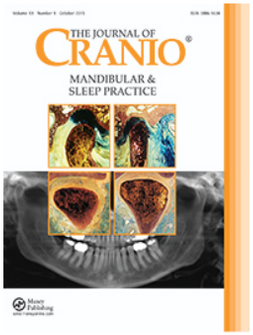

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Signs and Symptoms of Temporomandibular Joint Disorders in Caucasian Children and Adolescents

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ABSTRACT: This study investigated the prevalence of the signs and symptoms of temporomandibular disorders (TMD) in a population of children and adolescents. TMD signs and symptoms were recorded in 1,134 subjects (593 males and 541 females; age range 5-15 years), divided into various groups according to the: (i) Angle dental class; (ii) presence and type of crossbite; (iii) gender; and (iv) age (ages 5–11 and 12–15 years). The percentages of signs and symptoms were compared using the χ^2-test to determine the differences among the groups for the rates of TMD symptoms, bruxism, joint sounds, deviation during opening, reduced opening/lateral/protrusive movements, and myofascial pain. Subjects who were 12-15 years old showed a significantly higher prevalence of myofascial pain than those who were 5-11 years old ($\chi^2 = 4.263$; $p<0.05$). Females showed a significantly higher prevalence of myofascial pain than males ($\chi^2 = 3.882$; $p<0.05$). Subjects with posterior, unilateral crossbite showed a significantly higher prevalence of TMD symptoms ($\chi^2 = 33.877$; $p<0.001$) and reduction of functional movements ($\chi^2 = 10.800$; $p<0.05$) than those with no crossbite, or with anterior or posterior bilateral crossbite. TMD's signs and symptoms seem to be associated to some definite characteristics of the patient, such as female gender, young age, and presence of posterior unilateral crossbite.

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The prevalence of temporomandibular joint disorders (TMD) has been less studied in the population of children and adolescents[1-13] when compared with the adult population.

Additionally, none of the studies on young subjects compared the prevalence of TMD signs and symptoms between children and adolescents, but simply investigated groups of children or adolescents.

For example, some recent studies investigated groups of adolescents; among them, Nilsson,[12] included individuals ages 12-19 years; Hirsch,[8] investigated individuals ages 10-18 years, considering them all together in one group; LeResche[10] investigated individuals from 11-14 years of age; Akhter[4] investigated 1200 Bangladeshi students ages 12-17 years; Huddleston Slater[11] included a large sample (1,833 subjects) of children and teenagers, but grouped the subjects who were 4-18 years old together into one group and named it as the "children group," without any division between mixed and permanent dentitions.

Other recent studies investigated groups of young adults, including adolescents and individuals who were more than 20 years old in the same group; among them, Casanova-Rosado[9] included 506 Mexican subjects ages 14-25 years and Otuyemi[2] investigated a group of 308 Nigerian subjects, aged 17-32 years. Similarly, Nourallah and Johansson[1] investigated a sample of 105 dental students from Saudi Arabia, ages 20-29 years.

And finally, other studies were constructed in a prospective way; among them, Suvinen[3] studied 128 Finnish young adults (15, 18, and 23 years old) with an 8-year follow-up; Muhtarogullari[5] compared Turkish children with mixed (40 subjects) and primary dentition (40 subjects); Magnusson[7] in a prospective study, followed 402 randomly selected subjects who were 7, 11, and 15 years old, over a period of 20 years.

Most of these studies were generally constructed as cross-sectional studies[4,6,8,10,11] and clarified the existence of risk factors for TMD, using a logistical regression analysis.[9] For example, Casanova-Rosado[9] studied these risk factors in a university sample of 506 subjects, ages 14-25 years from Campeche, Mexico, using a cross-sectional evaluation and a logistical regression analysis, with TMD as the dependent variable, and identified the gender (female odds ratio [OR]=1.7), the presence of bruxism (OR=1.5), and unilateral chewing (OR=1.5), to be among the most significant associated risk factors.

Furthermore, the prospective studies also revealed interesting findings. For example, Suvinen,[3] through a prospective analysis, studied a sample of 128 Finnish young boys and girls (15, 18, and 23 years old) for eight years, recording TMD and psychosomatic symptoms, and observed that the majority of the subjects with TMD and psychosomatic symptoms in all the age groups were females, in a ratio of approximately 2:1, with respect to males.

Subsequently, Magnusson[7] used the prospective analysis, including a 20-year follow-up, and demonstrated an increasing prevalence of TMD signs and symptoms (evaluated through clinical evaluation and using a questionnaire) from childhood up to young adulthood.

In addition, that study also found that occlusal factors, such as unilateral crossbite and Angle dental class (in particular, Angle class II), were associated, although weakly, with TMD signs and symptoms and were considered possible local risk factors for the development of TMD.

Although these studies have clarified the existence of specific risk factors for TMD, in the current literature, most of the studies regarding the prevalence or the incidence of TMD signs and symptoms failed to consider these local risk factors, such as Angle dental class, presence of crossbite, and age in the selection of the sample; therefore, they never compared the subjects with regard to age, presence or absence of crossbite, and different Angle class in their sample.

Consequently, the literature lacks studies with respect to the prevalence of TMD signs and symptoms in subjects with different demographics (age and gender) and dental characteristics (Angle dental class and presence of crossbite).

Therefore, the aim of this investigation was to evaluate the prevalence of TMD signs and symptoms in a sample of Caucasian young subjects, divided into different subgroups, classified according to: (i) gender of the subjects; (ii) age (from 5-11 and 12-15 years); (iii) Angle dental class; and (iv) the presence and type of crossbite in a Caucasian population.

Materials and Methods

A total of 1134 newly arrived patients (593 males and 541 females; age range 5-15 years), were selected from the University G.D'Annunzio, Chieti-Pescara.

The following inclusion criteria were used for subject participation in the study:

1. a well-defined dental Cl I, Cl II/1, Cl II/2, and Cl III relationship
2. age between 5 to 15 years old

According to their medical histories, patients were excluded if they had a history of polyarthritis, acute traumatic injury, metabolic diseases, neurological disorders, vascular disease, neoplasia, psychiatric disorders, drug abuse, motor vehicle accidents, or presented with medical/dental emergencies, as well as visual, auditory, and motor impairments. In addition, patients who were currently receiving medication, particularly those affecting the central nervous system, were also excluded.[14,15]

The social and demographic information, TMD signs and symptoms, and occlusal features were recorded on the clinical examination form for each patient by two clinical researchers.

The occlusal assessment was made for some occlusal variables shown to be associated with TMD and that were easily recognizable by a general dentist, rather than an orthodontist, e.g., Angle malocclusion classification[16] and the presence of crossbite.[17] Furthermore, the current study was approved by the Institutional Review Board.

Group Classification According to the Categories

Four categories of groups were considered: (i) the category of Angle dental class included five groups; (ii) the category of the presence and type of crossbite included four groups; (iii) the category of age; and (iv) the category of gender.

The subjects were divided into various groups, according to each category of classification. The occlusal assessment was made for two occlusal variables that were observed to be associated with TMD[7,18] (e.g., Angle malocclusion classification and crossbite).

The subjects were first classified dentally by evaluating the Angle norms, particularly the molar relationship. In Class II malocclusion cases, the patients with retroclined upper incisors and deep anterior overbites were classified as Cl II/2 malocclusion group.

The classification of Angle malocclusion (Classes I and II) is described earlier.[16] However, Class III included cases with bilateral or unilateral mesial displacement of the lower first molar and canine of at least half a cusp. For the 5-year-old children without first permanent molars, the Angle classification was applied, considering the normal characteristics of the primary dentition.

The five groups were: (i) molar bilateral class I (Cl I); (ii) molar bilateral class II, division I (Cl II/1); (iii) molar bilateral class II, division II (Cl II/2); (iv) molar bilateral class III (Cl III); and (v) different classes in the two sides (DC).

The results were: Cl I, 345 subjects; Cl II/1, 122 subjects; Cl II/2, 54 subjects; Cl III, 157 subjects; and DC, 240 subjects.

The subjects were then divided into four groups based on the existence of crossbite: (i) absence of crossbites (unilateral or bilateral; anterior or posterior); (ii) presence of anterior crossbites; (iii) presence of posterior bilateral crossbites; and (iv) the presence of posterior unilateral crossbite. The results were: anterior crossbite, 193 subjects; posterior bilateral crossbite, 251 subjects; posterior unilateral crossbite, 45 subjects; absence of crossbite, 645 subjects.

Lastly, the subjects were classified into two groups according to their age: (i) 5-11 years (744 subjects); (ii) 12-15 years (390 subjects), and according to their gender, which included 593 males and 541 females.

After these classifications, the TMD signs and symptoms were evaluated using various criteria.

TMD Signs and Symptoms

The examination for TMD signs and symptoms was based on the standardized Research Diagnostic Criteria for Temporomandibular Disorders.[19] The same clinical research procedures were employed to assess TMD signs and symptoms (clinical examination form).

TMD signs and symptoms recorded were as follows:

TMD symptoms: All the descriptions or complaints by the patient were considered as symptoms. They were: acute muscle pain, muscle discomfort (ranging from slight tenderness to extreme pain), tenderness or stiffness in the neck and shoulders, muscle pain during functions, tenderness or pain in the joint area (arthralgia), difficulty to open the mouth, sensation of *stuck* or *locked*, and pain on chewing.

Bruxism: Patients were considered to suffer from bruxism when: (i) there was a myalgia associated with the parafunction. In fact, bruxism is a very common central nervous system phenomenon associated with dental abrasion/attrition, which becomes pathological in extenuating circumstances associated with nonadaptive processes and physiological changes, when it also causes muscle/joint pain. As is known, myalgia is associated with the continuous vasoconstriction of the relevant nutrient arteries and with the accumulation of metabolic waste products in the muscle tissue[20]; (ii) there were shiny flat areas of the teeth that do not match the natural occlusal form of the teeth (wear facets).

Temporomandibular joint's (TMJ) sounds: There are two general types of joint sounds—clicking and crepitation. Clicking consists of a single joint sound of short duration. It is loud and may be referred to as a pop. Crepitation is a multiple rough gravel-like sound described as grating.

Deviation during opening: The path taken by the midline of the mandible during maximum opening was evaluated. In the healthy masticatory system, there is no alteration in the straight opening pathway. Any alteration in the opening, deviation or deflection, was recorded.

Reduced opening, lateral, and protrusive movements: These were observed when, clinically, there was an inability to open the mouth to a normal range. This sign can be noted at any degree of opening. When measured intrinsically, the normal range of mandibular opening is between 53 and 58 mm.[21] However, a 6-year-old child can normally open the mouth to a maximum of 40 mm or more.[22] Therefore, a restricted mandibular opening is considered to be of any distance <40 mm, while also taking into account the overbite, vertical overlap of the anterior teeth, and age of the patient.

The lateral movements were noted when they were <8 mm, and the protrusive movements were also evaluated in a similar manner.[22]

Myofascial pain: Myofascial pain was noted when: (i) it originated in the masticatory muscular structures; (ii) it was related to the masticatory function. A pain scale was employed in allowing the patient to relate the degree of pain (from none to extreme) being experienced.

For the 5-6 years old children, pain registration was carried out using a nonverbal descriptor scale (face pain scale) or a visual analog pain scale instead of a verbal scale.

Muscles were digitally palpated to determine muscle

tenderness and pain, because a healthy muscle does not elicit sensations of tenderness or pain when palpated; however, deformation of compromised muscle tissue can elicit pain. Palpation was accomplished mainly by the palmar surface of the middle finger, with the index finger and forefinger testing the adjacent areas. Soft, but firm pressure was applied to the muscle, the finger compressing the adjacent tissue in a small circular motion (for a single firm thrust of 1–2 s).

Statistical Analysis

The data regarding the prevalence of signs and symptoms in the groups were analyzed considering the four categories of groups:

(i) Groups individuated according to the Angle dental class in the whole sample (five groups);
(ii) Groups individuated according to the crossbite distribution (four groups);
(iii) Groups individuated according to the gender;
(iv) Groups individuated according to the gender of the included subjects.

For each category of groups, the prevalence (expressed in percentage with respect to the number of subjects included in each group) of each TMD sign or symptom and the percentages among the different groups were compared using the χ^2 analysis. These calculations were performed for each of the four categories of the groups.

All analyses were performed using S.P.S.S. version 11.5 for Windows (SPSS Inc., Chicago, IL), and all statistical tests were set at a 95% confidence level ($p<0.05$).

Results

Gender and Age Range

In this study, the prevalence of signs and symptoms of TMD in subjects who were $5<x<11$ and $12<x<15$ years old were calculated to investigate the relationship between the prevalence of TMD and age (**Table 1a**). The results of the χ^2 test revealed that the older subjects showed a significantly higher prevalence of myofascial pain than the younger ones ($\chi^2 = 4.263$; $p<0.05$). In fact, among the younger subjects, the percentage of myofascial pain was 5.11%, while among the oldest subjects, it was 14.10%.

Subsequently, the prevalence of TMD signs and symptoms in both male and female subjects were calculated separately to investigate the relationship between the prevalence of TMD and gender (**Table 1b**).

The results of the χ^2-test revealed a statistically significant higher prevalence of myofascial pain in females than in males ($\chi^2 = 3.882$; $p< 0.05$). Among male subjects, the percentage of myofascial pain was 6.24%, while it was 10.35% among the female subjects.

Angle Dental Class

The prevalence for TMD signs and symptoms in subjects classified according to the Angle dental class are presented in **Tables 2a** and **2b**. In **Table 2a**, the data are presented considering the subjects in dental class II as one group, while in **Table 2b**, the subjects in dental class II were divided according to the incisive division. In both the analyses, there were no observed significant differences in the prevalence of any of the considered TMD signs and symptoms among the different groups.

Crossbite

The prevalence of TMD signs and symptoms in the subjects classified according to the presence and the type of crossbite are presented in **Table 3**. Significant differences among the groups were observed. In fact, subjects with posterior unilateral crossbite showed a significantly higher prevalence of TMD symptoms, when compared with the other three groups ($\chi^2 = 33.877$; $P<0.001$), as shown in **Table 3**.

In addition, subjects with posterior unilateral crossbite showed a significantly higher prevalence of reduced functional movements, compared with all the other groups ($\chi^2 = 10.800$; $p<0.05$), as shown in **Table 3**.

Discussion

General Observations

In this investigation, the patients were classified on the basis of some occlusal characteristics and demographic data assessing the prevalence of traditional TMD signs and symptoms in each subgroup. An associational design was selected because it is the most adequate analysis to study cases where the latency period of the disease is long.[23-24]

The subjects were subgrouped on the basis of age, gender, presence and type of crossbites, and Angle dental class, because in a recent important study by Magnusson,[7] who carried out a 20-year follow-up study, the age and some occlusal factors, such as unilateral crossbite and Angle dental class (in particular, dental class II) were found to be the possible local risk factors for the development of TMD.

In addition, this procedure of subject classification is in agreement with a current trend in the TMD literature to study well-defined populations to increase the internal validity and reproducibility of the results.[25] Although, some studies showed that different TMD subgroups have different risk factors and etiologies.[14,26-27]

The Variable: "TMD Symptoms"

The prevalence of TMD symptoms was 28.21% among

Table 1a
Prevalence of TMD Signs and Symptoms (Expressed as % of Subjects with Signs and Symptoms) within the Sample Classified on the Basis of Age

	5<age<11	12<age<15	χ^2	p
TMD symptoms	22.58	28.21	.490	.484
Bruxism	13.31	11.54	.040	.841
TMJ sounds	1.75	8.21	3.600	.058
Deviation during opening	1.08	5.13	2.667	.102
Reduced movements of opening/lateral/protrusive	0.27	2.82	1.000	.317
Myofascial pain	5.11	14.10	4.263	.039*

Note: Chi-square analysis was used to verify the existence of statistically significant differences between the two groups.
*Significant difference between the two groups.

Table 1b
Prevalence of TMD Signs and Symptoms (Expressed as % of Subjects with Signs and Symptoms) within the Sample Classified on the Basis of Gender

	Male 5<age<11	Female 12<age<15	χ^2	p
TMD symptoms	23.78	25.32	.058	.810
Bruxism	13.66	11.65	2.250	.134
TMJ sounds	2.70	5.36	3.756	.053
Deviation during opening	1.69	3.33	2.286	.131
Reduced movements of opening/lateral/protrusive	0.84	1.48	.692	.405
Myofascial pain	6.24	10.35	3.882	.049*

Note: Chi-square analysis was used to verify the existence of statistically significant differences between the two groups.
*Significant difference between the two groups.

subjects who were 12-15 years old and 22.58% among those who were 5-11 years old (**Table 1a**), with no significant difference between the two subgroups. In addition, the prevalence was 25.32% among females and 23.78% among males (**Table 1b**), with no significant difference with respect to gender distribution. However, it was nearly similar among subjects with different dental class (range 14.81-27.54%), without any significant difference among the subgroups (**Tables 2a** and **2b**). Finally, the prevalence of TMD symptoms was nearly similar among patients with or without crossbites (range 20.21–25.90%), except for the patients with posterior unilateral crossbite who showed a significantly higher prevalence of TMD symptoms (60%; $p<0.01$; $\chi^2 = 33.877$), compared with the other subgroups (**Table 3**). Furthermore, the current findings are in accordance with other studies, such as those by Suvinen,[3] who observed a prevalence of TMD symptoms, which ranged from 6-12% for pain symptoms, 12-28% for dysfunctional symptoms, and 4-7% for a combination of these two types of symptoms. Although all pain symptoms were considered dysfunctional symptoms, and the combination of these two types of symptoms together as *TMD symptoms*, our findings can be considered to be in accordance with those by Suvinen,[3] because there was no observed prevalence of TMD symptoms >28.21% (like the percentage observed among subjects aged 12-15 years) (**Table 1a**), except in the group of subjects with posterior unilateral crossbite, in which there was observed a prevalence of TMD symptoms of 60% (Table 3). In another recent study,[28] investigating a sample of 4-12 year old subjects, the prevalence of at least one sign or symptom of TMD was only 12.26%, but that study only included deviation during opening, joint noises, limitation of movement, and pain in the mandible during movement, and did not consider muscular symptoms.

Table 2a
Prevalence of TMD Signs and Symptoms (Expressed as % of Subjects with Signs and Symptoms) within the Sample Classified on the Basis of Dental Class

	Cl I	Cl II	Cl III	Different Cl	χ^2	p
TMD symptoms	27.54	27.83	25.48	19.67	4.450	.348
Bruxism	15.65	16.04	9.55	8.61	4.545	.337
TMJ sounds	3.19	5.19	4.46	4.92	1.444	.836
Deviation during opening	2.61	3.77	1.91	2.87	1.273	.866
Reduced movements of opening/lateral/protrusive	0.87	2.36	0.00	1.64	.857	.931
Myofascial pain	7.54	9.43	10.19	9.02	3.135	.535

Note: Chi-square analysis was used to verify the existence of statistically significant differences among the groups.

Table 2b
Prevalence of TMD Signs and Symptoms (Expressed as % of Subjects with Signs and Symptoms) within the Sample Classified on the Basis of Dental Class Considering Divisions I and II of Class II

	Cl I	Cl II (div I)	Cl II (div II)	Cl III	Different Cl	χ^2	p
TMD symptoms	27.54	22.95	14.81	25.48	19.67	4.450	.348
Bruxism	15.65	13.11	7.41	9.55	8.61	4.545	.337
TMJ sounds	3.19	1.64	3.70	4.46	4.92	1.444	.836
Deviation during opening	2.61	0.00	1.85	1.91	2.87	1.273	.866
Reduced movements of opening/lateral/protrusive	0.87	0.00	1.85	0.00	1.64	.857	.931
Myofascial pain	7.54	5.74	3.70	10.19	9.02	3.135	.535

Note: Chi-square analysis was used to verify the existence of statistically significant differences among the groups.

Age and Gender Distribution

The findings in the current study regarding the subgroups individuated on the basis of age and gender distribution are illustrated in **Tables 1a** and **1b**.

These findings can be compared with the study by Magnusson,[7] in which 402 randomly selected subjects who were 7, 11, and 15 years old were examined clinically and by means of a questionnaire at the beginning of the study, after 4-5 years, and after 10 and 20 years, respectively. Magnusson[7] commonly observed that the prevalence of TMD signs and symptoms increased from childhood up to young adulthood, and this observation was confirmed in the current study, through an associational construction, because it was observed that 12- to 15-year-old subjects showed a significantly higher prevalence of myofascial pain than 5- to 11-year-old subjects (14.10% and 5.11%, respectively; $\chi^2 = 4.263$; $p<0.05$) (**Table 1a**).

To confirm the observations on the relationship between TMD symptoms and age, the cross-sectional study by Muhtarogullari[5] can also be considered, in which 40 children with primary dentition were compared with 40 children with mixed dentition, and an increase in the signs and symptoms of TMD from the primary to the mixed dentition was observed, although only joint sounds were found to be significantly different between the two groups.

With respect to the differences associated with the age and gender of the subjects, the findings in the current study can also be compared with a recent study by Nilsson,[12] which included all subjects, who responded positively to the following clinical questions in their category of *TMD pain*: (i) Do you have pain in your temples, face, TMJ, or jaws once a week or more?; and (ii) Do you have pain when you open your mouth wide or chew, once a week or more?, thus, considering together muscular and

Table 3
Prevalence of TMD Signs and Symptoms (Expressed as % of Subjects with Signs and Symptoms) within the Sample Classified on the Basis of Cross-Bite

	No cross-bite	Anterior cross-bite	Posterior bilateral cross-bite	Posterior unilateral cross-bite	χ^2	p
TMD symptoms	22.79	20.21	25.90	60.00*	33.877	.000
Bruxism	12.40	12.44	12.75	17.78	1.800	.615
TMJ sounds	4.03	3.63	3.19	8.89	4.400	.221
Deviation during opening	2.79	1.55	2.39	2.22	.333	.954
Reduced movements of opening/lateral/protrusive	1.24	0.00	0.80	6.67**	10.800	.013
Myofascial pain	7.54	9.43	10.19	9.02	.222	.974

Note: Chi-square analysis was used to verify the existence of statistically significant differences among the groups.
*Significantly higher than all the other three groups, respectively, χ^2: 8.130 and p=0.004 when compared to subjects with no cross-bite; χ^2: 9.556 and p=0.002 when compared to subjects with anterior cross-bite; χ^2: 14.080 and p=0.000 when compared to subjects with posterior bilateral cross-bite.
**Significantly higher than all the other three groups, respectively, χ^2: 4.500 and p=0.034 when compared to subjects with no cross-bite; χ^2: 4.500 and p=0.034 when compared to subjects with anterior cross-bite; χ^2: 4.500 and p=0.034 when compared to subjects with posterior bilateral cross-bite.

articular pain, while the current study specifically considered myofascial pain.

Furthermore, the findings in the current study, with respect to gender, also confirm the conclusions of the following recent studies:

LeResche[10] assessed the risk factors for TMD pain in a group of 1996 subjects during early adolescence, boys and girls, initially at 11 years of age, and found that one of the most important predictors of clinically significant pain included female gender [OR=2.0, 95%; Confidence Interval (CI)=1.2–3.3].

Another study by de Oliveira[29] with subjects aged 17-25 years demonstrated, in general, a significantly higher percentage of males without TMD (43.74%) with respect to females, partly confirming the findings in the current study.

In addition, Hirsch[8] observed that females were more affected by orofacial pain than males in a sample of 1011 children and adolescents from a metropolitan area in Germany.

Also, Casanova-Rosado[9] in a sample of 506 students aged 14-25 years from Campeche, Mexico, through a cross-sectional evaluation and a logistical regression analysis with TMD as the dependent variable, identified the gender (OR=1.7) among the most significant associated variables. There was also a reported prevalence of bruxism of 33.3% in their sample.

Meanwhile, Suvinen,[3] who focused on a sample of 128 Finnish young males and females (15, 18, and 23 years old) for an 8-year follow-up, recording the TMD and psychosomatic symptoms, observed that the majority of the subjects in all age groups with both TMD and psychosomatic symptoms were female, in a ratio of approximately 2:1, with respect to males.

Wahlund[30] who investigated the prevalence of TMD pain and the gender differences among 864 adolescents from a Public Dental Service Clinic, found that TMD pain was more common in females than in males.

The Variable: "Bruxism"

Bruxism was observed in 13.31% of 5- to 11-year-old subjects and 11.54% of 12- to 15-year-old subjects, with no significant differences between the two groups (**Table 1a**). Bruxism was also observed in 13.66% in males and 11.65% in females with no significant difference between the two groups (**Table 1b**). It was also observed in 7.41–16.04% of subjects with different Angle dental class, with no significant difference among the subjects (**Tables 2a** and **2b**). Finally, bruxism was also observed in 12.40–17.78% of subjects, with or without cross-bite, with no significant differences among the groups (**Table 3**).

However, the findings in the current study with regard to the prevalence of bruxism seem to be in disagreement with the current literature.

For example, Magnusson[7] observed significant correlations between reported bruxism and TMD symptoms and concluded that a baseline report of tooth-grinding is a

predictor of TMD treatment during the 20-year follow-up covered in their investigation.

Recently, also a percentage of 74% of bruxism was observed in a sample of 9-15 year old subjects.[31]

Also, Casanova-Rosado,[9] in their 506 subjects aged 14-25 years, observed a prevalence of bruxism of 33.3%. The difference within the current study's data (bruxism approximately 12% in 12-15 year old subjects) could be related to the restricted parameters of the study, with respect to Casanova-Rosado and to the different range of age in the sample.

There were no statistically significant differences observed in the current study in the prevalence of bruxism or tooth-grinding in subjects with different age, gender, Angle dental class, or type of crossbite; therefore, the current study was unable to confirm the data observed by other researchers using the current study's sample. This might possibly be due to the absence of a follow-up or a logistical regression analysis of the observed sample.

Subgroups Individuated on the Basis of Presence and Type of Crossbite

The differences among subjects with or without crossbites are illustrated in **Table 3**.

In the current study sample, the group of subjects with posterior unilateral crossbite showed a significantly higher percentage of TMD symptoms and reduced significant movements than the other groups (no crossbite, anterior crossbite, posterior bilateral crossbite) (**Table 3**).

Also, the findings of the current study seem to confirm the data of other recent studies. For example, Magnusson[7] stated that the unilateral crossbite is a possible local risk factor for the development of TMD.

It was observed in the current study that the reduced opening/lateral/protrusive movements showed a significantly higher prevalence among subjects with posterior unilateral crossbites than those with no crossbite, anterior crossbite, or posterior bilateral crossbite.

Subgroups Individuated on the Basis of the Angle Dental Class

There were no observed significant differences in the prevalence of TMD among subjects with different dental classes (dental class I, dental class II with division I, dental class II with division II, dental class III, and different classes) with respect to the occlusal factors, as shown in **Tables 2a** and **2b**.

In a recent study, Selaimen[25] determined the role of occlusal variables for TMD by comparing 72 TMD patients with myofascial pain, with or without limited opening and arthralgia with 30 age- and gender-matched pain-free concurrent controls. They concluded that Angle class II was a risk indicator for TMD. The findings in the current study do not seem to confirm those of Selaimen,[25] although the different constructions of the two studies could explain the different observations.

Limitations of the Study

The research in the current study is an associational type research and not a cause-effect investigation. Based on this fact, it is not possible to establish a causal link among the variables. In addition, no control group was used for comparison with the study group. Due to the associational construction, the sample was stratified retrospectively rather than prospectively (a priori) and, consequently, the subgroups were not evenly distributed with regard to size.

Conclusions

Through an analysis of prevalence, the results in the current study indicate, in a Caucasian sample of 5- to 15-year-olds (1134 subjects), an association among TMD signs and symptoms and some patient features:

(i) The presence of unilateral posterior crossbite and the prevalence of various TMD symptoms because approximately 60% of patients with unilateral posterior crossbite showed various TMD symptoms;

(ii) The female gender and the prevalence of myofascial pain because myofasial pain was observed in approximately 10% of females versus the 5% observed among males. In addition, subjects who were $12<x<15$ years old showed a higher prevalence of myofascial pain than the younger ones (about 14% of prevalence versus the 5% of prevalence of myofascial pain observed in subjects who were $5<x<11$ years old).

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