and LeResche, 1999).

An acute episode of pain generally has a sudden onset due to local tissue damage and it resolves within 4 to 12 weeks (Cousins, 1994). Marbach have also suggested that acute temporomandibular joint patients are those who have not previously been diagnosed with joint dysfunction during the last six months (Marbach, 2001). The conversion from acute to chronic pain may result from the body's inability to restore normal physiological function (Loezer and Melzack, 1999).

CLASSIFICATION

Historically, there are several suggested TMD classifications emphasizing either the mechanical or psychological concepts. Classifying TMD has been a difficult task and several proposals exist within the literature. The range of classification systems creates a field of diagnostic confusion.

One of the oldest classification systems distinguishes two categories of TMJ pain, a) the masticatory myalgia and b) the TMJ arthralgia. The former was subdivided into splinting, spastic and inflammatory pain while the latter into discal, retrodisca, capsular and arthropathic pain (Bell, 1982a; Bell, 1982b).

A few years later, the same author classified the TMJ non-arthritic arthralgia as a deep somatic pain of disc attachment (Bell, 1989).

Another classification system separates the condition into the general groups of 1) rheumatoid changes with synovitis, 2) arthralgia, 3) condylar degeneration, 4) open bite deformity, 5) chronic pain with link to behavior, 6) myofascial pain and dysfunction, 7) internal derangement with displacement and reduction (Goldstein, 1999). A more recent classification system relating the TMD to Masticatory Myofascial Pain (MMFP) in association to TMJ pain with or without joint sounds, suggest that Myofascial Pain Dysfunction (MPD), masticatory myalgia, masticatory myositis, tendinitis and Whiplash TMJ are all variations of the Myofascial Pain syndromes (Ogle and Hertz, 2000).

One of the most comprehensive classifications is currently the research diagnostic criteria RDC/TMD. This is an all-inclusive system for TMD classification which differentiates the TMD entities along two axes. The first axis (Axis I) refers to the clinical evaluation of TMD conditions. It is divided into three main groups, a) the muscular involvement, b) the disc displacement and c) the arthritic origin of the condition. The second axis (Axis II), considers pain related disability and psychological status in association with TMD (Dworkin and LeResche, 1992). Good to excellent reliability results were found using these criteria in an adolescent study for each category of RDC/TMD (Wahlund et al., 1998). The RDC/TMD and more specifically the jaw disability checklist, evaluates the jaw function and determines in depth the extent of interference caused by the TMD (Dworkin and LeResche, 1992). Eating, yawning and chewing were found to be the most common jaw functions that interfered with the TMJ using the RDC/TMD (Yap et al., 2002a, b).

PATHOGENESIS

Lack of evidence, regarding the pathological origin of the chronic TMJ dysfunction, exists in up to 95% of the cases (Goldstein, 1999). Currently, there are observations indicating a multifactorial etiology of the disease.

At the moment, the involvement of psychological factors in the etiology of many TMJ disorders is well established, implicating emotion, behavior and personality as the major causes of the pain-dysfunction syndrome (Ogus and Toller, 1986). Furthermore, trauma, parafunctional habits, third molar extraction, somatization and female gender were identified as risk factors in patients with myofascial pain as well as in subjects with concurrent myofascial pain and arthralgia (Huang et al., 2002; Conti et al., 2003). In the following section the possible role of the above mentioned trauma, psychological factors, gender and occlusion in the pathogenesis of the condition are reviewed.

Trauma: Injuries of the TMJ might be direct or indirect and micro or macro-traumatic. The reaction of the mandible to Whiplash injury may induce tears of the retrodiscal tissues and TMJ ligaments by the sudden protrusion and retro-positioning of the mandible in response to the rapid deceleration of the motor vehicle (Ogle and Hertz, 2000). Other trauma of the TMJ could be
related to scuba diving, childbirth, endotracheal intubation, violin playing, a direct blow and banana peel fall (Goldman, 1991). The parafunctional habits such as chewing gum, biting nails and pencils and grinding teeth may cause microtrauma which with chronic persistence of the stimulus, may induce pain and various sounds of the TMJ. Since sounds of the joint are not always pathognomonic, the necessity of assessing the condition carefully is essential. In general, past trauma of the head and neck might be a contributing factor of the joint disability (Velly et al., 2003; Klobas et al., 2004). Trauma patients may understandably show higher psychological disability than the non-trauma group (Steed and Wexler, 2001), emphasizing further the psychological component.

Psychological factors: It is well known that pain disorders may be directly or indirectly associated to psychological factors. However, the question whether chronic pain is caused by a pre-existing psychological condition or vice versa cannot easily be answered. Presence of widespread pain (back, head, chest, stomach), or pain outside the masticatory system are found to be a risk factor for chronic TMD pain among women (John et al., 2003). Pain in multiple body sites were significantly more common in the TMD group compared to a control group (List et al., 2001b).

Psychological factors play a more prominent role when the pain is of muscular origin (Auerbach et al., 2001; Yap et al., 2002a, b) and are considered to be the major issues in the onset, exacerbation, or perpetuation of the pain (Neligh, 1996). This theory is partly supported by research, concluding that the perpetuation of chronic pain is influenced by psychosocial implications (Fritton and Olsen, 1996). In a study group, the muscular tenderness of the masticatory system was found to be correlated with facial pain (Sipila et al., 2002). It is also identified that these patients are more distressed by cephalalgias (Yap et al., 2002a, b). The cause of muscular involvement seems to be related to fatigue from chronic parafunctional habits secondary to psychological stress conditions (Klineberg, 1991). Patients who develop chronic TMD appear to have more psychosocial distress before the diagnosis of chronicity than do individuals who have acute symptoms that subside (Phillips et al., 2001). Whist work and social factors were found to be related to the occurrence of TMD symptoms (Rantala et al., 2003); the demographics, emotion, behavior and cognition, as more general psychosocial factors may predict the treatment outcome (Fritton and Olsen, 1996). Women who developed chronic TMD were significantly more likely to be diagnosed as having a muscle disorder than were women who did not develop chronic TMD (Phillips et al., 2001). Finally, it is important to note that about 50% of depressed individuals have pain as a current complaint at examination (Feinmann, 2002). The need of the psychological assessment should be emphasized for the patients benefit.

In a study with a control group, the TMD patients reported a history of physical or sexual abuse in 44.8% of the diseased group, a percentage that is slightly higher than the control group (Fillingim et al., 1997). Previous physical abuse in females seems to indicate an enhanced presence of symptoms such as pain, anxiety and depression (Campbell et al., 2000). Patients with a history of both physical and sexual abuse in childhood may be suffered from more depression (Goldberg, 1994).

Gender: Compared to males, chronic TMJ dysfunction is more prevalent in females of reproductive age with the prevalence being as high as 80% (Warren and Fried, 2001). Chronic facial pain is also more common in women, accounting for 75% of the cases (Bell, 1989). The high prevalence of TMD in women is supported by several studies (LeResche et al., 1997; Eiker et al., 1999; Rauhala et al., 2000; Huang et al., 2002; Macfarlane et al., 2002; Rantala et al., 2003). Interestingly, subjective symptoms such as pain are more frequently reported by females while objective disabilities such as diminished jaw opening and masticatory disability more commonly affect males (Johansson et al., 2003). The discrepancy of TMJ disease between genders is not clearly understood although theories suggest a hormonal influence, differences in the pain signaling process and in seeking medical care.

The involvement of female hormones in the pathology of TMJ pain derives mainly from observations correlating the intake of postmenopausal hormones with an increased risk for TMD development (LeResche et al., 1997). Furthermore, women who report orofacial pain are more likely to report symptoms associated with menstruation (Macfarlane et al., 2002). Though the precise pathogenesis of the disease is unknown, the activation of cytokine production via estrogen receptors in the temporomandibular joints of females has been suggested to explain the hormonal involvement (Gollon and Spagnoli, 2001; Phillips et al., 2001). More recently, the cumulative exposure to female reproductive hormones may also be associated with the onset of TMD in females (LeResche et al., 2005).

Another possible explanation is based on the findings that men and women might not process pain signals in the same way developing a different perception and reaction to pain between genders (Bradbury, 2003).
Finally, the fact that women seek health care for pain more frequently than men also contributes to the reported higher prevalence of TMD by females in the clinical population (LeResche, 2001).

**Occlusion**: The role of occlusion in the pathogenesis of the TMD condition is still controversial. Reported studies include: a) a relationship of mandibular prognathism to TMJ symptoms (Kobayashi, 1999) and b) the reduction of symptoms in Angle class II retroclussion postsurgically (Rodrigues-Garcia et al., 1998); although both results were not statistically significant.

Stronger evidence comes from studies suggesting occlusion is not considered to be a significant factor for the pathogenesis of TMD (Kitai et al., 1997; Miragi et al., 1997; Goldstein, 1999). Furthermore, orthodontic treatment leading to extensive changes of the occlusion was not associated with the development of TMD (Goldstein, 1999; Conti et al., 2003). The negative co-relation of occlusion to TMJ symptoms was established in an observational study with two groups of individuals, one with normal occlusion and the other with malocclusion with no statistical difference between these samples (Matsumoto et al., 2002).

Occlusal malfunction, such as bruxism has not been found to induce TMD (John et al., 2002; Pergamalian et al., 2003). Moreover, bruxism activity was not correlated with myalgias (Pergamalian et al., 2003). However, the two components of bruxism, clenching during daytime and nocturnal grinding were not the same indicating that these two may be different (Carlsson et al., 2003). The reason for the author’s interest is the fact that in one chronic TMD study more than 60% of bruxism in individuals presented with TMD (Alvarez-Arenal et al., 2002).

Concluding, there is currently not sufficient evidence to implicate occlusion patterns in the pathogenesis of the TMD (Goldstein, 1999).

**PSYCHOLOGICAL APPROACHES**

**Informed reassurance**: Informed reassurance, as a psychological technique is an empathic explanation of the disease status either in verbal or written form. This should be done in a simple manner to be clearly understood by the patient. The technique of reassurance has been found very useful in around 80% of cases when used in conjunction with simple analgesics, physiotherapy and occlusal splint (Mitchell and Mitchell, 1999). Informed reassurance and placebo were found to be effective in relieving symptoms in 45% of cases (Feinmann and Harris, 1984). Early discussion and intervention may prevent the development of chronicity (Eppert et al., 1999; Newton-John et al., 2001). It is important to mention that only 2-5% of all patients treated for TMJ disorders undergo surgery emphasizing the majority of patients receive conservative management with 70% therapeutic results (Feinmann, 1993; Mazzenetto et al., 2001). Most of TMD patients suffered from stress and pain were found to be sensitive to reassurance (Harris, 1987).

**Mind-body therapies**: Stress has been found to be an important factor in the genesis of musculoskeletal disorders and techniques such as yoga are used to relieve individual stress and lead to a state of relaxation (Gura, 2002). Evaluation of this technique was difficult due to transpersonal and philosophical dimensions (Nespore, 1991). Yoga, hypnosis, relaxation, meditation, imagery and biofeedback are considered as being mind body therapies (Astin, 2004).

The anxiety and pain complex may be the most common indication for dental hypnosis (Schaeferlakens, 2003). Although, hypnotic induced reduction in frequency, duration and intensity of TMD pain has been observed (Simon and Lewis, 2000), there is no significant difference in analgesia with the addition of suggestion under hypnosis (Gaspar et al., 2003). Another recommendation that hypnosis could be effective for the treatment of a wide range of acute and recurring painful conditions should be taken into account (Barber, 2001).

In general, relaxation and imagery techniques are not clearly understood methods in the treatment of both acute and chronic pain syndromes. Individuals with strong religious or other objections should be excluded from these options (Syrjala, 2001). The possible target of relaxation is to clamp down the sympathetic nervous system and to decrease functional metabolic activity (Jessup and Galegos, 1994).

**Cognitive-behavioral therapy**: Any patient with long-term pain may benefit from cognitive behavioral therapy (CBT),
which is divided into cognitive restructuring and coping skills training (Turner and Romano, 2001). The inter-related components of the treatment are education, skills acquisition, cognitive and behavioral rehearsal, homework, generalization and maintenance (Turk and Rudy, 1994). A recent randomized clinical trial concludes that patients with enhanced psychological and social disability, after 6 sessions of CBT, showed improvement in pain variables (Dworkin et al., 2002). Combination treatment of cognitive skills training and biofeedback were more effective in comparison to the use of these options alone (Gardea et al., 2001). Individuals who suffered from dysfunctional profiles or patterns of TMD, in other terms high distress and pain, were associated with both failure of conservative and surgical treatment (Dahlstrom et al., 1997). Additionally, patients with dysfunctional pain did not benefit from brief CBT (Dworkin et al., 1994). The need for more research in this field has been emphasized (Turner et al., 1995).

Combining biofeedback with intra-oral appliances was more favourable in comparison to each treatment alone in reducing pain, hence supporting the concept of combined management (Turk et al., 1993).

In another study designed with a pre-test and post-test control group, the use of habit reversal treatment for TMD revealed that reduction in pain was accompanied by a reduction in oral habits with minimal clinical contact (Townsend et al., 2001).

OPERATIONAL APPROACHES

Occlusal therapies: Occlusal therapies can be subdivided into occlusal adjustment and appliances. Occlusal adjustment as an irreversible alteration of the occlusion has been used for the treatment of TMD without a sound literature background regarding its efficacy (Kirveskari, 1997). A recent study showed that occlusal adjustment was not convincing for the alleviation of symptoms of chronic TMD because of the non-powerful experimental evidence (Tsukiyama et al., 2001). Thus occlusal adjustment cannot be recommended for the management of TMD (Tsukiyama et al., 2001; Koh and Robinson, 2003, 2004).

Occlusal splints as two major types of removable orthopaedic appliances can be distinguished into repositioning and stabilization appliances; the former is used to decrease pain, clicking and secondary muscular symptoms, while the latter is mainly indicated for muscular relaxation and protection of teeth (Yap, 1998). The efficacy of occlusal appliances is based on a reduction of electromyographic activity and in modification of the parafunctional behavior (Dao and Lavigne, 1998; Raphael et al., 2003a; Raphael et al., 2003b). The role of occlusal appliances was considered to be the decompression of the condyle in the articulating fossa, but research showed that there is no evident increase in joint space during clenching (Kuboki et al., 1997). A randomized controlled trial concludes that stabilization appliances are more effective in the myalgia type of the disorder, with regards to reduction in symptoms and signs (Ekberg et al., 2003), while the role of anterior repositioning splints is restricted mainly to joints with arthralgia and painful click (Major and Nebbe, 1997). Prolonged splint wear may induce remodeling and even injury of the TMJ as indicated in research undertaken on miniature pigs (Sindelar et al., 2002). Therefore, splints should perhaps be constructed only as an initial short term form of therapy (Mitchell and Mitchell, 1999).

In general occlusal appliances were found to be more effective in pain reduction than the combined treatment option of informed reassurance and relaxation (p<0.05) (Wahlund et al., 2003). Appliances are suggested to have an equivalent effect to placebo (Kuboki et al., 1997; Raphael et al., 2003b). Failure of occlusal splint therapy to resolve symptoms, particularly pain, may be related to psychological implications (Alvarez-Arenal et al., 2002).

Pharmacological modalities: The medications reported to be effective in the management of TMD are NSAIDs, corticosteroids, antidepressants, muscle relaxants, sedative-hypnotics, botulinum toxin and capsaicin (Dionne, 1997; Freund et al., 2000; Winocur et al., 2000). Opiates have been used for a long time for pain control especially in chronic conditions (MacPherson, 2000). Intra-articular morphine has been used in a randomized double blind study showing a significant increase in pain threshold in the diseased joint (List et al., 2001a). Antidepressants such as triyclics, have been shown to produce effective pain relief at low dosage amongst chronic cases, a good example being amitriptyline (McQuay et al., 1996; Flesh et al., 2000). Tricyclic antidepressants are central analgesics acting by inhibition of serotonin re-uptake, norepinephrine and \( \alpha_2 \)-receptor blockade (Pettengill and Reisner-Keller, 1997; Sudoh et al., 2003). Treatment with antidepressants cannot be expected to give immediate pain relief because of the delayed onset of their action (Skolnick, 1999). Corticosteroids have been injected or applied topically in cases of condylar erosion, myalgia and trismus with relatively favourable results (Dionne, 1997). However, there are no randomized controlled trials to support these findings.

A randomized controlled trial does not support the use of botulinum toxin A in patients with moderate to
severe chronic muscular type of pain, concluding that these patients had less wide jaw opening compared to a placebo group (Nixdorf et al., 2002). A similar study design showed that the topical application of capsaicin is statistically insignificant if compared to the effect of placebo (Winoeur et al., 2000).

**Physiotherapy:** A study of complementary and alternative medicine showed that massage is rated as the most frequent and amongst the most effective treatment modality (DeBar et al., 2003). This approach seems to be more effective in subacute and chronic non-specific conditions (Hanada, 2003). Others characterize massage as ineffective for pain in general but evidence remains lacking (Ernst, 2004).

Heat and cold techniques (lasers, diathermy, microwaves, packs) and therapeutic ultrasound may be used to relieve musculoskeletal pain. These methods have been found effective through a counterirritant mechanism, by relaxing the muscle and reducing the spindle response respectively (Lehmann and de Lateur, 1994).

The management with electrotherapy remains controversial because of the lack of well-designed studies (Hanada, 2003). There is no substantial improvement of TMD signs and symptoms when managed with trans electrical nerve stimulation (Alvarez-Arenal et al., 2002). An electromyographic study revealed that an imbalance of the masticatory muscles might lead to clicking, headaches, earaches and deviation of the mandible. The authors suggested that finding could be beneficial for the management of masseteric involvement using neuromuscular electrostimulation of the weakened muscle (Bevilaqua-Grosso et al., 2002). The use of microcurrent stimulation and mid-laser were significantly better than the placebo effect (Bertolacci and Grey, 1995). Silver spike point electrotherapy combined with occlusal splint was found to be favourable treatment, with a good response in 90% of patients (Sugimoto et al., 1995). Alternatively, no statistically significant results were found in randomized controlled trials comparing placebo to applied electroalvancic stimulation (Payne, 1994), low-level laser (Kulekcioglu et al., 2003), pulsed radio-frequency and pulsed electromagnetic fields (Al-Badawi et al., 2004; Perez et al., 2004).

**Acupuncture:** The use of acupuncture in TMJ pain management seems to be positive, although the analgesic effect of this technique is still under consideration (Rosted, 1998). It was suggested that acupuncture is comparable to the conservative treatment options (Myers et al., 2002). The use of acupuncture in combination with occlusal splint and point injection was found to be useful for managing TMD (Wong and Cheng, 2003). The level of analgesia induced by this method may be modified by stress and anxiety (Widerstrom-Noga et al., 1998). It is worth noting that electrical stimulation of acupuncture needles in comparison to TENS has not shown any significant difference (Butler and Chapman, 2001).

**Surgery:** Less than 8% of facial arthromyalgia cases require surgery (Ryan et al., 1990). The surgical approach should be considered in patients diagnosed with advanced internal derangement caused by ankylosis or severe degenerative disease with no improvement after conservative methods (Mazzonetto et al., 2001).

Surgical procedures like arthroscopy, arthrocentesis, interpositional grafting, arthrotony and arthropasty can be helpful in certain situations where adherence to indications and limitations are observed (Assael, 1991; Hoffman et al., 1991; Mazzonetto et al., 2001).

**CONCLUSION**

Chronic TMD is a complex clinical condition of yet unknown pathogenesis, which requires further research mainly focused on the etiological patterns of the disease. Management of the condition requires a multidisciplinary approach. The co-operation of dentists, psychologists/psychiatrists and physiotherapists, with an interest in pain disorders, can aim to design and apply a successful therapeutic strategy for TMD patients.

**REFERENCES**


