Prevalence of Temporomandibular Dysfunction and its Association with Malocclusion in Children: An Epidemiologic Study

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Introduction: *Malocclusion is one etiological factor of temporomandibular joint disorder (TMD). This study investigates the prevalence of TMD and the relationship between TMD and the type of occlusion.* ***Study design:*** *A sample of 923 children (463 girls and 460 boys, ages 7-12 years old) was grouped not only by chronological age but also by gender. The information was collected on functional occlusion (anterior and lateral sliding, interferences), dental wear, mandibular mobility (maximal opening, deflection, deviation), and temporomandibular joint and muscular pain recorded by palpation.* ***Results:*** *Headache was the only symptom of temporomandibular dysfunction (TMD) reported by the children. The results showed that one or more clinical signs were recorded in 25% of the subjects, most of which were mild in character. The prevalence increased during the developmental stages. Girls were in general more affected than boys.* ***Conclusions:*** *In this study, many subjects with TMD had malocclusions. Early treatment may be important in the prevention of severe TMD. Significant associations were found between different signs, and TMD was associated with posterior crossbite, anterior open bite, Angle Class II and III malocclusions, and extreme maxillary overjet.*

Key words: *Temporomandibular dysfunction, Epidemiology, Children.*

INTRODUCTION

Clinical signs and symptoms of temporomandibular dysfunction (TMD) are generally related to the masticatory muscles and the temporomandibular joints (TMJs).[1] Symptoms may include TMJ sounds, myofascial pain and dysfunction, arthritic disorders, internal derangement, and muscle hyperactivity disorders.[2,3] Joint noises, muscular pain, and joint pain were the most frequent symptoms in subjects with TMJ disorders.[4]

Epidemiological studies have found that 60% of the entire population and more than one-third of children and adolescents have various symptoms of TMJ disorder. The prevalence and the severity of the symptoms of TMD increase particularly in girls between the ages of 12-15 and continue to increase with advancing age.[5-7]

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The etiology of TMD may be due to various reasons such as anatomic, systemic, and psychological factors.[7] Several investigators have reported a significant correlation between malocclusions (such as Angle's classification of molars, open bite, deep bite, cross-bite, irregular contacts of the teeth, occlusal discrepancies, or excessive overjet) and temporomandibular joint (TMJ) disorders.[4-10] In cases of dental interferences, the mandible may be positioned distally and posterior attachment of the disc may be damaged.[11]

The relationship between occlusion and TMD has been discussed frequently in the literature. Masticatory performance may decrease due to malocclusion.[12] It is generally agreed that functional disorders in the masticatory system occur depending on occlusal changes, but this effect remains at a minor level.[5,13-15]

Existing malocclusion in childhood and adolescence may be a risk factor for developing TMD later in life.[16] Our aim in this study is to assess the prevalence of TMD in primary school children and investigate the relationship between the type of occlusion with TMD in light of the multi-factorial problem.

MATERIALS AND METHOD

In the present study, 463 girls and 460 boys between 7 and 12 years of age were selected randomly from three different central schools in Kirikkale, Turkey. The samples were grouped not only by chronological age but also by gender. The distribution of chronological age for all participants is shown in Table 1, and the distribution of the dentition for all participants is shown in Table 2. Children

with any systemic disease, cleft, or any syndrome were not included in our group.

The registrations included functional occlusion (anterior and lateral sliding, interferences), dental wear, mandibular mobility (maximal opening, deflection, deviation), and temporomandibular joint and muscular pain recorded by palpation. Also, a data collection form containing all the variables evaluated, such as height, weight, oral health, the presence of malocclusion, functional disorders, oral habits, was prepared for each child.

Receiving the results of clinical records was carried out as follows. Functional occlusion registration was recorded in most backward and maximum intercuspidation position of the mandible and during anterior-posterior and lateral movements of the mandible. Also, non-working side interferences were determined. Registration of individual symptoms was recorded during interviews with children and parents using a questionnaire.

The signs of temporomandibular dysfunction (TMD) were performed with records of

- maximum opening
- deflection
- function of the temporomandibular joints
- pain of the temporomandibular joints
- muscle sensitivity

Table 1: Distribution of individuals by age.

Age	Girls		Boys		Total	
	n	%	n	%	n	%
7	70	7.6	70	7.6	140	15.2
8	102	11.1	81	8.8	183	19.8
9	111	12.0	101	10.9	212	23.0
10	87	9.4	97	10.5	184	19.9
11	92	10.0	106	11.5	198	21.5
12	1	0.1	5	0.5	6	0.7
Total	**463**	**50.2**	**460**	**49.8**	**923**	**100**

Table 2: Distribution of individuals according to the dentition.

Dentition	Girls		Boys		Total	
	n	%	n	%	n	%
Mixed	416	45.1	421	45.6	**837**	90.7
Permanent	47	5.1	39	4.2	**86**	9.3
Total	463	50.2	460	49.8	**923**	100.0

Clinical Dysfunction Index (Modified Helkimo Dysfunction Index)

Helkimo is an index that can be used to measure the severity of TMD and the pain in the joints.[17] The index was performed by obtaining points as described by Thilander et al.[1]

Maximum opening: 0 point: >40/>35 mm.
1 point: 30-39/25-34 mm.
2 points: < 30/25 mm.

Deflection during mandible opening: 0 points: <2mm.
1 point: 2-5 mm.
2 points :>5 mm.

Impaired TMJ function: (clicking, deadlock, luxation)
0 points: no impairment,
1 point: palpable click,
2 points: audible click,
deadlock, luxation.

Pain of the temporomandibular joints: 0 points: no pain,
1 point: palpable pain,
2 points: palpebral reflex.

Muscle pain: 0 points: no pain,
1 point: palpable pain,
2 points: palpebral reflex.

The sum of points obtained according to this index expressed as follows.

0: no dysfunction,
I: mild dysfunction (1-4 points)
II: moderate dysfunction (5-9 points)
III: serious dysfunction (>9 points)

Statistical Method

TMD signs and symptoms for girls and boys in different developmental periods were evaluated separately. T-test and K-square tests were used to investigate the relationships between the different functional and morphological malocclusions ($p < 0.05$).

RESULTS

The difference between centric relation and centric occlusion in the anterior-posterior direction was 4.4%, and it was 1.9% in the lateral direction. Interferences were 10.2% in the non-working side. Dental erosion was observed more in deciduous teeth facets (see Table 3).

Limitation of mouth opening was more pronounced in girls; the average rate of the deflection was 5% in both sexes while opening the mouth (see Table 4).

According to the registration of individual symptoms, the sole TMD symptoms reported by the children were head and ear pain.

TMJ pain on palpation was 1.8%, and clicking percentage was 5.6% and was higher in girls. Masseter muscle pain on palpation was 2.5% and was higher in boys. Temporalis muscle pain on palpation was 4.2% and was higher in girls. Headaches were the most prominent symptoms and were higher in girls (see Table 5). All symptoms and signs were found to increase with age and were more pronounced in the 9-10 age group (see Table 6). TMJ pain and clicking were associated significantly with almost all variables. Muscle sensitivity and especially muscle interferences were associated significantly with mouth opening limitation and pain of the head and ears (see Table 7).

Table 3: Percentage of occlusal interferences and dental erosions in individuals.

	Girls	Boys	Total
Between centric relation and centric occlusion			
Anterior deflection > 1.5 mm.	4.9	4.0	4.4
Lateral deflection > 0.5 mm.	2.0	1.7	1.9
Interferences in the non-working side	8.3	12.1	10.2
Dental wearing			
Deciduous teeth	2.5	3.7	3.1
Permanent teeth	0.3	0.4	0.4

Table 4: Percentage of limitation of mandibular movement in individuals.

	Girls	Boys	Total
Maximum opening the mouth			
normal	28.1	33.3	30.7
reduced	21.9	16.5	19.2
significantly increased	0.2	0.1	0.2
Deflection while opening the mouth			
<2 mm.	94.4	95.2	94.8
2-5 mm.	5.5	4.6	5.0
>5 mm.	0.1	0.2	0.2

Table 5: TMD prevalence, percentage of headache and ear pain by gender.

	Girls	Boys	Total
TMJ pain on palpation			
1 point	1.8	1.8	1.8
2 point	0.4	0.3	0.4
Clicking	0.0	0.0	0.0
palpable	3.9	2.9	3.4
listenable	2.3	2.2	2.2
Deadlocks	0.0	0.0	0.0
Luxation	0.0	0.1	0.1
Masseter muscle pain on palpation	0.0	0.0	0.0
Masseter 1 point	1.8	3.3	2.5
Masseter 2 point	0.2		0.2
Temporalis 1 point	4.6	3.9	4.2
Temporalis 2 point	0.0	0.0	0.0
Headache	12.1	11.2	11.6
Ear pain	3.8	4.2	4.0
Headache and Ear pain	5.6	4.4	5.0

Table 6: TMD prevalence, percentage of headache and ear pain by age.

	7-8 age	9-10 age	11-12 age
TMJ pain on palpation			
1 point	1.7	3.4	1.4
2 point	0.2	0.3	0.2
Clicking			
palpable	0.5	1.7	1.1
listenable	0.1	0.5	0.7
Deadlocks	0.0	0.0	0.0
Luxation	0.0	0.1	0.0
Masseter muscle pain on palpation			
Masseter 1 point	0.7	2.6	1.6
Masseter 2 point	0.2	0.4	0.2
Temporalis 1 point	1.7	4.4	2.3
Temporalis 2 point	0.0	0.0	0.0
Headache	5.0	10.9	7.4
Ear pain	3.6	3.6	2.0
Headache and Ear pain	2.5	3.8	2.7

Table 7: Results of the relationship between different variables in individuals.

	Anterior deflection	Lateral deflection	Interferences	Limitation while opening the mouth	Muscle sensitivity	Dental erosion	Headache	Ear pain
TMJ pain	**	***		***	***	**	***	**
Clicking	***	***	**	**	***	**	**	**
Deadlocks								
Luxation								
Masseter sensitivity	*	*	**	***		*	***	***
Temporalis sensitivity	*		**	***		*	**	**

* P<.05 ** P<.01 *** P<.001

When dysfunction scores were assessed according to the modified Helkimo Index, it was observed that 16.7% of individuals had 1 and the top score, and the majority of individuals were girls (see Table 8). According to the different malocclusions, prevalence of TMD reached 40%, and its severity was generally mild. Moderate and severe dysfunctions were seen in individuals with Angle Cl III malocclusion, overjet greater than 0 and less than 6, and increased overbite (see Table 9).

DISCUSSION

The average 25% of the individuals who participated in this study had clinical signs of TMD depending on the masticatory system disorders. These findings are lower than data obtained in previous studies because the study group consisted of patients in the prepubescent period and with ethnic differences.[1,8,13,18,19] The need for TMD treatment in adults is found in only 2-4% of the population.[20]

In the present study, we preferred the modified dysfunction Helkimo index (Di) because it allows numerical scoring of the severity of TMD.[21]

Table 8: The distribution of Helkimo scores by gender. [%]

	Girls	Boys	Total
Scores			
0	81.5	85.0	83.3
1-4	15.1	12.1	13.6
5-9	3.0	2.6	2.8
>9	0.4	0.3	0.3

Table 9: Prevalence of TMD according to different malocclusions.

		Temporomandibuler Dysfunction			
	n	none	mild	moderate	severe
Angle					
Class I	666	64.9	20.1	14.3	0.8
Class II:1	222	59.9	16.7	19.4	4.1
Class II:2	14	71.4	7.1	14.3	7.1
Class III	21	38.1	33.3	23.8	4.8
Bimaxiller protrusion	157	74.5	21.7	3.8	0.0
Overjet					
<0 mm	43	58.1	20.9	20.9	0.0
4-6 mm	86	69.8	16.3	12.8	1.2
>6 mm	30	53.3	16.7	23.3	6.7
Overbite					
<0 mm	78	66.7	17.9	11.5	3.8
4-6 mm	88	58.0	15.9	21.6	4.5
>6 mm	5	40.0	0.0	40.0	20.0
Posterior crossbite	44	50.0	27.3	18.2	4.5

Some long-term follow-up studies have reported that TMD signals and symptoms increase with age. In our study, it was observed that TMD symptoms and signals increased with increasing age in the study group. We therefore suggest that when the symptoms occur at an early age, the patient should be treated as soon as possible to prevent advancement of the problem.[22]

TMD frequency was found to be greater in females than males. The girls may be more sensitive because girls give more responses during palpation of the joints and muscles. Also, it was reported that reproductive hormones in women have an active role in the etiology of TMD, therefore, an increase in prevalence of TMJ pain would be expected in pubescent girls.[9,23,24] In a study conducted among young adults, it was reported that female gender is the only significant predictors of TMD.[25] However, Almăsan et al. found no significant differences between sexes in terms of TMD.[4]

Researchers during occlusal development have reported that early decay and tooth loss, rotations, forward shift of the first molars, interferences, posterior crossbite, and mandibular shifts predispose an individual to the development of the TMD and increase the sensitivity of skeletal muscle. Williamson and Lundquist[26] reported that interfering dental contacts have significant effects on volumetric muscle activity. A significant relationship was detected between the posterior crossbite and joint sounds, clicking, and muscle tenderness. Muscle tenderness is more common in children with crossbite than in children without crossbite. Other studies found asymmetric activity of the masticatory muscles due to the differences in muscle thickness on the crossbite and non-crossbite sides.[27-29] Also, significant relationships were observed between anterior crossbite and medial pterygoid and temporal muscle tenderness.[30] According to the previous studies, protrusive interferences increase the probability of occurrence clicking in adulthood, but do not increase the probability of occurrence clicking in children.[16] It is also reported that the presence of teeth clenching and grinding leads to increased sensitivity of muscle, clicking, limitation of mouth opening, and development of TMD. Results in this study were consistent with the findings of these other researchers.[1,13,18,19]

A previous study found that the main symptom of TMD was the sound among elementary school level children.[25] In our study, head and ear pain was found to be closely associated with the presence clicking, muscle pain, and TMJ pain. Orofacial pain is seen more frequently in patients with TMD than in patients without TMD.[31] Thilander stated that it was uncertain whether headache increases muscle pain or whether headache occurs from the muscle pain.[1]

In our study, high prevalence of TMD was found in children with Angle Cl III malocclusion, bimaxillar protrusion, decreased and increased overjet, deepbite or openbite, and posterior crossbite. However, there are different opinions in the literature about early orthodontic treatment; early treatment is recommended to eliminate the characteristics of these morphological abnormalities.[1] In a study of young adults,[32] it was observed that Class III malocclusions have an important role in the deviation of the temporomandibular joint components and also on the masticatory muscle tenderness.

It was found that excessive overjet may stress the masticatory muscles and have an impact on the displacement of the TMJ disk.[5,33] A significant relationship was found between overjet and temporomandibular disorders, independently of the types of

malocclusions.[1,5,6] In this study, large overjet increased the risk of TMJ disorders. Also, greater muscular strength was found in cases with deep overbite, which is more common in subjects with anterior growth rotation development.[4,34] Our results are in agreement with the findings of previous studies.[1,13,18,19]

CONCLUSIONS

The TME status is an important factor to be taken into consideration when assessing malocclusion. There appears to be an open issue according to all the evidence, namely, whether early orthodontic treatment would hamper the development of TMD or mitigate the signals or symptoms of TMD. We need to conduct long-term follow-up studies of children who received early orthodontic treatment to find the answers to these questions.

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