Original Article

Prevalence of Temporomandibular Dysfunction and Its Association With Malocclusion in Children and Adolescents: An Epidemiologic Study Related to Specified Stages of Dental Development

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Abstract: A sample of 4724 children (2353 girls and 2371 boys) (5–17 years old) were grouped not only by chronological age but also by stage of dental development (deciduous, early mixed, late mixed, and permanent dentition). The registrations included functional occlusion (anterior and lateral sliding, interferences), dental wear, mandibular mobility (maximal opening, deflection), and temporomandibular joint and muscular pain recorded by palpation. 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 them being mild in character. The prevalences increased during the developmental stages. Girls were in general more affected than boys. Significant associations were found between different signs, and TMD was associated with posterior crossbite, anterior open bite, Angle Class III malocclusion, and extreme maxillary overjet. (*Angle Orthod* 2002;72:146–154.)

Key Words: Temporomandibular dysfunction; Epidemiology; Temporomandibular dysfunction related to malocclusions

INTRODUCTION

Temporomandibular dysfunction (TMD) is a generic term for a number of clinical signs and symptoms involving the masticatory muscles, the temporomandibular joints (TMJs), and associated structures. A number of studies[1–21] have shown that functional disturbances of the masticatory system in children and adolescents are common (Table 1) and seem to increase with age into adulthood. However, severe and moderate signs and symptoms are not frequent and only a few need functional treatment.

Most of these studies report a high frequency of clinical signs of dysfunction (eg, clicking and tenderness of masticatory muscles on palpation) as well as subjective symptoms. The reported prevalences, however, vary greatly, probably due to variations in number and age of the subjects examined, methods used, and diagnostic criteria. Furthermore, the terms parafunction and dysfunction are often confused, and consequently no distinction between mandibular dysfunction and orofacial parafunction is made in some studies. More confusing is the fact that parafunctions are sometimes included as subjective symptoms and sometimes as clinical signs.

Another problem associated with the description of mandibular dysfunction is the difficulty in precisely defining subjective symptoms and clinical signs qualitatively. Differences in degree between mild, moderate, and severe signs and especially symptoms are very difficult to estimate. Therefore, it is important to use consistent and well-defined criteria when comparing different studies of dysfunction.

Even with a strict definition of dysfunction, there will still be considerable disagreement concerning the importance of different etiological factors. Since the cause of TMD in children as well as in adults is obviously multifactorial, prevention of such disorders alone seldom warrants a decision to start orthodontic treatment. A difficulty in this context is that we not only have to deal with the malocclusions present in the young dentition but also have to predict the long-term development of the occlusion.

Though the role of morphological and functional occlusion as contributing factors in the development of TMD has

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TABLE 1. Prevalence (%) of Symptoms and Signs of Temporomandibular Dysfunction in Children and Adolescents in Different Ethnic Groups

Author(s)	Country	Subjects		Symptoms	Signs
		Number	Age		
Geering-Gaerny and Rakosi[1]	Switzerland	233	8–14	—	41
Siebert[2]	Germany	232	12–16	—	62–80
Grosfeld and Czarnecka[3]	Poland	250	6–8	6	56
		250	13–15	10	68
Dibbets[4]	Netherlands	112	8–17		46[a]
Williamsson[5]	United States	304	6–16	—	35
Wigdorowicz et al[6]	Poland	2100	10–15	—	60
Egermark-Eriksson[7]	Sweden	136	7	39	33
		131	11	67	46
		135	15	74	61
Nilner[8]	Sweden	440	7–14	36	64
		309	15–18	41	55
Gazit et al[9]	Israel	369	10–18	—	56
Ogura et al[10]	Japan	2198	10–18		10[a]
Könönen et al[11]	Finland	156	10–16	52	65
Jämsä et al[12]	Finland	127	5	—	12
		109	10	—	41
		147	15	—	42
Bernal and Tsamtsouris[13]	United States	305	3–5	38	36
Heikinheimo et al[14]	Finland	167	12–15	65	—
Nielsen and Terp[15]	Denmark	706	14–16		41[a]
Pahkala and Laine[16]	Finland	1008	5–15		39[a]
Mohlin et al[17]	England	1000	12	16	46
Motegi et al[18]	Japan	7337	6–18		12[a]
Keeling et al[19]	United States	3428	6–12	—	10
Deng et al[20]	China	3105	3–19	—	18
Alamoudi et al[21]	Saudi Arabia	502	3–7	—	16

[a] Symptoms and signs together.

been discussed during the last decades, there are still different opinions about the relative importance of occlusion to other contributing factors.[22–25] Even if much controversy has been reported regarding the role of occlusion on TMD, there is, however, no doubt that occlusal variables influence natural masticatory muscle function.[26] Placement of the intercuspal position relative to muscles and joints is determined by the formative craniofacial development. During puberty, with intensive skeletal growth and increasing muscular strength, discrepancies in the mutual timing of these two elements as well as of tooth eruption may influence the intermaxillary relationship, which may have an effect on the occlusal stability.

In Colombia, South America, information on prevalences of temporomandibular dysfunction is missing. Thus, the aim of the present study was to assess the prevalence of TMD in a population of Bogotanian children and adolescents. In light of the multifactorial problems of mandibular dysfunction, it was also decided to study potential associations between functional and morphological malocclusions in the different stages of dental developmental periods.

MATERIALS AND METHODS

Subjects

A sample of 4724 children (2353 girls and 2371 boys) (5–17 years old) was randomly selected from a population that attended the Dental Health Service of the Pediatric Clinic of Colsubsidio in Bogota. Family origin, registered in order to determine the Colombian racial composition of the sample, was found representative of Bogotanians with an ancestry from the central part of the country. Children with clefts and syndromes or suffering from systemic health disease were excluded from the examination, as were those children who had previously had any kind of orthodontic treatment.

The subjects were not only grouped by chronological age (Table 2) but also by stage of dental development (DS) described by Björk et al[27] according to the variation of tooth eruption as follows: deciduous teeth fully erupted (DS02), incisors erupting (DS1) and fully erupted (DS2), canines erupting (DS3) and fully erupted (DS4), first molars not fully erupted (DSM0) and fully erupted (DSM1), and second molars fully erupted (DSM2). Based on their dental stages, the subjects were grouped into four developmental periods, including deciduous, early mixed, late mixed, and permanent dentition (Table 3).

For each child, a four-page registration chart was designed, including all variables with their criteria as described in detail in a manual, eg, body height, weight, dental health, presence of malocclusion, functional disturbances, and oral habits. The prevalence of malocclusion in the different developmental periods is presented elsewhere.[28] The present

TABLE 2. Distribution of the 4724 Subjects (*N*) Related to Chronological Age; Number of Children (n) and Percentage (n/N × 100)(%)

Age (y)	Girls		Boys		Total	
	n	%	n	%	n	%
5	217	4.6	197	4.2	414	8.8
6	192	4.1	177	3.8	369	7.9
7	213	4.5	208	4.4	421	8.9
8	199	4.2	204	4.3	403	8.5
9	202	4.3	196	4.2	398	8.5
10	206	4.4	221	4.6	427	9.0
11	224	4.7	226	4.8	450	9.5
12	191	4.0	195	4.1	386	8.1
13	207	4.4	213	4.5	420	8.9
14	173	3.7	183	3.9	356	7.6
15	129	2.7	155	3.3	284	6.0
16	109	2.3	115	2.4	224	4.7
17	91	1.9	81	1.7	172	3.6
Total	2353	49.8	2371	50.2	4724	100

TABLE 3. Grouping of the 4724 Subjects According to Specified Stages of Dental Development; Number of Children (n) and Percentage (n/N × 100)(%)

Dentition[a]	Girls		Boys		Total	
	n	%	n	%	n	%
Deciduous	182	3.9	191	4.0	373	7.9
Early mixed	748	15.9	791	16.7	1539	32.6
Late mixed	667	14.1	704	14.9	1371	29.0
Permanent	756	16.0	685	14.5	1441	30.5

[a] Deciduous, DS02; early mixed, DS02M1, DS1M0, DS1M1, DS2M0, DS2M1; late mixed, DS3M1, DS3M2, DS4M1; permanent, DS4M2. DS according to Björk et al.[27]

study deals only with data related to functional disturbances and their potential association with malocclusion.

Tranining and calibration of the examiners

Before the clinical registrations, the examiners were required to take part in a course on methods of clinical research, including morphological and functional diagnoses. The outcome of the calibration of the morphological diagnoses is presented elsewhere.[28] In regard to the functional analysis, the examiners were trained to locate the specific muscle and joint palpation sites and to apply a moderate pressure at these sites. When they were well trained, an inter- and intraobserver calibration test was performed in 50 children of different ages before starting the present study. The reproducibility of most of the TMD signs was good in this pilot study. The few variables with too great of variations were excluded in the present study and the variables with good reproducibility are those presented below.

Clinical examination and registrations

Functional occlusion was registered as the difference (in millimeters) between retruded position (RP) and maximal intercuspal position (MIP) in antero-posterior and lateral sliding of the mandible. Nonworking interferences were registered during the sliding.

Dental wear was registered in the permanent dentition in the incisor, canine, and molar regions (evident facets and/or visible dentine). In the deciduous dentition, only generalized attrition was recorded.

Symptoms of TMD

Registration of subjective symptoms requires the use of a questionnaire or an interview with children and parents. This type of registration was not realistic to perform in the present sample, which became evident in the pilot study. However, headache was the only symptom of TMD reported by the children.

Signs of TMD

These registrations were performed according to the following criteria.

Mandibular mobility. In children older than 10 years, the maximal opening was recorded as moderately reduced capacity (30–39 mm) or severely reduced capacity (<30 mm). In children younger than 10 years, the corresponding values were 25–34 mm and <25 mm.

Deflection. Deflection of the mandible was recorded if the mandibular midline deviated at least 2 mm during opening. A deflection >5 mm was registered as severe.

TMJ function. Joint clicking was recorded for right and left sides without use of a stethoscope as palpable or evidently audible. Locking and luxation were recorded during mandibular movements.

TMJ pain. The joints were palpated both from the lateral sides and via the auditory meatus. The tenderness was recorded as palpable or as a palpebral reflex (pain causing eyelid reaction).

Muscle tenderness. Muscle tenderness was recorded by palpation of the temporal and masseter muscles (both sides) using the same assessments as for TMJ pain.

Clinical dysfunction index. A modified version of Helkimo's dysfunction index[29] was calculated. The clinical signs were scored as follows:

1. Maximal opening (children <10 years given in parentheses): 0 = >40 mm (>35 mm), 1 = 30–39 mm (25–34 mm), 2 = <30 mm (<25 mm)
2. Mandibular deflection during opening movement: 0 = <2 mm, 1 = 2–5 mm, 2 = >5 mm
3. Impaired TMJ function (clicking, locking, luxation): 0 = no impairment, 1 = palpable clicking, 2 = evidently clicking, locking, luxation
4. TMJ pain: 0 = no pain, 1 = palpable pain, 2 = palpebral reflex
5. Muscle pain: 0 = no pain, 1 = palpable pain, 2 = palpebral reflex.

The sum of the scores (points) form the basis of grouping

TABLE 4. Prevalence of Occlusal Interferences and Dental Wear in the Subjects Examined (2353 girls and 2371 boys), Given in Percent

	Girls	Boys	Total
RP-MIP			
Anterior sliding >1.5 mm	6.5	7.1	6.8
Lateral sliding >0.5 mm	4.2	3.8	4.1
Nonworking-side interferences	38.7	36.1	37.4
Dental wear			
Deciduous teeth	20.7	25.3	23.0
Permanent teeth	34.3	36.1	35.2

TABLE 5. Prevalence of Movement Capacity in the Subjects (2353 girls and 2371 boys), Given in Percent

	Girls	Boys	Total
Maximal opening			
Normal	97.8	97.0	97.3
Moderately reduced	2.5	2.8	2.6
Severely reduced	0.04	0.0	0.04
Deflection during opening			
<2 mm	90.0	90.6	90.3
2–5 mm	9.1	9.1	9.1
>5 mm	0.6	0.2	0.4

by grade of dysfunction, where 0 = no dysfunction; I = mild dysfunction (1–4 points); II = moderate dysfunction (5–9 points); III = severe dysfunction (>9 points).

Statistical analysis

The prevalence of the TMD signs and symptoms were analyzed regarding the total number of subjects in the different developmental periods for girls and boys separately. The *t*-test and chi-square test methods were used to determine associations between the different functional and morphological malocclusions. The level of significance was determined at $P < .05$.

RESULTS

Overall findings

One or more clinical signs of TMD were recorded in 25% of the subjects, most of them being mild in character. The prevalences increased during the dental developmental stages. Girls were in general more affected than boys. The prevalences for the different variables are presented in Tables 4–7.

Functional occlusion

The mandibular displacement from RP to MIP >1.5 mm in the anterior direction and >0.5 mm in the lateral direction was recorded in 6.8% and 4.1%, respectively, of all the subjects (Table 4). This guidance of the mandible was morphologically diagnosed as a functional posterior crossbite. Displacement of the mandible was significantly associated with clicking, muscle tenderness, and TMJ pain (Table 8). Nonworking side interferences were observed in 37.4% of the subjects (Table 4) and were significantly associated with clicking and muscle tenderness (Table 8).

TABLE 6. Prevalences of Temporomandibular Joint Dysfunction and Headache in the Sample Examined (2353 girls and 2371 boys), Given in Percent

	Girls	Boys	Total
TMJ pain on palpation			
Grade 1	4.6	3.3	4.0
Grade 2	0.1	0.1	0.1
Clicking			
Palpable	10.8	7.9	9.3
Audible	0.8	0.6	0.7
Locking	1.6	0.9	1.3
Luxation	0.6	0.2	0.4
Muscle pain on palpation			
Masseter grade 1	6.3	4.5	5.4
Masseter grade 2	0.5	0.0	0.3
Temporalis grade 1	7.6	5.7	6.7
Temporalis grade 2	0.7	0.3	0.5
Headache	14.2	8.7	11.4

Dental wear

Dental wear was common for both deciduous and permanent teeth (Table 4), usually noted as evident facets. Of the 35% in the permanent teeth, only 2% were recorded as dentine visible, most frequent in boys. As seen from Table 8, dental wear was significantly associated with muscle tenderness and TMJ pain.

Movement capacity of the mandible

No difference in mandibular mobility was noted between boys and girls. A reduced opening was recorded in only 2.6% of the subjects (Table 5). However, during opening, a deflection of the mandible beyond 2 mm was observed in 9%. A reduced opening capacity was associated with locking, clicking, TMJ pain, and muscle tenderness (Table 8).

Tenderness to TMJ and muscles on palpation

Tenderness to TMJ and muscles on palpation varied between 4% and 7% and was more frequent among girls (Table 6). Pain giving rise to palpebral reflex, however, was recorded in only a few subjects. The prevalences of both TMJ pain and muscle tenderness on palpation increased during the developmental stages (Table 7), being around twice as frequent in the permanent dentition as in the early mixed dentition. As seen from Table 8, significant associations were found between muscle tenderness and TMJ pain.

TABLE 7. Prevalences of Temporomandibular Joint Dysfunction and Headache in the Subjects (N) in Different Developmental Periods, Given in Percent

	Deciduous (N = 373)	Early Mixed (N = 1539)	Late Mixed (N = 1369)	Permanent (N = 1443)
TMJ pain on palpation				
Grade 1	0.0	2.2	4.9	6.0
Grade 2	0.0	0.0	0.0	0.3
Clicking				
Palpable	2.7	3.4	10.1	16.6
Audible	0.0	0.2	0.2	1.8
Locking	0.5	0.7	1.2	2.1
Luxation	0.3	0.3	0.4	0.5
Muscle pain on palpation				
Masseter grade 1	0.5	4.4	5.8	7.4
Masseter grade 2	0.0	0.2	0.2	0.5
Temporalis grade 1	1.9	4.6	7.9	9.0
Temporalis grade 2	0.0	0.1	0.7	0.7
Headache	5.3	5.9	12.1	18.6

TMJ function

As will be seen from Table 6, clicking was more frequent than locking and luxation and affected girls more than boys. The prevalences increased with the developmental stages (Table 7), especially for clicking, being 18.4% in the permanent dentition, though recorded as audible only in 1.8%. Clicking was significantly associated with sliding of the mandible, muscle tenderness, reduced opening capacity, and interferences (Table 8).

Subjective symptom

Headache, the only symptom registered, was recorded in 11.4%, more frequent in girls than in boys (Table 6) and increasing from early mixed to permanent dentition (Table 7). Headache was also significantly associated with TMJ pain and tenderness to palpation of the masticatory muscles (Table 8).

Clinical dysfunction index

Table 9 describes the score points used in the modified version of Helkimo's index.[29] Score points above zero were observed in 25.5%, generally more common in girls. However, a score of 1–4 points (mild dysfunction) was registered in most of these subjects, while 2.6% had a score of 5–9 points (moderate dysfunction) and only a few subjects had a severe dysfunction (a score above 9 points).

Associations between dysfunction index and malocclusions

As will be seen from Table 10, the prevalence of dysfunction varied between 24.3% and 45.7% for the different malocclusions, though were generally of a mild type. Moderate and severe dysfunctions, however, were found above all in children with posterior crossbite (in 10.3%), anterior open bite (in 8.2%), Angle Class III (in 5.3%), and extreme maxillary overjet (in 4.0%) but with the other malocclusions in less than 3%.

DISCUSSION

The present study has shown that the prevalence of functional disturbances of the masticatory system, recorded as clinical signs (25%), is lower than in most previous publications. The explanation of these differences may be found in the selection and magnitude of the samples and/or in methodological registration criteria. In epidemiological studies of this kind, the material should be obtained from a well-defined population and be large enough and cover nonorthodontically treated children and adolescents of different ages. The present sample satisfies these requirements well. Many of the previous studies describe relatively small amounts of material of various chronological ages, and in some of them, the children had received orthodontic treatment earlier in life.

Another explanation of the differences in the TMD reported may be that a real difference exists in various ethnic populations. So, eg, similar prevalences have been reported in two large samples of Japanese children[10,18] (10% and 12%, respectively), which is close to the prevalence in Chinese children of the same age.[20] Additional support for the hypothesis of ethnic influence are two studies on well-defined populations of separate ages that were nonorthodontically treated, eg, 7-, 11-, and 15-year-old Swedes (Egermark-Eriksson[7]) and 5-, 10-, and 15-year-old Finns (Jämsä et al[12]). The numbers of subjects of the different chronological ages are about the same in these two well-designed studies. It is interesting to note that no agreement exists in prevalences of TMD signs between the Swedish and Finnish children, while Pahkala and Lane,[16] in another group of Finnish children, observed similar prevalence as given by

TABLE 8. Results of Associations Between the Different Variables in the 4724 Subjects

	Sliding Anteriorly	Sliding Laterally	Interferences	Reduced Opening	Muscle Tenderness	Dental Wear	Headache
TMJ pain	**	**	*	**	***	***	***
Clicking	***	***	**	**	***	*	
Locking				***			
Masseter tenderness			**	**		***	***
Temporalis tenderness	**	**	**	**		**	***

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

TABLE 9. Prevalence of Dysfunction Scores Modified From Helkimo,[29] Given in Percent

	Girls	Boys	Total
Score points			
0	73.1	75.9	74.5
1–4	23.4	22.1	22.8
5–9	3.4	1.9	2.6
>9	0.6	0.1	0.2

Jämsä et al.[12] However, against the hypothesis of racial significance are the results from two Swedish studies.[7,8] Egermark-Eriksson[7] reported a higher prevalence of symptoms but lower prevalence of signs than Nilner[8] did. Furthermore, signs and symptoms in Danish adolescents[15] were less frequent than in the two Swedish studies.

Thus, the differences of the prevalences of signs and symptoms of TMD, not only between various populations but also within samples of the same population and of the same chronological ages, may depend on methodological registration criteria. Joint clicking, eg, might in all likelihood be diagnosed less frequently when registered as evidently audible than with the use of a stethoscope. The frequency of subjective symptoms depends on the outline of the questionnaire or the way of interviewing children and/or parents, which may give rise to misinterpretation. Finally, the differences of reported prevalences of signs and symptoms can be explained by variations in the registration reproducibility of the examiners. It has been shown that interobserver variation is greater than the intraobserver variation,[30–33] findings indicating that only one observer ought to be involved in the recordings of signs of TMD. In the present epidemiological study of close to 5000 subjects, such was not considered. An inter- and intraobserver test was performed before the start of the study, ending up in a satisfactory conformity for those variables, which were registered in the final examination. However, one of the problems in palpation of TMJ and masticatory muscles was to consistently apply the suitable finger pressure, which is critical to the replicability of the palpation procedure. During examination, inter- and intraobserver variations in registrations may occur, indicating that comparisons between

TABLE 10. Prevalence of Temporomandibular Dysfunction in the Different Malocclusions, Given in Percent; Number of Children (N) with Diagnosed Malocclusion

		Temporomandibular Dysfunction			
Malocclusion	N	None	Mild	Moderate	Severe
Angle					
Class I	3568	74.7	22.4	2.7	0.2
Class II: 1	703	71.0	25.8	3.0	0.1
Class II: 2	278	72.3	24.8	2.9	0.0
Class III	175	67.1	27.6	4.3	1.0
Bimaxillary protrusion	469	67.5	29.9	2.7	0.0
Overjet					
<0 mm	272	75.1	22.3	2.4	0.2
4–6 mm	1057	71.2	25.4	3.3	0.1
>6 mm	160	65.6	30.4	3.4	0.6
Overbite					
<0 mm	425	62.2	29.6	6.8	1.4
4–6 mm	936	74.2	24.7	1.1	0.0
>6 mm	85	70.8	26.3	2.8	0.1
Posterior crossbite	216	54.1	35.6	9.3	1.0

different studies on TMD, especially tenderness to palpation of muscles, should be interpreted with caution.

It is important to note that the present results are unambiguous regarding differences between various developmental occlusal stages. When comparing the prevalences of signs of TMD in the early mixed, late mixed, and permanent dentitions, the cross-sectional nature of the present study must be taken into account. Although the sample was sufficiently large to demonstrate average changes in the prevalences of signs from one dental stage to another, individual changes in the prevalences of the functional variables could not be assessed. This would have required longitudinal collection of the material, as has been performed in English children at 12, 15, and 19 years of age[17,34,35] and in Swedish children at 11, 15, and 20 years of age.[36–38] These longitudinal studies clearly indicate that both subjective symptoms and clinical signs of TMD increase with age into adulthood. Longitudinal follow-up of the present sample is impossible to perform due to social conditions in the Colombian region. However, the classification according to dental stages resulted in three groups of rather equal size, ie, those of special interest from a developmental aspect (early mixed, late mixed, young permanent dentitions). It was clearly shown that changes in prevalences in these different dental periods occurred, indicating an increase from no signs to mild, moderate, and finally to severe signs in some cases.

Sex differences in prevalences of certain clinical signs were demonstrated also in the various dental stages, indicating higher frequencies for girls than boys. It is well known that there are developmental differences in tooth-eruption time between girls and boys as well as between individual children; some are 'early' and some are 'late' throughout their occlusal development. This is also valid for the present sample since the various dental stage groups comprised children of different chronological ages. However, sex differences in prevalence of clinical signs of TMD could probably be explained by mental factors, ie, girls may be more sensitive to tenderness and pain on palpation of the TMJ and muscles.[39] Other factors may also be crucial, and it is well known from TMD studies in adults that women are more affected than men.[39]

Significant associations were found between different signs of TMD, which is in agreement with most published results. Displacement of the mandible seems to be an important factor in the present study. Sliding of the mandible laterally, from RP to MIP, will explain the significant association between TMD and posterior crossbite and hence the association with clicking and muscle tenderness. Sliding of the mandible, anteriorly as well as laterally, is unfavorably influenced by nonworking-side interferences. In the present sample, carious lesions and extracted deciduous molars were frequent occurrences. The occlusal development became negatively influenced due to mesial migration of the first permanent molars, which in turn caused deviation of the midline and tipped and rotated teeth, resulting in occlusal instability.[28] All these factors may explain the high prevalence of nonworking-side interferences in the sample, and it cannot be excluded that the poor dental health in the sample partly explains this high prevalence.

Dental wear was common in the present study and also was associated with TMJ pain and muscle tenderness, especially in cases recorded as dentine visible, which was most frequent in boys. Those subjects were asked about oral habits, and they admitted that they frequently ground or clenched their teeth, which may result in muscular hyperactivity, accompanied by muscle tenderness, clicking, and reduced mandibular capacity. This is in agreement with recently published findings, ie, that prolonged light clenching can induce signs and symptoms of TMD in healthy subjects.[40] It has also been reported that the jaw muscles seem to be more vulnerable to low-level static contractions than to prolonged heavy contractions, eg, intensive use of chewing gum.[41] Headache was also associated with muscle pain, but whether muscle pain gives rise to headache or vice versa is an open question.

Due to the complexity of the masticatory system, instability in the intermaxillary relation, such as interferences, will elicit motor disturbances in the masticatory input from receptors in the periodontium (PDL) and TMJ, resulting in asymmetric muscle function. The masticatory system, being bilateral as well as complex, is particularly sensitive to disturbances of this kind through the muscle spindles. The question of whether altered muscle activity, elicited by occlusal interferences, will sooner or later cause tissue damage in muscles and joints is largely dependent on individual reactive patterns, eg, personality and behavior.

Besides posterior crossbite, TMD was also associated with Angle Class III, anterior open bite, and extreme maxillary overjet, which is in agreement with some earlier published findings.[7,12,24,42] The question then arises whether early orthodontic treatment in these subjects is indicated or not. Different opinions of early orthodontic treatment prevail. The desirability of initiating orthodontic measures at an early age is becoming more generally accepted. It seems logical to assume that some malocclusions should be treated early to take advantage of the craniofacial growth and thereby achieve the greatest possible adaptation in function. Thus, subjects with a morphological malocclusion (eg, posterior crossbite, Angle Class III, anterior open bite, extreme maxillary overjet) should be treated orthodontically at an early age to eliminate the traits of the anomaly. The question of whether or not such measures also will prevent development of TMD or even reduce TMD signs and symptoms in these patients is still open to discussion,[24,43–45] since the cause of mandibular dysfunction is obviously multifactorial. These patients should be followed longitudinally to develop recommendations for adequate treatment planning in the future.

CONCLUSION

Functional disturbances of the masticatory system were recorded in 25% of the present children and adolescents, most of them being mild in character. Girls were in general more affected than boys. The prevalence of clinical signs increased during the developmental stages.

Significant associations were found between different signs of TMD. Instability in the intermaxillary relation elicits motor disturbances in the masticatory input from receptors in the PDL and TMJ. The masticatory system is sensitive to those disturbances through their muscle spindles. The question of whether altered muscle activity will cause tissue damage in muscles and joints is, however, dependent on individual reactive patterns, eg, personality and behavior.

TMD was significantly associated with posterior crossbite, anterior open bite, Angle Class III malocclusion, and extreme maxillary overjet. These morphological malocclusions should be treated orthodontically at an early age to eliminate the traits of the anomaly. The question of whether or not such measures also will prevent development of TMD or decrease the TMD signs in such patients is still open to discussion since the cause of mandibular dysfunction is obviously multifactorial.

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