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Considerations in the Diagnosis and Treatment of Temporomandibular Disorders in Children and Adolescents: A Review

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Temporomandibular disorders (TMDs) are a group of musculoskeletal disorders that encompass symptoms caused by abnormalities of the craniofacial structures of the temporomandibular joint (TMJ), muscles involved in the masticatory system, and other related tissues or structures. Although TMDs can occur at any age, research on the prevalence, epidemiology, and treatment strategies of TMDs has been conducted in all age groups, but primarily in adults. Unlike adults, children and adolescents are in a period of cognitive and physical development. Because of this growth potential, children respond better to TMD treatment than adults do. However, clinicians must remember that chronic pain and growth abnormalities can occur if the patient's symptoms and signs are not accurately diagnosed and treated. This article reviews the growth and development of the craniofacial region, including the TMJ, and discusses considerations when diagnosing and treating TMDs in children and adolescents.

Keywords: Adolescent; Children; Diagnosis; Growth; Temporomandibular disorders

INTRODUCTION

Temporomandibular disorders (TMDs) are a group of musculoskeletal conditions encompassing symptoms caused by abnormalities in the craniofacial structures of the temporomandibular joint (TMJ), muscles involved in the masticatory system, and other related tissues or structures [1]. Although TMDs can occur at any age, TMD-related signs and symptoms are rare in infants and children with primary teeth [2]. However, the prevalence of TMD signs and symptoms increases with age after childhood [3]. Furthermore, TMD pain has been reported to be a significant factor in adolescent patients seeking dental and medical care [4], and children and adolescents with orofacial pain are known to experience psychological distress and problems with daily functioning [5].

Studies of the prevalence, epidemiology, and treatment strategies for TMDs have been conducted in all age groups, but mainly in adults [3]. In particular, the research diagnostic criteria for TMD (RDC/TMD) and the TMD diagnostic criteria (DC/TMD), designed to diagnose TMDs systematically, have also been verified in adults [1]. Because of their growth potential, children and adolescents are more adaptable than adults are [6]; thus, nonsurgical treatment of TMDs often improves their symptoms and signs. However, one longitudinal study found that adolescents with TMD pain were three times more likely to develop TMD pain when they became young adults than those without a history of TMD pain [7]. Therefore, it is crucial to recognize TMD pain in children and adolescents as early as possible to prevent it from becoming chronic.

If left chronic, TMD can last for months or years, causing

pain, functional impairment, and suffering. In addition, as a long-term consequence of chronic TMD, pathological degeneration of the jaw and facial muscles may result in craniofacial changes [8]. Because children and adolescents are undergoing physical growth, clinicians should pay attention to the potential adverse effects of TMD on the orofacial growth of their pediatric and adolescent patients.

In this article, we review the growth and development of the craniofacial region, including the TMJ, and discuss considerations for diagnosing and treating TMDs in children and adolescents.

DEVELOPMENT AND GROWTH OF THE TMJ AND CRANIOFACIAL REGION

To date, craniofacial growth has been studied primarily in the context of surgical procedures. The craniofacial region develops in utero, continues to grow after birth, and continues steady growth until adulthood [9]. Unlike other synovial joints, the TMJ develops from three distinct mesenchymal condensations [10]. These three separate structures, formed by two different branchial arch origins [11], become the glenoid fossa of the temporal bone, the mandibular condyle, and the articular disc. These complex structures allow secondary cartilaginous growth during TMJ growth [10].

In the early stages of craniofacial growth and development, the growth of the skull base, orbits, and upper third of the face occurs primarily in association with the rapid growth of brain tissue [12]. In particular, the cranium reaches nearly adult size by about 5 years of age [9]. In contrast to the cranium, the mandible is very small at birth, and the functional demands of mastication, swallowing, and speech drive its width growth [9]. Growth of the mandible begins at the age of 5-6 years [11]. These differences in growth may explain why TMDs in children rarely occur before age 5. Mandibular growth occurs in the following order: mandibular width, body length, and height [9]. In particular, the mandible height can grow until the early 20s in men [10], which is relatively later than average physical growth. This growth might be influenced by the fibrous cartilage of the mandibular condyle, which acts as a secondary growth center [13]. Unlike hyaline cartilage, which is present in other articular surfaces in the body, fibrocartilage has a high density of fibrous connective tissue, which allows it to withstand loads. Excessive loading beyond functional limits, macrotrauma such as a fall or microtrauma caused by psychological anxiety can be risk factors for TMDs [3].

DIAGNOSIS OF TMDs IN CHILDREN AND ADOLESCENTS

The process of diagnosing TMD itself is similar between adults and children/adolescents. Medical and dental history, clinical examination, radiologic examination, and psychological testing related to symptom triggers may be required [14]. Clinicians should adjust the language required for testing based on the patient's age and cognitive level.

The history taking process should include questions about head and neck pain and dysfunction, previous craniofacial trauma, history of current illness, and current symptoms [15]. Various etiological factors may contribute to TMD. Macrotrauma has been reported as the common cause of TMD in children and adolescents [3]. Injuries such as falls, car accidents, playing sports, being physically abused, and iatrogenic accidents such as enforced intubation are examples of microtrauma [14]. Inappropriate treatment or prolonged immobilization for traumatic fractures can result in facial asymmetry or TMJ ankylosis [16]. To prevent the development of these complications, long-term follow-up is required for those diagnosed with trauma-related TMDs. Although not as common as trauma, systemic factors should be considered as contributors to TMD [3]. Among connective tissue diseases, diseases that affect joints can also affect TMJ. These include rheumatoid arthritis, juvenile idiopathic arthritis, systemic lupus erythematosus, and ankylosing spondylitis [3,16-19]. Trauma and systemic disease may not have a direct effect at the time of presentation but can alter condylar growth and result in facial asymmetry and skeletal deformities [20]. Repetitive or habitual behaviors such as teeth grinding and clenching can overload the TMJ and cause microscopic changes within the joint, leading in TMD development [15,21]. Other examples of microtrauma include playing wind instruments, nail-biting, and excessive mouth opening [3,20]. Psychosocial factors may play a role in the etiology of TMD [3]. Emotional stress can lead to muscle hyperactivity and abnormal parafunctional

habits, which increases the likelihood of TMD development [22]. Adolescents with TMDs have higher rates of anxiety, depression, post-traumatic stress disorder, fatigue, and poorer quality of life than pain-free youths do [23-26]. These psychosocial factors, in turn, contribute to the etiology of TMD and may also influence the maintenance of TMD symptoms and long-term prognosis [3,14,22]. Finally, although the role of hormones in the sex disparity in TMD is controversial, there are reports of an increase in TMD-related symptoms around puberty, especially in women [3,8,27]. When pediatric and adolescent patients present with TMD symptoms, clinicians unfamiliar with the multifactorial etiology of TMD often emphasize psychosocial factors [4]. Therefore, a comprehensive evaluation of the patient's symptoms should be performed by history taking, TMD-specific clinical examination, and, if needed, radiologic examination [3,14].

Clinical evaluation of TMD may include TMJ sounds, mandibular range of motion, pain evaluation, and occlusal examination [3,14,15]. Imaging studies to evaluate TMD include conventional panoramic, lateral cephalogram, computed tomography (CT), cone-beam CT (CBCT), and magnetic resonance imaging [14]. Because bone surfaces and salivary glands absorb higher doses than other tissues do, clinicians should exercise caution when performing radiography to evaluate for TMDs to minimize radiation exposure in growing children and adolescents [28]. Radiological examination is recommended in cases of recent trauma, growth abnormalities, or failure to respond to conservative TMD treatment [3,14,15]. In addition, when evaluating radiologic images, the size and shape of the mandibular condyle can change significantly during growth [20]. During the growth of the mandible, the condyle's position within the mandibular fossa changes and the shape of the mandibular condyle changes from round to oval [29]. CT or CBCT images are used when evaluating osteoarthritis of the TMJ to assess cortical bone continuity of the mandibular condyle [30]. However, because the mandible matures later than other body parts do, clinicians should consider that the continuity of the cortical bone of the mandibular condyle occurs in the early to mid-20s [31,32].

DC/TMD and RDC/TMD are designed for systematic diagnosis of TMD, and both criteria consist of two axes and respective assessment tools [1]. These two axes are Axis I, for physical diagnosis, and Axis II, for assessing psychosocial conditions and pain-related disorders. The DC/TMD, a revised version of the RDC/TMD, was published in 2014. It has been validated in adult populations and is used worldwide to diagnose TMD [1,33]. The expert group agreed that children and adolescents need age-specific adaptations to use DC/TMD, and after some preliminary work [34], they published separate diagnostic criteria for children and adolescents [33,35]. Adolescents were defined as those aged 10-19 years according to the World Health Organization definition [33]. The experts concluded that DC/TMD for children should target children aged 6-9 years, with age 6 being the lower cutoff for clinical TMD [35]. The changes made to the pediatric DC/TMD compared with the adult version include rephrasing the questionnaires to make them more suitable for children and changing or replacing several questionnaires. The number of palpation sites per muscle has been reduced from nine in adults to three when palpating the masseter and temporalis muscles [35]. The threshold for restricted opening was adjusted from 40 mm in adults to 32 mm (third percentile at age 6 years) [36]. The differences between DC/TMD for adolescents and adults are similar to those for children. Briefly, the language of the questionnaire was adjusted for adolescents [33]. Unlike the DC/TMD for adults, the DC/TMD for children and adolescents adds questions for patients and caregivers from the general health questionnaire, and stress, catastrophic thinking, and sleep disorders were added to evaluate psychosocial functions [33,35]. However, the method of palpating the masseter and temporalis muscles and the cutoff values for mandibular movement limitations are the same as that in adults [33].

CONSIDERATIONS FOR THE TREATMENT OF TMDs IN CHILDREN AND ADOLESCENTS

The goal of TMD treatment is to improve the patient's quality of life through pain relief and functional recovery [2]. Children and adolescents are more resilient than adults are, and they recover well from musculoskeletal conditions [37]. Moreover, few studies have documented the long-term success or failure of specific treatment modalities for TMD in children and adolescents [3]. Therefore, reversible and

conservative treatment modalities should be considered for children and adolescents with signs and symptoms of TMD [4,20].

In general, reversible treatment of TMD consists of a combination of patient education and self-care regimens, biobehavioral therapy, physical therapy, pharmacotherapy, and occlusal appliance therapy [2,3,14]. A multimodal strategy may be more successful in treating TMD than a single treatment modality is [3].

Patient education includes presumptive diagnosis, risk factors, initiating and perpetuating factors for TMD, treatment goals, and self-management practices [3]. It is crucial to educate patients and their parents in clear, simple, and easy-to-understand language [2]. Modifying behavioral therapy is recommended through patient education, which is essential in controlling factors of TMD persistence and providing effective treatment [14]. If symptoms do not improve with behavioral therapy modifications, the use of a removable occlusal device may be more motivating [4,38]. Although long-term follow-up studies of adolescent TMD patients show the superiority of occlusal device treatment, the long-term effects in growing children have yet to be studied [4,38,39]. Therefore, clinicians should examine whether the patient's dentition is mixed or permanent and take great care when choosing the material of the device or determining the duration of wear [2,4,14].

Irreversible treatment of TMD, especially surgical treatment, is considered when the condition does not respond to conservative treatment and significant pain and limitations in activities of daily living result from structural or anatomical factors [2]. These factors include craniofacial congenital anomalies, posttraumatic facial asymmetry, or facial balance disorders due to therapeutic radiation [12]. However, deciding to have surgery before growth is complete is a very complex issue, given the risk of symptom recurrence [1,12]. Therefore, accurate diagnosis, evaluation, and a conservative, multimodal treatment approach are essential before irreversible intervention is initiated.

CONCLUSION

TMD is a multifactorial musculoskeletal disorder. Unlike adults, children and adolescents are in period of cognitive and physical development. Although this growth potential makes children respond better to TMD treatment than adults do, clinicians should remember that chronic pain and growth abnormalities can occur if the patient's symptoms and signs are not accurately diagnosed and treated. Recently, the DC/TMD, which was validated for reliability in adults, was modified and published for diagnosis in children and adolescents. Based on the adjusted diagnostic criteria, we hope that research on TMD in children and adolescents will be systematically and actively conducted. Treatment strategies for TMD in children and adolescents should be conservative and combined. To establish evidence-based treatment strategies, long-term observational studies of conservative treatment are needed to effectively treat TMD in children and adolescents.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

DATA AVAILABILITY STATEMENT

The data sets used in the current study are available from the corresponding author upon reasonable request.

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