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INVITED REVIEW

Temporomandibular disorders (TMD): an overview

J. Durham

School of Dental Sciences, Newcastle University, Framlington Place, Newcastle upon Tyne, UK

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Correspondence to:
Dr J Durham
School of Dental Sciences
Newcastle University
Framlington Place
NE2 4BW
UK
Tel.: +44 191 222 6000
Fax: +44 191 222 8191
email: j.a.durham@ncl.ac.uk

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Abstract

This article discusses the aetiology, signs and symptoms, diagnosis, psychological factors and management of temporomandibular disorders (TMD). It highlights the difficulty of evidence-based practice with respect to TMD.

Introduction

Signs and symptoms of temporomandibular disorders (TMD) were first recognised by Costen in 1934[1] and since then a plethora of terms have been used, somewhat interchangeably, to describe TMD. These include Costen's syndrome, temporomandibular joint dysfunction syndrome[2], pain dysfunction syndrome[3] and facial arthromyalgia[4]. TMD[5], defined by the American Association of Orofacial Pain (AAOP) as:

> A collective term embracing a number of clinical problems that involve the masticatory musculature, the Temporomandibular joint and associated structures, or both[6].

The incorrect use of TMD as a catch-all term has recently been highlighted[7]. Laskin suggests that researchers have tended to use it as a singular noun and by doing so have made their findings difficult to interpret in relation to the differing origins of the complaint. His editorial suggests that TMD should be removed from the diagnostic vocabulary and instead individual terms should be used that describe the origin of the complaint. This very recent suggestion has yet to be debated within the literature and therefore this article will continue to use the term, as defined by the AAOP, for the interim.

This article will discuss the aetiology, signs and symptoms, diagnosis, psychological factors and management of TMD. The article will highlight areas where there is a need for more research and illustrate why evidence-based management of TMD is difficult.

Aetiology

The aetiology of TMD is poorly understood and can easily be misrepresented. There are initiating factors, predisposing factors and perpetuating factors and consequently no single 'cause'[8]. Okeson[9] identifies five factors associated with TMD: occlusal factors, trauma, emotional stress, deep pain input and parafunctional activities, but these have been the subject of much debate and enthusiastic treatment[10–21].

Signs and symptoms

Signs and symptoms of TMD have a higher incidence in the general population (20–75%) than the proportion

of the population who present for treatment (2–4%). The age range of presentation varies from the second to the fourth decade[3]. Gender differences in symptoms are not observed (1:1) but the ratio presenting for treatment is substantially different, with females outnumbering males, 7:1[3,22–25]. Suggestions that this is due to differences in gender behaviour are not scientifically supported[23].

There is a great deal of inter-individual variability in the signs and symptoms of TMD but they can be divided into six broad groups[3,8,26,27]:

- Joint noises – clicking, creptius (grinding);
- Locking – open (inability to close fully) closed (inability to open fully);
- Pain – in head, neck and shoulders;
- Muscular tenderness – in face, neck and shoulders;
- Ear complaints – otalgia, tinnitus;
- Psychosocial effects.

The variability in the signs and symptoms of TMD can make diagnosis, and therefore, the standardisation of inclusion criteria for trials difficult unless specific criteria are followed.

Diagnosis

Diagnosis of TMD has been attempted via epidemiological indices, radiography, electronic tests and clinical diagnostic indices.

Epidemiological indices have been created to screen populations for global signs and symptoms of TMD[28–34]. These indices are applicable for large population surveys but perhaps less applicable to individual clinical situations as they do not subclassify the patient in any way or discriminate between the differing origins of the complaint.

Simple plain radiography, despite much debate, has not been found to be particularly useful in the diagnosis or monitoring of TMD as defined by the Research Diagnostic Criteria (RDC) [35–37]. It is, however, useful for demonstrating, or excluding, other pathology of the temporomandibular joint, e.g. rheumatoid arthritis. Computed tomography tends to be limited to the same use. Magnetic resonance imaging has been accepted as the current gold standard for imaging of the joint and its associated structures when the history and clinical exam indicate[38] although it is not without problems such as false positives[9,39] and misinterpretation[40]. Other newer imaging techniques, such as ultrasound[41], have yet to undergo thorough evaluation.

Over the years, electronic tests such as jaw tracking, vibratography, sonography, electromyography and thermography have all been suggested as diagnostic aids. Only thermography has yet to be fully investigated; the others have been rejected as unreliable in all potential functions as diagnostic aids[42–46].

The final option available for diagnosing TMD is the clinical diagnostic index. There have been a number of attempts over the years to construct a definitive index[5,6,47–51] and the National Institute of Dental Research in the U.S.A. supported research into producing clinically applicable research criteria for TMD. The result of this sponsorship was the RDC[51], a dual-axis approach to the diagnosis of TMD.

Axis 1 of the RDC concentrates on the clinical examination and Axis 2 focuses on the psychosocial effects of the condition. Axis 1 has a standardised protocol for the clinical examination, has well defined inclusion and exclusion criteria, and permits multiple diagnoses. Axis 1 is, however, extremely long which may make it inapplicable to routine clinical use in all but its simplest classification. Its three groups of TMD are: Group I – myofascial pain disorder; and Group II – disc displacement disorder; Group III – degenerative disease disorder.

Axis 2 of the RDC consists of a self-administered questionnaire that the patient completes. The clinician can use this questionnaire, with the scoring system provided, to assess the level of the patient's: chronic jaw pain; disability caused by their jaw complaint; depression and non-specific symptoms. The questionnaire can also be used as a basis for discussion when eliciting the patient's complaint.

The RDC has shown fair to good reliability in diagnosing into its three distinct Axis 1 subgroups[52,53] and is reliable enough to be the only descriptive diagnostic system in wide spread use for TMD research. Further details and videos of how to complete both axes are available on the RDC web site (http://www.rdc-tmdinternational.org).

Psychological and psychosocial factors in TMD

TMD is now recognised as a group of biopsychosocial illnesses; a trio of physical, psychological and psychosocial factors[27]. The physical, psychological and psychosocial factors of TMD have measurable impacts on oral health related quality of life[54] but the relationship between these impacts and the effects on the patient is best described as indirect and complex[55]. There is still no real evidence to equate any aspect of psychology as an aetiological factor, or as a consequence of TMD. Irrespective of this, the influence of psychological factors on TMD is of therapeutic importance[27].

It is known that psychological disorders are prevalent in patients suffering from TMD[56,57], that they increase the risk of progressing to long-term TMD, which is difficult to manage[58], and that their role varies depending on gender[59]. Specifically, the presence of psychological disorders is more frequent in females, in the form of depression[59].

Psychological disorders are present both in acute and in chronic TMD patients but more so in the latter. It is thought that they may have an influence on the progression towards chronic TMD[56]. It is known that the myofascial subgroup of TMD (Group I in RDC Axis I) have a predisposition to experiencing more psychological distress than the other subgroups[60].

Two of the more common psychological disorders in chronic TMD are somatisation (55% of patients)[56,61,62] and depression (39% of patients)[62,63]; this is in keeping with chronic pain generally[64]. Both somatisation and depression are felt to affect treatment adversely, with patients being less able to cope and placing greater demands on health care[62,65,66,58]. It is reasonable, however, to question whether this is a 'chicken and egg' situation and therefore TMD sufferers should not be stigmatised.

Management of TMD

The literature surrounding the management of TMD is vast, often confusing, idiosyncratic, and can be scientifically unsubstantiated. This is in the main due to: methodological flaws, the multitude of outcome measures employed[9], the lack of a reliable standardised outcome measure so that meta-analysis of randomised controlled trials can occur[67,68] and until recently (1992), the lack of a clear diagnostic classification of TMD for research purposes.

There is now a consensus that reversible conservative therapy, because of its efficacy in relieving symptoms, should be the first-line management for TMD[8,69–71]. It should be instituted once organic pathology such as systemic disease, hereditary conditions, or neoplasia is excluded as a possible diagnosis. Such organic pathology is rare, recent figures for incidentally found tumours of the temporomandibular joint show their incidence to be less than 1% of cases[72], but cases of fibrosarcoma, nasopharyngeal carcinoma and lateral pharyngeal space infections have been reported in the literature as mimicking the signs and symptoms of TMD[73–75]. Practitioners should therefore ensure they have undertaken a thorough examination of the patient and should investigate patients appropriately.

The National Institute of Health in the U.S.A. suggests reversible conservative therapy as the primary treatment modality for TMD once organic pathology is excluded[76]. They define conservative therapy as including: supportive patient education, physical therapy (physiotherapy), pharmacological pain control, intraoral appliances and simple occlusal therapy.

The other, irreversible, therapies purported for TMD are complex occlusal interventions (such as full rehabilitation) and surgical approaches[76]. There are, of course, other 'medical' therapies available for TMD including transcutaneous electrical nerve stimulation, soft laser, radiofrequency surgical cauterisation and chiropractic care. None of these, according to Greene, has any scientific foundation to be recommended as a treatment modality in TMD[77].

Before considering the literature behind the management of TMD in detail it is important to bear in mind Greene and Laskin's statement, 'with TMD patients it is often not what is done for them, but how it is done, that is important.' This statement is based on their research which that elicited a 35–60% placebo response rate[70,78–82] with TMD patients.

Conservative therapy

A number of approaches have been used within conservative therapy: cognitive behavioural therapy, physical therapy, pharmacological therapy and intraoral appliances. Although cognitive behavioural therapy has been used with varying success in TMD patients[83], it is suggested that all patients might experience some benefit from it[84]. It aims to increase patients' knowledge about factors that influence TMD symptoms; increase functional and physical activities; and train individuals to use relaxation, hypnosis and other techniques to modify the perception of pain and related sensations[85]. At the most basic level some of this can be provided by simple reassurance from the clinician that TMD usually follows benign self-limiting course when managed conservatively[86–88] and is a chronic illness[89].

Physical therapy (physiotherapy) seems an intuitive choice for an individual who may have pain in their musculature. Its aim is to restore normal joint function, decrease loading and pain and facilitate rehabilitation to normal everyday activities[90]. Although physical therapy produces short-term relief of signs and symptoms, there is little evidence suggesting that it produces a long-term reduction in signs and symptoms of TMD[91–95]. It will, however, perform a useful role in helping the sufferer re-establish a degree of control in an acute phase of TMD.

Pharmacological therapy for TMD has included such classes of drugs as non-steroidal anti-inflammatories, opiates, antidepressants, anxiolytics and cortico-

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steroids. As Dionne[96] points out, in his review of pharmacological interventions for TMD, most of those pharmacological agents used to manage TMD have not completed any standardised assessment of efficacy. They therefore, as with most TMD treatment, require careful evaluation through appropriately constructed randomised controlled trials to demonstrate their efficacy.

The final approach to conservative management is the use of intra-oral appliances. Many designs of intra-oral appliances have been purported as efficacious in the management of TMD; this review will discuss the two most common splints, the soft splint and the stabilisation splint[97,98]. The soft splint is usually a flexible polyvinyl, 2 mm thick, full coverage 'mouth guard' type lower jaw appliance[99]. It is not adjusted to the occlusion but it will provide approximate bilateral occlusal contact.

The mechanism of action of splints is poorly understood and disputed, with physiological and behavioural mechanisms the main theories mooted[13]. Splints' effectiveness is also a matter for debate because of: variation in outcome measures, variability in follow-up and explanation of treatment outcomes[100].

Soft splints have little evidence to support their efficacy. In myogenous TMD they appear to significantly improve symptoms in comparison to no intervention[101] and perform as well as stabilisation appliances[102]. As with stabilisation splints there are, however, counter claims that they are ineffective[103,104] and some say that they can cause increases in symptomatology in a small number of sufferers[99]. These claims and counter-claims are all somewhat flawed because of the methods used in the studies investigating. In light of the poor evidence base for most TMD treatment and as soft splints are reversible, inexpensive, easy to construct, well tolerated by most patients and possibly efficacious, they seem a reasonable choice for the initial management of TMD sufferers.

The stabilisation splint can be provided in either jaw but often is provided in the upper jaw (maxillary). It is usually constructed from hard acrylic or from softer polyvinyl, or a combination, although these are less common approaches[105,106]. It is accurately adjusted to the patient's occlusion and provides an optimal occlusion for the individual which places their condyles in their most 'musculoskeletally stable position'[9].

Stabilisation splints have their proponents[107–109] and opponents[110,111]. Their efficacy, as with so many TMD treatments, may also be questionable as there is some evidence to show the placebo effect is similar to their own[112]. A systematic review of stabilisation splints usage[67] recently concluded that there was insufficient evidence to argue for or against their widespread usage and therefore they continue to be used, most commonly for myogenous and arthogenous TMD[112].

Irreversible therapy

The two main forms of irreversible therapy for TMD are occlusal therapy and surgery and over the years their popularity has waxed and waned.

The inception of occlusal therapy was probably with Costen's original theory[1] where he questioned the 'bite' of individuals presenting with signs and symptoms of TMD and suggested that treatment ought to be directed towards correcting it. In particular, correcting overclosure because of loss of teeth or worn dentures. Subsequently, the ideal occlusion of teeth became somewhat of a mantra and prophylactic measures to correct it became briefly acceptable[113]. The theory underlying the correction of occlusion was that it, to a large extent, controlled the forces applied to the TMJ and muscles of mastication and therefore if the occlusion was optimised there would be no TMD.

The process of equally distributing contacting forces across the teeth and 'correcting' the occlusion is known as equilibration and it is done through a complex process of a diagnostic stabilisation splint, sometimes mounted study model trials (a mock equilibration) and eventual grinding of the teeth in the mouth (the occlusal equilibration).

Occlusal therapy has been shown to be effective in some cases[37,114–116] but evidence for its widespread use as prophylaxis or treatment has found to be lacking[68,109,117] and this includes the replacement of posterior teeth[21].

The best summation of the indications for occlusal therapy is by De Boever *et al.*[20], 'Occlusal therapy and occlusal adjustment as the only treatment modality is rarely defendable; however, in combination with other forms of therapy, occlusal adjustment can contribute to a positive treatment outcome in selected cases'.

Temporomandibular joint surgery has taken many forms over the years, ranging from open joint procedures to minimally invasive arthroscopy. Indications for surgery have been suggested to be either absolute or relative[118,119]. Absolute indications are associated with trauma, ankylosis, congenital anomalies or organic pathology that requires excision. Relative indications, it is suggested, are subjectively determined by the surgeon and should not blindly include failure of conservative therapy as this may be based on inaccurate diagnosis and treatment. Psychological and cultural background should also play a large part in helping the surgeon determine whether or not surgery is an option. In the main the philosophy that

surgery 'should avoid further harm to the joint' should be adopted[120] and there should be objective signs that it is indicated. Given the limitations of imaging techniques already mentioned, it is important to use these as supportive evidence rather than as an absolute indication for surgery[119].

Arthroscopy and arthrocentesis have been reported as minimally invasive and efficacious in the management of a range of TMD including disc displacement, arthogenous TMD, and TMD that is refractory to conservative treatment[121–123]. Unfortunately the numerous studies of arthroscopy and arthrocentesis suffer from the same flaws as other trials of TMD management. A recent meta-analysis of surgical treatments highlighted this, specifically mentioning the lack of randomised controlled trials[124].

Reston and Turkelson in their meta-analysis[124] did, however, use a method to minimise the possibility of spontaneous improvement in a parallel control group. Using this method they found that arthrocentesis and arthroscopy were effective for disc displacement without reduction. Interestingly, they also found no significant difference in outcome between arthroscopy and arthrocentesis. These results must, however, be interpreted with caution as Reston and Turkelson recognise the 'low quality' TMD literature their review is based on and call for better designed trials of surgical therapy for TMD, as do other reviews of surgical therapy[125,126]. A recent randomised effectiveness study has demonstrated that, as a primary treatment modality for closed lock, arthroscopy provides no significant benefit over medical management[127]. These discrepancies in the literature mean that definitive answers on the place of arthrocentesis and arthroscopy in the management of TMD are still lacking.

Conclusions

TMD are a group of complex biopsychosocial chronic illnesses, which may exhibit high placebo response rates to therapy. This along with the lack of a standardised reproducible patient-based outcome measure makes the evidence for TMD management difficult to interpret. Reversible therapies are currently considered to be the first-line management of TMD. There may be specific indications for when irreversible therapies might be efficacious in the management of TMD but these are yet to be substantiated by high-quality evidence. There is a need for an accepted standardised reproducible outcome measure for TMD so that large-scale meta-analyses of management modalities can be carried out. Only then will truly evidence-based management of TMD be possible.

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