Acquired Temporomandibular Disorders in Infants, Children, and Adolescents

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Abstract

This best practice assists dental practitioners in recognizing and diagnosing temporomandibular disorders and identifying evidence-based treatment options. Temporomandibular disorders are a group of musculoskeletal and neuromuscular conditions that include clinical signs and symptoms involving the muscles of mastication, the temporomandibular joint, and associated structures and occasionally occur in infants, children, and adolescents. Temporomandibular disorders generally are classified into two broad categories: temporomandibular joint disorders and masticatory muscle disorders. Diagnosing temporomandibular disorders should be based on a screening history, clinical examination, and/or craniocervical and temporomandibular joint imaging. Temporomandibular disorder treatment goals include restoring function, reducing pain, reducing risk factors, and improving quality of life. The two main treatment approaches are reversible and irreversible therapies. Common reversible approaches include patient instruction, physical therapy, behavioral therapy, prescription medication, and occlusal splints. Meanwhile, with limited evidence for effectiveness of irreversible therapies (e.g., occlusal adjustments, orthodontic treatment, surgery), such approaches should be avoided in children.

This document was developed through a collaborative effort of the American Academy of Pediatric Dentistry Councils on Clinical Affairs and Scientific Affairs to offer updated information and guidance on acquired temporomandibular disorders in infants, children, and adolescents.

KEYWORDS: EVIDENCE-BASED DENTISTRY; PEDIATRIC DENTISTRY; TEMPOROMANDIBULAR JOINT DISORDERS; TEMPOROMANDIBULAR JOINT

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes that disorders of the temporomandibular joint (**TMJ**), masticatory muscles, and associated structures occasionally occur in infants, children, and adolescents. These recommendations are intended to assist the practitioner in the recognition and diagnosis of temporomandibular disorder (**TMD**) and to identify possible treatment options. It is beyond the scope of this document to recommend the use of specific treatment modalities.

Methods

Recommendations on acquired temporomandibular disorders in infants, children, and adolescents were developed by the Clinical Affairs Committee—Temporomandibular Joint Problems in Children Subcommittee and adopted in 1990.[1] This document by the Council on Clinical Affairs is a revision of the previous version, last revised in 2015.[2] The update included an electronic search using the terms: temporomandibular disorder, TMJ dysfunction, TMD AND adolescents, TMD AND gender differences, TMD AND occlusion, TMD AND treatment; fields: all fields; limits: within the last 15 years, humans, English, clinical trials. The reviewers agreed upon the inclusion of 104 references to support these recommendations. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Definition of TMD

TMD is a collective term for a group of musculoskeletal and neuromuscular conditions which includes several clinical signs and symptoms involving the muscles of mastication, the TMJ, and associated structures.[3] While TMD has been defined as "functional disturbances of the masticatory system",[4] some researchers and clinicians include masticatory muscle disorders,[5] degenerative and inflammatory TMJ disorders,[6] and TMJ disk displacements[5] under the umbrella of TMD.

Prevalence of TMD in children and adolescents

TMDs have been identified as a major cause of nonodontogenic pain in the orofacial region.[8] The reported prevalence of TMD in infants, children, and adolescents varies widely in the literature.[9-14] This variation may be due to differences in populations studied, diagnostic criteria, examination methods, and inter- and/or intrarater variations of examining practitioners.[15,16] The Diagnostic Criteria (**DC**) TMD examination protocol is used in research settings to decrease variability in diagnosis; however, few pediatric studies use this methodology.[17,18] One

ABBREVIATIONS
AAPD: American Academy of Pediatric Dentistry. **CBCT:** Cone-beam computed tomography. **DC:** Diagnostic Criteria. **TMD:** Temporomandibular disorder. **TMJ:** Temporomandibular joint.

study using the criteria from the DC/TMD demonstrated an 11.9 percent prevalence of TMD in adolescents.[18] Most data suggests the prevalence of signs and symptoms of TMD increases with age.[14,18,19] One investigation noted that TMD-related symptoms were rare in three- and five-year-olds whereas five to nine percent of 10- and 15-year-olds reported more severe symptoms.[19] Another study found4.2 percent of adolescents aged 12-19 years reported TMD pain.[16] A study of children in the primary dentition found that 34 percent of patients have signs and/or symptoms of TMD.[20] This could be due, in part, to inclusion of muscular signs such as tenderness to palpation which can be difficult to assess in young children.[13,20] A systematic review and meta-analysis of intra-articular TMD in children and adolescents found a 16 percent prevalence of clinical signs and a 14 percent prevalence of TMJ sounds.[13] Although TMD pain in children increases with age in both boys and girls, recent surveys have indicated a significantly higher prevalence of symptoms and greater need for treatment in girls than boys.[14,21] The development of symptomatic TMD has been correlated with the onset of puberty in girls.[22] For ages 16-19 years, 32.5 percent of girls compared to 9.7 percent of boys reported school absences and analgesic consumption due to TMD-related pain.[21] Headaches appear to be independently and highly associated with TMD in adolescents, with most occurring before the onset of jaw pain.[23]

Etiology of TMD

Temporomandibular disorders have multiple etiological factors.[24] There is insufficient evidence to reliably predict which patients will or will not develop TMD.[25] Predisposing (risk) factors, precipitating (initiating) factors, and perpetuating (or sustaining) factors contribute to the development of TMDs.[25] The available evidence base suggests a poor correlation between any single etiological factor and resulting signs (i.e., findings identified by the dentist during the examination) and symptoms (i.e., findings reported by the child or parent).[26] Alterations in any one or a combination of teeth, periodontal ligament, the TMJ, or the muscles of mastication may lead to TMD.[26] Furthermore, systemic and psychosocial factors may reduce the adaptive capacity of the masticatory system and contribute to TMD.[27]

Etiologic factors suggested as contributing to the development of TMD are:

1. macrotrauma: a common occurrence in childhood because of falling, chin trauma is reported to be a factor in the development of TMD in pediatric patients.[28-31] Additional macrotraumatic injuries occur due to motor vehicle accidents, sports, physical abuse, forceful intubation, and third molar extraction.[31,32] Unilateral and bilateral intracapsular or subcondylar fractures are the most common mandibular fractures in children.[33] Closed reduction and prolonged immobilization can result in ankylosis.[34,35] Improperly treated fractures may result in facial asymmetry.[34,35] Traumatic brain injury may accompany mandibular fracture and other types of jaw injuries.[31] Indirect trauma such as flexion-extension (whiplash) injuries may alter pain processing and lead to TMD symptoms; however, a direct relationship between TMD and indirect trauma has yet to be established.[27]
2. microtrauma from parafunctional habits: bruxism, clenching, hyperextension, and other repetitive habitual behaviors are thought to contribute to the development of TMD by joint overloading that leads to cartilage breakdown, synovial fluid alterations, and other changes within the joint.[36] Bruxism may occur while the patient is asleep or awake; sleep bruxism is a different entity from daytime bruxism. Sleep bruxism has been classified as a sleep-related movement disorder.[37] A study of 854 patients younger than 17 years old found the prevalence of bruxism to be 38 percent,[38] but studies generally do not distinguish between sleep or daytime bruxism. The literature on the association between parafunction and TMD in pediatric patients is contradictory.[39-41] However, childhood parafunction was found to be a predictor of the same parafunction 20 years later.[42] Other studies found a significant association between reported bruxism and TMD.[34,44] Children who grind their teeth were found to complain more often of pain and muscle tenderness when eating.[45] Other examples of microtrauma include repetitive strain such as playing a wind instrument, fingernail biting,[25] or another activity in which the mouth is held open outside of rest position.
3. anatomical factors (skeletal and occlusal) and orthodontic treatment: The association of skeletal and occlusal factors and the development of TMD is relatively weak.[27,46-48] Furthermore, the available data does not support that the development of TMD is caused or improved by orthodontic treatment,[49-53] regardless of whether premolars were extracted.[32] Changes in freeway dimension of the rest position (normally two to four millimeters) may be impinged by occlusal changes, disease, muscle spasms, nervous tension, and/or restorative prosthetics.[4] While most children and adolescents may be able to compensate without problem, in others, failure of the masticatory system to adapt may lead to greater risk of dysfunction. Although there is little evidence to implicate skeletal or occlusal factors with TMD, the following have some association across studies:
    a. skeletal anterior open bite.[54,55]
    b. steep articular eminence of the temporal bone.[27]
    c. overjet greater than six to seven millimeters.[54-57]
    d. skeletal Class II profile[58]
    e. Class III malocclusion.[16]
    f. unilateral posterior crossbite.[46-55]
    g. posterior crossbite.[46]

Craniocervical posture has been suggested to be associated with occlusion and with dysfunction of the TMJ, including abnormalities of the mandibular fossa, condyle, ramus, and disc.[59] Cervical pain and dysfunction can be

a result of poor posture.[60] Cervical pain is frequently referred to orofacial structures and can be misinterpreted as TMD.[61]

4. psychosocial factors: psychosocial factors may play a part in the etiology of TMD.[61,62] Behavioral factors such as somatization, anxiety, obsessive-compulsive feelings, and psychologic stress were predictors of TMD onset.[61] Emotional stress predisposes to clenching and bruxism which in turn contribute to orofacial pain.[63] Results from a case-control study indicate that management of stress and anxiety can mitigate the signs and symptoms of TMD.[64] Depression, anxiety, post-traumatic stress disorder, psychologic distress, and sleep dysfunction may influence TMD prognosis and symptoms.[64] Higher pain intensity in the orofacial region correlated with greater impact on quality of life including difficulty with prolonged jaw opening, eating hard/soft foods, and sleeping.[64]
5. systemic and pathologic factors: systemic factors contributing to TMD include connective tissue diseases such as rheumatoid arthritis, systemic lupus erythematosus, juvenile idiopathic arthritis, and psoriatic arthritis.[25,65,66] These systemic diseases occur as a result of imbalance of pro-inflammatory cytokines which causes oxidative stress, free radical formation, and ultimately joint damage.[67] Other systemic factors may include joint hypermobility, genetic susceptibility, and hormonal fluctuations. Generalized joint laxity or hypermobility (e.g., Ehler Danlos syndrome) has been cited but has a weak association with TMD.[68,69] Pathologic hyperplasia and condylar tumors represent a unique category of TMDs.[66]
6. genetic and hormonal factors: there is little research regarding genetic susceptibility for development of TMD. Recently, study of catechol-O-methyl-transferase haplotypes found that the presence of one low pain sensitivity haplotype decreased the risk of developing TMD.[61] The role of hormones in the etiology of TMD is debatable. Randomized controlled trials indicate that estrogen does not play a role in the etiology of TMD, whereas cohort and case-controlled studies show the opposite.[27] Although the biological basis for gender-based disparity in TMD is unclear, the time course of symptoms is of note in females. Additional studies have shown that TMJ pain and other symptoms vary in relation to phases of the menstrual cycle.[70] The suggestion of a hormonal influence in development of TMD is supported clinically by a study of 3,428 patients who sought treatment for TMD. This study revealed that 85.4 percent of patients seeking treatment were female and the peak age for treatment seeking was 33.8 years.[70] In a similar study of adolescents,[71] 15.1 percent of all patients evaluated for TMD were less than 20 years of age, and girls accounted for 89.9 percent of patients aged 15-19 seeking care and 75.5 percent of patient six-14 years of age.

Diagnosing TMD

All comprehensive dental examinations should include a screening evaluation of the TMJ and surrounding area.[72,73] Diagnosis of TMD is based upon a combination of historical information, clinical examination, and/or craniocervical and TMJ imaging.[27] The findings are classified as symptoms and signs.[72] These symptoms may include pain, headache, TMJ sounds, TMJ locking, and ear pain.[24] Certain medical conditions are reported to occasionally mimic TMD. Among these differential diagnoses are trigeminal neuralgia, central nervous system lesions, odontogenic pain, sinus pain, otological pain, developmental abnormalities, neoplasias, parotid diseases, vascular diseases, myofascial pain, cervical muscle dysfunction, and Eagle's syndrome.[8] Other common medical conditions (e.g., otitis media, allergies, airway congestion, rheumatoid arthritis) can cause symptoms similar to TMD.[24]

Clinical and physical assessment of the patient may include history and determination of joint sounds, evaluation of mandibular range of motion, appraisal of pain, evaluation for signs of inflammation, and select radiographic examination.[24] A screening history, as part of the health history, may include questions such as:[25,27]

- do you have difficulty opening your mouth?
- do you hear noises within your jaw joint?
- do you have pain in or around your ears or your cheeks?
- do you have pain when chewing, talking, or using your jaws?
- do you have pain when opening your mouth wide or when yawning?
- has your bite felt uncomfortable or unusual?
- does your jaw ever lock or go out?
- have you ever had an injury to your jaw, head, or neck? If so, when? How was it treated?
- have you previously been treated for a temporomandibular disorder? If so, when? How was it treated?

Physical assessment should include the following:[24,25,27]

1. palpation of the muscles of mastication and cervical muscles for tenderness, pain, or pain referral patterns;
2. palpation of the lateral capsule of the TMJs;
3. mandibular function and provocation tests;
4. palpation and auscultation for TMJ sounds; and
5. mandibular range of motion.

Evaluation of jaw movements including assessment of mandibular range of motion using a millimeter ruler (i.e., maximum unassisted opening, maximum assisted opening, maximum lateral excursion, maximum protrusive excursion) and mandibular opening pattern (i.e., symmetrical vs. asymmetrical) may be helpful in the diagnosis of TMD. In addition, both limited and excessive mandibular range of motion may be seen in TMD.[25,27]

TMJ imaging is recommended when there is a recent history of trauma or developing facial asymmetry, or when hard-tissue grinding or crepitus is detected.[74] Imaging also should be considered in patients who have failed to respond

to conservative TMD treatment.[36] TMJ imaging assessment may include:

- panoramic radiograph;
- mandible radiographs including oblique views;
- conventional computed tomography (CT) or cone-beam computed tomography (**CBCT**);
- magnetic resonance imaging (both open and closed mouth to view disc position); and
- ultrasound.

TMJ arthography is not recommended as a routine diagnostic procedure.[75-77] The readily available panoramic radiograph is reliable for evaluating condylar head morphology and angulation but does not permit evaluation of the joint space, soft tissues, or condylar motion.[25] The panoramic radiograph may indicate osseous changes, but negative findings do not rule out TMJ pathology.[78] CBCT can be used to detect boney abnormalities and fractures and to assess asymmetry,[76-78] but it generates a much higher radiation burden than the panoramic image. Magnetic resonance imaging provides visualization of soft tissues, specifically the position and contours of the TMJ disc, and can be used to detect inflammation.[25,74,77] Ultrasound is a noninvasive imaging method for viewing superficial lateral aspects of the TMJ.[79]

TMD has been divided into two broad categories, TMJ disorders and masticatory muscles disorders,[77] which are listed below.

1. TMJ disorders:
   a. joint pain:
      (1) arthralgia.
      (2) arthritis.
   b. joint disorders:
      (1) disc-condyle complex disorders (disc displacement with reduction, disc displacement with reduction with intermittent locking, disc displacement without reduction with limited opening, disc displacement without reduction without limited opening).
      (2) hypomobility disorders (ankylosis, bony ankylosis, fibrous adhesions).
      (3) hypermobility disorders (subluxation, luxation).
   c. joint diseases:
      (1) osteoarthritis (degenerative joint disease, condylysis/idiopathic condylar resorption, osteochondritis dissecans, osteonecrosis).
      (2) systemic arthritides such as rheumatoid arthritis, idiopathic juvenile arthritis, spondyloarthropathies, psoriatic arthritis, infections arthritis, Reiter syndrome, and crystal induced disease.
      (3) neoplasms.
      (4) fractures (open and closed condylar and subcondylar).
2. Masticatory muscle disorders:
   a. muscle pain limited to orofacial region (myalgia, myofascial pain with spreading, myofascial pain with referral, tendonitis, myositis, spasm).
   b. muscle pain due to systemic/central disorders (centrally mediated myalgia, fibromyalgia).
   c. movement disorders (dyskinesia, dystonia).
   d. other muscle disorders (contracture, hypertrophy, neoplasm).

Treatment of TMD

The goals of TMD treatment include restoration of function, decreased pain, decreased aggravating or contributing factors, and improved quality of life.[80,81] Few studies document success or failure of specific treatment modalities for TMD in infants, children, and adolescents on a long-term basis. It has been suggested that simple, conservative, and reversible types of therapy are effective in reducing most TMD symptoms in children.[81,82] The focus of treatment should be to find a balance between active and passive treatment modalities. Active modalities include participation of the patient whereas passive modalities may include wearing a stabilization splint. In a randomized trial, adolescents undergoing occlusal appliance therapy combined with information attained a clinically significant improvement on the pain index.[83] Combined approaches may be more successful in treating TMD than single treatment modalities.[81]

Treatment of TMD can be divided into reversible and irreversible treatment. Reversible therapies may include:

- patient education (e.g., explanation in clear and simple terms describing the nature of the disorder, the significance of predisposing, precipitating, and perpetuating factors, anatomy of the TMJ, management options, and goals of therapy).[27,81]
- physical therapy (e.g., jaw exercises or transcutaneous electrical nerve stimulation [TENS], ultrasound, iontophoresis, massage, TMJ distraction and mobilization, thermotherapy, coolant therapy).[27,36,81,84-86]
- behavioral therapy (e.g., biofeedback, relaxation training, cognitive behavioral therapy [CBT] for developing behavior-coping strategies and modifying perceptions about TMD, habit reversal and awareness of daytime clenching and bruxing, avoiding excessive chewing of hard foods or gum, voluntary avoidance of stressors, treatment of co-morbid behavioral health conditions, obtaining adequate, uninterrupted sleep).[36,81,86]
- prescription medication (e.g., nonsteroidal anti-inflammatory drugs, anxiolytic agents, muscle relaxers). While antidepressants have proved to be beneficial, they should be prescribed by a practitioner familiar with pain management.[27,36,81,87]
- occlusal splints. The goal of an occlusal appliance is to provide orthopedic stability to the TMJ. These alter the patient's occlusion temporarily and may be used to decrease parafunctional activity and pain.[83,88-90] Occlusal splints may be made of hard or soft acrylic. The stabilization type of splint covers all teeth on either the maxillary or mandibular arch and is balanced so that all teeth are in occlusion when the patient is closed and the jaw is in a musculoskeletally stable position.[8,36]

Additional reversible therapies may include TMJ arthrocentesis, TMJ injections, nerve blocks, acupuncture, trigger point injections, and off-label use of botulinum toxin A injections.[91-95]

Irreversible therapies can include:

- occlusal adjustment (i.e., permanently altering the occlusion or mandibular position by selective grinding or full mouth restorative dentistry).[96] A systematic review and meta-analysis demonstrated that occlusal alteration seems to have no effect on TMD.[97]
- orthodontics. This may include mandibular positioning devices designed to alter the growth or permanently reposition the mandible (e.g., headgear, functional appliances). There is little evidence that orthodontic treatment can prevent or relieve TMD.[27,98,99]
- surgery. Surgical interventional includes orthognathic surgery, open joint TMJ surgery to removed diseased synovium, and TMJ reconstruction.[66] Data suggests surgery is limited in most situations to cases of severe joint degeneration or destruction following trauma or tumor resection.[66,81,100]

Controversy surrounds the significance of signs and symptoms in children and adolescents, the value of certain diagnostic procedures, and what constitutes appropriate therapy.[58,101,102] It is not clear whether these signs and symptoms constitute normal variation, preclinical features, or manifestations of a disease state.[103] Whether these signs and symptoms warrant treatment as predictors of TMD in adulthood is questionable.[42,103]

Recommendations

Every comprehensive dental history and examination should include a TMJ history and assessment.[73] The history should include questions concerning the presence of head and neck pain and mandibular dysfunction, previous orofacial trauma, and history of present illness with an account of current symptoms.[102] In the presence of a positive history and/or signs and symptoms of TMD, a more comprehensive examination (e.g., palpation of masticatory and associated muscles and the TMJ's, documentation of joint sounds, occlusal analysis, and assessment of range of mandibular movements including maximum opening, protrusion, and lateral excursions) should be performed.[102] Joint imaging may be recommended in some cases.[74] Referral should be made to other health care providers, including those with expertise in TMD, oral surgery, or pain management, when the diagnostic and/or treatment needs are beyond the treating dentist's scope of practice.[27]

Reversible therapies should be considered for children and adolescents with signs and symptoms of TMD.[83,104] Because of inadequate data regarding their effectiveness, irreversible therapies should be avoided.[83,96,99] Referral to a medical specialist may be indicated when primary headaches, otitis media, allergies, abnormal posture, airway congestion, rheumatoid arthritis, connective tissue disease, psychiatric disorders, or other medical conditions are suspected.

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