Chapter 73

Temporomandibular Disorders and Tension-Type Headache

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INTRODUCTION

Can headache originate from the masticatory system and associated structures including the dentition? According to the dental literature, this is often the case (9,11,27,29,39,43). Although temporomandibular disorder (TMD) and headache occur together frequently, it could be simply by chance, because both disorders are extremely prevalent (3,17,30,32). Guidelines for the evaluation, diagnosis, and management of TMD have been presented (4,26) but as yet cannot be regarded as internationally accepted. Of the variables included, only masticatory muscles painful to palpation have been found consistently to have a distinct relationship to headache (9,12,23). It is not clear if this represents a specific peripheral response to central sensitization or of there is local pathology. Because tenderness may be a part of a generalized myofascial syndrome, the real question of whether occlusal and mandibular abnormalities may be the cause or the effect of tenderness and pain remains largely unanswered.

The Headache Classification Subcommittee of the International Headache Society (IHS) tried to obviate such problems by creating a new term, *oromandibular dysfunction* (OMD) (12), as a fourth-digit code number, one of several most likely causative factors to tension-type headache (TTH), in the hierarchical classification system. These operational diagnostic criteria of OMD included some signs and symptoms of morphologic abnormalities and dysfunctions as well as parafunction of the jaw, tongue, and mouth. It does not include pericranial or jaw-muscle tenderness (Table 73-1). This term is no longer present in the revised IHS classification (13). Since the introduction of the IHS classification in 1988 (12), only a few studies have dealt with this term, and the terminology and diagnostic criteria in this field are still intensely debated. In the IHS classification (12,13), diagnostic criteria for temporomandibular joint (TMJ) disease are also listed as a secondary specific headache form; however, scientific evidence for the exact relation of TMJ disease to headache and orofacial pain is rather limited, and hopefully further research and exchange between the dental and medical specialties can be encouraged.

In the following discussion, TMD refers to the fulfillment of the IHS criteria.

IHS Code and Diagnosis: 11.7 Headache or facial pain attributed to temporomandibular joint (TMJ) disorder
World Health Organization (WHO) ICD-10A code: G44.846

In this discussion some population-based investigations are presented. Normative data from healthy subjects are compared with findings in subjects with TTH and related to the clinical literature.

OROFACIAL EXAMINATION

A brief orofacial interview and examination is easy to perform during examination of a headache patient and will reveal most of the dental dysfunction that may be associated with headache. The items of oromandibular dysfunction 2.1.X.2 in the IHS classification 1988 are included in the suggested questionnaire (Table 73-1). These also help in defining the new IHS criteria for TMD listed in Table 73-2. The appropriate screening questionnaire and examination for this disorder are described in Tables 73-3 and 73-4. The use of such diagnostic tools is, however, controversial; Gerstner and colleagues reported that a brief questionnaire was valuable to distinguish between patients with TMD and healthy controls but was unable to separate these TMD patients from patients with TTH (10). Because many patients relate their pain to previous trauma, infections, extractions, and joint problems, a short history of these factors also may be included, although the

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TABLE 73-1 Criteria for Oromandibular Dysfunction (OMD Criteria)[a]

Three or more of the following:
Temporomandibular joint noise on jaw movements
Limited or jerky jaw movements
Pain on jaw function
Locking of jaw on opening
Clenching of teeth
Gnashing (grinding) of teeth
Other oral parafunction (tongue, lips, or cheek biting or pressing).

[a]Fourth-digit code for group 2 indicates most likely causative factor to tension-type headache (old IHS criteria) (12).

relationship between trauma and TMD is quite uncertain. In addition to the present IHS criteria of oromandibular dysfunction, a brief evaluation of the bite function may be recommended as well. A significant loss of molars, impaired chewing ability, significant history of bruxism with tooth wear, or malfunctioning dentures should be noted during the examination, because any of these factors may be a perpetuating factor to the pain (5,37,43). For research purposes, blinded designs must be used because of the subjectivity of the examination and because 13% of a general population had three or more symptoms or signs of TMD, thus fulfilling the IHS criteria (17).

PREVALENCE

Disorders affecting the oromandibular system may be occlusal (e.g., lack of molars, occlusal disorders), parafunctional (e.g., bruxism, clenching, tongue pressure), or articular factors (arthritis, arthrosis, clicking at function). Some of these disorders are purely organic, whereas some may have a behavioral background. Various terms, such as *temporomandibular joint pain dysfunction syndrome*, *myofascial pain dysfunction syndrome*, *craniomandibular disorders*, and *temporomandibular dysfunction*, including jaw-muscle tenderness, have been used. Therefore, the prevalence of a specific disorder is difficult to determine because of this lack of a universally accepted classification system. The complexity of the field is also reflected by the fact that objective signs often show a distribution of age and sex that is different from the distribution of symptoms (17,29,39,43), and that the correlation between signs and symptoms is generally poor (4). In various series, the proportion of subjects with TMD in need of orofacial treatment is 3.5 to 9.7%, depending on the definition used (2,30).

TABLE 73-2 IHS Diagnostic Criteria for Headache or Facial Pain Attributed to Temporomandibular Joint (TMJ) Disorder (13)

Diagnostic criteria:

A. Recurrent pain in one or more regions of the head and/or face fulfilling criteria C and D
B. X-ray, magnetics resonance imaging and/or bone scintigraphy demonstrates TMJ disorder.
C. Evidence that pain can be attributed to TMJ disorder, based on at least one of the following:
   1. Pain is precipitated by jaw movements and/or chewing of hard or tough food
   2. Reduced range of or irregular jaw opening
   3. Noise from one or both TMJs during jaw movements
   4. Tenderness of the joint capsule(s) of one or both TMJs
D. Headache resolves within 3 months and does not recur after successful treatment of the TMJ disorder.

TABLE 73-3 Suggested Temporomandibular Disorder Screening Questionnaire

	Never	*Often*	*Daily*
Do you hear noises from jaw joints?			
Do you have pain with jaw function?			
Do you clench your teeth?			
Do you grind your teeth?			
Does your jaw get locked so you can't open or close it?			
Do you bite your tongue, lips, or cheek?			
Do you press your tongue against your cheek or teeth?			
Do you have pain in or about the ears, temples, or cheeks?			

NORMATIVE DATA

The prevalence of TMD, headache, and muscle tenderness was studied in a random sample of 735 adults representative of the total Danish population (9,11–13). The investigation was performed in a standardized way, with the observer of TMD and tenderness blinded to the previous history of TMD and headache and any other

TABLE 73-4 Suggested Temporomandibular Disorder Screening Examination

Listen for sounds and clicking of the temporomandibular joint (TMJ).
Palpate for crepitus of TMJ.
Measure interincisal mouth opening (>40 mm).
Palpate the lateral and dorsal TMJ capsules for tenderness.
Determine tooth contacts in molar, premolar, and incisor areas, including loss of molars and malfunctioning dentures.
Determine if funcion of the jaw aggravates the patient's pain complaint.

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information about the subjects (14,16–18). The most common symptoms of TMD were clenching (22%) and grinding of teeth (15%), and the most common sign was irregular jaw movements on opening and closing (29%). In total, 13% of the subjects had three or more symptoms or signs of TMD as required by the IHS definition of TMD (13). Female subjects were affected more often than male subjects, but no significant relation to age was noted (17). Similar data were obtained in a Canadian epidemiologic study in which 12.9% reported functional pain or pain at rest, with women and younger age groups more likely than men and older age groups to report one or more symptoms (22). Significant associations between symptoms and potential risk factors as parafunctional behaviors were also reported (22).

RELATION TO HEADACHE TYPE

The prevalence of TMD did not differ between subjects with frequent TTH, migraineurs, and headache-free persons in the Danish population study (18). Subjects with frequent TTH (more than 14 days in the previous year) had the same frequency of three or more symptoms and signs of TMD as the rest of the general population (18). Any causal relationship between TMD and TTH seems therefore to be absent or weak. Nevertheless, a minor positive relation between TMD and increasing frequency of TTH was noted, but no such relation was found with increasing frequency of migraine (18). The lack of relationship between TMD and migraine indicates that dental treatment directed toward the chewing apparatus is inappropriate in migraine patients but may be of use in patients with frequent TTH.

FINDINGS IN TENSION-TYPE HEADACHE

Clinical studies of the association between the former term *craniomandibular disorder* and headache have shown conflicting results (5,9,27,43). Most studies report a positive correlation, but in none of the studies were oromandibular or headache disorders sufficiently classified. Despite the high prevalence of temporomandibular disorder and headache in the general population, many clinical studies did not include controls. In one study, headache, facial pain, and pericranial muscle tenderness were included in the definition of these disorders (43). It is not surprising, therefore, that a close relationship was found between headache and craniomandibular disorder, because a highly significant positive association between the frequency of TTH and tenderness in pericranial muscles, quite independent of oromandibular dysfunction, has been reported (14).

Magnusson and Carlsson (23) studied 80 patients referred because of TMJ pain–dysfunction syndrome and 80 patients seeking dental treatment for other reasons. They noted, in correspondence with several others (14,18,43,24), that the frequency and severity of headache varied with the severity of the tenderness in pericranial muscles, but no other significant correlation was found between headache and TMJ signs or symptoms. In the Danish population study, no relation between TMD and the intensity of TTH was found, in agreement with Forssell and Kangasniemi (5) but not with others (43).

Solberg studied 735 young subjects from a dental clinic, and headache subjects reported tenderness of their TMJ and muscles in the jaw and head more frequently than nonsufferers of headache, but no other significant differences were reported (39). A significant positive correlation between tenderness and several other TMJ symptoms and signs has been described (9,45), but the use of imprecise classification of headache and TMJ symptoms as well as the use of uncontrolled and unblinded designs explain most of these discrepancies.

In conclusion, pericranial tenderness is increased in patients with frequent TTH, whereas morphologic and articular disorders have no or, at most, an uncertain relation to headache. It is still necessary to understand if there is a relationship to tenderness and central sensitization. No functional imaging studies are available in these disorders. There is clearly an increase in symptomatology in the presence of estrogen, suggesting a central rather than peripheral process for tenderness.

Wänmann and Agerberg (43) examined a random group of 285 adolescents aged 17 years for the frequency and intensity of headache and dysfunction of the masticatory system. Tooth grinding and clenching were related to frequency of headache (24). Significant associations between bruxism, limited opening, muscular tenderness, and headache have been presented in other studies (14,18,19). When each sex was analyzed separately in a large sample of the general population, clenching and parafunctions were more frequent in subjects with frequent TTH than in subjects without headache (13) (Fig 73-1). In female subjects, but not in male subjects, TMJ noises and irregular movements were also more frequent among headache sufferers. Furthermore, both male and female subjects with clenching and female subjects with grinding had more tenderness than subjects with the identical frequency of headache but without parafunctional complaints (13). Recently, it was demonstrated that sustained tooth clenching provoked headache in 69% of patients with frequent TTH but in only 17% of healthy controls, and this headache development was preceded by increased tenderness. These data indicate that tenderness may be a causative factor to headache (10,11). On balance, an association between parafunction, tenderness, and headache is likely. Tenderness resulting from excessive strain of

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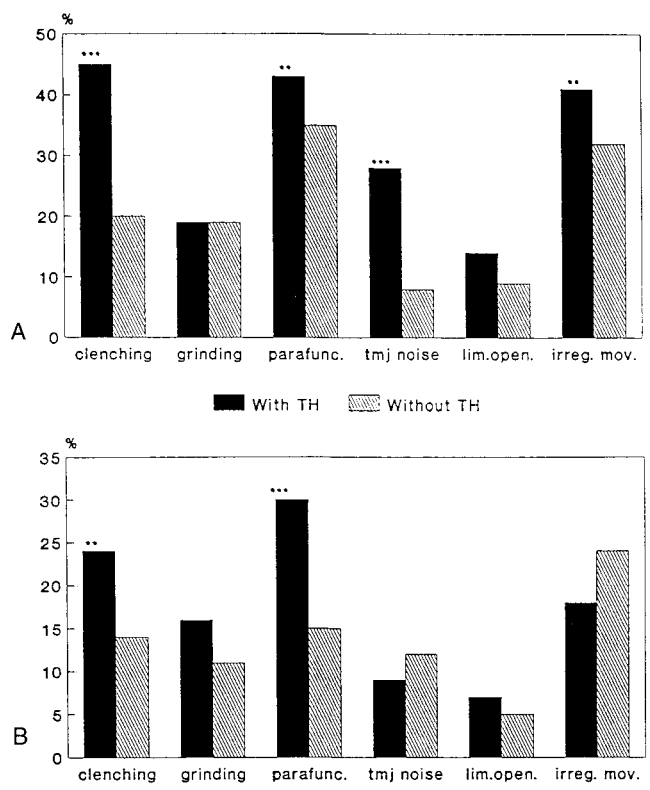

FIGURE 73-1. Distribution of individual symptoms and signs of oromandibular dysfunctions in subjects with frequent tension-type headache (>14 days with tension headache per year) compared with headache-free subjects. **A:** Female subjects. **B:** Male subjects. **Statistical significance with $p < 0.01$. ***$p < 0.001$. (From ref. 13, with permission.)

masticatory muscles may contribute to TTH, or these two disorders may be caused by a common, yet unknown, etiology.

RELATION TO HEADACHE FREQUENCY

Frequent, but not further specified headache, was reported by 48% of heavily affected persons with bruxism (14) compared with only 15% from a general population (12). In the Danish population study (12), TMD was positively associated with increasing frequency of TTH but not with the frequency of migraine. In correspondence, the few studies (4,24) in which a clinical index to the frequency of headache was calculated also reported increasing values with increasing frequency of headache. Forssell and Kangasniemi found a positive but not a strong ($p = 0.045$) correlation between a clinical index of mandibular dysfunction and the frequency of headache, but the reported symptoms did not correlate with the frequency of headache ($p = 0.78$) (5). Recently, significant correlations between frequent tooth clenching, headache, sleep disorders, and high scores of clinical dysfunction index were reported, but the study was uncontrolled and based on highly selected subjects (14).

A positive association of TMD with the frequency of TTH indicates that TMD may be an aggravating factor for headache, or it may be another denominator of the same underlying pathophysiologic mechanism (5,7,13).

OCCLUSION

The role of functional occlusal relationships in TMD disorders and headache has been studied intensively but, as is the case with the other hypotheses, none has been scientifically validated. By reviewing the literature, Seligman and Pullinger found no significant association between malocclusion and TMD (37), in line with the Danish population study (10), in which no association between occlusive disorders and headache could be noted (12). Overall, it seems that changes in occlusion do not have a primary role in headache, and complex occlusal therapy in headache patients should therefore be avoided. In a qualitative systematic review of randomized controlled trials of analysis of occlusal therapies for TMD, Forssell et al. concluded there was insufficient evidence to support the use of occlusal adjustments and suggestive evidence for splint therapy (8).

THERAPY

Treating Headache by Targeting TMD

In that there are thought to be several etiologic factors involved in TMD, it is to be expected that there are several different therapeutic approaches. Unfortunately, most of the literature concerning the treatment methods of TMD consists of uncontrolled observations; less than 5% of treatment studies have been controlled clinical trials (1). Even these are sometimes compromised by weaknesses in their design. Thus, only general conclusions can be drawn regarding treatment effectiveness. When the effects of different treatments are compared, the results seldom reveal major advantages of one method over another. Elimination of the cause would be the most effective treatment. However, if the cause cannot be identified, symptomatic treatment has to be provided. The goals of treatment are to decrease pain, to decrease adverse loading, and to restore normal function. Because the signs and symptoms of TMD can be transient and self-limiting, simple and reversible treatments are preferred over complicated and irreversible procedures.

Nonsurgical Treatment

In an uncontrolled study, 33 TMD patients were treated with occlusal splint therapy (21). Following 4 weeks of therapy, 64% of patients reported a decrease in the number of

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weekly headaches, 30% showing a complete remission of headache. Patients with high frequency of headaches (four or more per week) seemed to respond more favorably to occlusal splint therapy.

In another uncontrolled study with TMD patients, changes in headache were followed 1 year after the start of TMD treatment (24). The treatment consisted of occlusal splints, therapeutic exercises for masticatory muscles, occlusal adjustment, or most often combinations of these measures. Seventy percent of these patients reported less frequent headaches than 1 year earlier. Forty percent reported less severe head pain. The results achieved seemed to be lasting at a 2.5-year follow-up (25). These studies, however, did not control for the placebo effect, and the definition for the type of headache being treated was not clearly stated. Furthermore, one cannot know what part of the treatment was actually necessary.

Vallon and coworkers (40–42) assessed the effects of occlusal adjustment on headache in TMD patients. Fifty patients were randomly assigned to a treatment group and a control group receiving only counseling. The treatment outcome was evaluated after 1, 3, and 6 months and 2 years by a blinded examiner. No significant differences were found at follow-ups regarding changes in frequency of headache. The problem with the study was the great dropout of patients from the original treatment groups, ranging from 20% at the 3-month follow-up to 66% at 2 years.

A new form of splint therapy has been suggested to effectively manage headache. Shankland (38) suggested an intraoral nociceptive trigeminal inhibition tension suppression system (NTI-tss) device for the reduction of frequency and severity of tension-type and migraine headache, as compared to the known efficacy of the noncommercially available full-coverage occlusal splint. A multicenter open labeled trial was conducted to determine the response in migraine. The NTI-tss is a small intraoral device, which is fitted over the two maxillary central incisors, and has a dome-shaped protrusion, which extends lingually. The dome is customized by the provider to act as single-point contact at the incisal embrasure of the two mandibular central incisors, thereby preventing posterior or canine tooth contact. Following a 4-week pretreatment baseline observation, patients were instructed to insert and wear their device during sleep, and as required during perceived stressful times during the day, for 8 consecutive weeks. A control device, a mandibular full-coverage occlusal splint (OS), was used. Ninety-four patients were studied and randomized to the NTI-tss ($n = 43$) or full-coverage occlusal splint ($n = 51$). Although this was a migraine study, it appears that patients had chronic tension-type headache (CTTH). The statistical analysis is confusing because no information is given on pretreatment days of headache and outcome is reported in the number of headaches reduced. An example is that the reduction in the number of migraines per month is reported as the same (2) in weeks 4, 5, 6, and 7, but at week 8 the NTI-tss reduces migraine events by 2.5 per month and the OS episodes by 1.6 per month. As with many other intraoral appliance studies, it is difficult to correlate outcome with pharmacologic studies of prevention because the patient selection, outcome criteria, and statistical analysis are confusing. This is not to deter from the concept that managing TMD in a migraine patient may reduce headache frequency.

Because TMD is believed to have a multifactorial etiology, it is assumed that the best treatment results are achieved by using several different treatment methods to eliminate as many predisposing and perpetuating factors as possible. This assumption was addressed in a randomized controlled study comparing the effects of occlusal equilibration and other forms of TMD therapy in patients with signs and symptoms of TMD, including headache (44,45). The TMD therapy consisted of occlusal splints as well as muscle exercises and minor occlusal adjustment in some cases, while the comparison group received only occlusal equilibration therapy. The reduction in the symptoms of TMD and in the frequency and intensity of headache was significantly greater in the combined therapy group vs. the comparison group.

Some studies focusing on signs and symptoms attributable to TMD have been performed on general headache patients. In a series of studies, 100 recurrent headache patients, referred for neurologic examination, were invited for a functional examination of the stomatognathic system (34). In total, 55 patients displayed pain caused by TMD. In 51 patients the pain was determined to be of myogenous and in four of arthrogenous origin. The 55 patients were divided at random into two groups (35,36). One group was treated by the neurologist according to conventional headache treatment regimes, and the other group was treated with stabilization splints for 6 weeks and in some cases with physical therapy. In the TMD treatment group, headache frequency decreased in 56% of patients compared to 32% in the neurologic treatment group. There is also a reported significant difference in the reduction of headache intensity as well as in the symptomatic medication taken to control headache. Thus, the clinical result of TMD therapy exceeded the results of the neurologic treatment in patients in whom headache was assumed to be related to TMD. The confounding factor is that the TMD group had a much greater exposure to the treating clinician, which could in part account for the difference.

A randomized controlled trial by Forssell et al. (6) evaluated the effect of occlusal adjustment versus a mock adjustment on TTH using a double-blind study design. The patients were 56 tension headache patients (20 of them having also migraine, i.e., combination headache) from a neurologic clinic. Most of them reported subjective

symptoms of TMD, and in all patients signs of TMD were registered. Patients were randomly assigned to active and placebo groups, and after a 4- to 8-month follow-up period a neurologist evaluated the treatment outcome. The headache frequency was reduced in 80% and the intensity in 47% of patients in the active group and in 50% and 16% in the placebo group. Some of the patients from the placebo group having moderate to severe TMD symptoms were afterwards treated with occlusal therapy (7). A significant reduction in headache frequency was also observed in these patients. Except for the possible confounder that the same clinician performed both treatments (active and placebo) unblinded, this study again supports the value of TMD treatment for TTH associated with TMD signs and symptoms.

Contradictory results were reported by Quayle and coworkers (31) in an uncontrolled study of headache patients who were treated with soft occlusal splints for 6 weeks. Many patients with migraine type of headache improved, but most patients suffering from tension headache failed to benefit from splint therapy. The small number of patients (n = 9) in the tension headache group may reduce the significance of the result.

In the double-blind trial by Karppinen (20), 44 patients seeking treatment for chronic headache and neck and shoulder pain received a routine battery of physical therapy. In addition, 23 of the patients were randomly allocated to occlusal adjustment group, and 21 to a mock adjustment group. Patients were followed up for 6 weeks and 12 months. The short-term response to physical therapy was good and was not associated with the type of occlusal treatment. At 12 months, the effects of treatment began to subside in the mock adjustment group, but further improvement was evident in the real adjustment group. A statistically significant decrease in the occurrence of headache was observed in the real adjustment group compared to the mock adjustment group. As several controlled clinical trials seem to suggest that TMD treatment can be effective for headache, the question arises whether there are some special features that could in practice help to single out patients whose headache is related to TMD from other headache patients. Reik and Hale (33) suggested that patients with continuous unilateral headache were patients with TMD. This was not supported by Schokker et al. (36), who found that headaches responsive to TMD treatment were mainly bilateral and showed only a tendency to be present permanently. In that study, patients with headaches linked to TMD showed a greater difference between passive and active mouth opening recorded before treatment. This is considered to be a sign of myogenous origin of TMD. Another study showed that patients who had reported pain while chewing responded more favorably in terms of headache reduction following TMD therapy. Pain while chewing is one of the most common subjective symptoms of TMD.

Surgical Treatment

TMJ surgery is considered to be useful treatment for certain TMDs. There are very few studies that examine surgery and response to headache. Vallerand and Hall reported on 50 patients diagnosed with internal TMJ derangements, myalgia, and headaches who had not responded to nonsurgical management. The surgical procedures they underwent included disc repositioning, repair of disc perforation, disc recontouring, lysis of adhesions, and discectomy. In the retrospective evaluation, the majority of patients reported decreases in headache in addition to decreases in joint pain and noise. The surgeons offer the explanation that the change in head pain is a secondary result of decreasing joint pain, which allowed the patients to cope better with other pains. In another study, Montgomery et al. (28) reported significant changes in TMJ, ear, neck, and shoulder pains, whereas headaches were less consistently changed, following arthroscopy of the TMJ.

CONCLUSION

When tenderness is analyzed separately from other disorders of the masticatory apparatus, as indicated by the IHS criteria, only parafunctional complaints, such as clenching, grinding of teeth, and pain by jaw function, are more prevalent in patients with frequent TTH compared with headache-free subjects. These functional disturbances may be secondary to psychosocial stress or even may be a consequence of headache rather than its cause. Furthermore, the significant relation between parafunctional disorders and headache may represent a common underlying mechanism rather than a causal relationship, and a specific treatment directed toward these parafunctions, therefore, cannot be recommended. It seems clear that headache is not caused by morphologic abnormalities in the great majority of patients.

Therapy aimed at TMD may decrease headache, but the cause and effect relationship is not clear. While altering peripheral trigeminal nociception can decrease headache, it does not imply there is a physiologic or mechanistic relationship.

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