Gnathological features in growing subjects

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Summary

Aim. **Aim of this study was to evaluate the prevalence of temporomandibular disorders (TMD) in a sample of consecutive subjects.** ***Materials and methods.*** **TMDs were recorded in a sample of 580 subjects (279 M, 301 F; mean age: 13.4y). For each subject a case history was compiled to evaluate the social and demographic parameters. An extraoral exam was effected to point out the face proportions, and an intraoral exam was performed to analyze dental occlusion, mandibular deviation during opening, presence of cross-bites, overjet and overbite. A functional exam was carried out to evaluate mandibular movements and to find joint sounds and myofascial pain. The sample was divided into 6 groups according to the: gender, age (ages 6y- 11y and 12y-16y), Angle Dental Class, cross-bite, midline deviation and chewing side. For this investigation latex gloves, a millimeter calipers (precision 0,01 mm) and a phonendoscope were used. The percentages of signs and symptoms were compared using the ?2-test with Yates correction to determine the differences among the groups for the rates of TMDs, reduced opening/lateral/protrusive movements, and myofascial pain.** ***Results.*** **The prevalence of TMDs in the total sample was 13,9%. Among 6y-11y subjects the percentage of TMD was 7,3% while it was 16,1% among 12y-16y subjects (?2=1.634;; p=0.201). Females showed a percentage of 16,6% of TMDs while males one of 10,8% (?2=0.556;; p=0.456). According to angle malocclusion, the prevalence was 14% in subjects with Class I malocclusion, 15% in sample with Class II and 9% in patients with Class III (?2=0.540;; p=0.763). According to presence or absence of crossbite, prevalence of TMD signs and symptoms was 13,8% among subjects without crossbite and 14,3% among subjects with crossbite, with no significant difference between the two subgroups (?2= 0,047619;; p=0.050). In relation of midline deviation, prevalence of TMDs was 15% in subjects without deviation, 15,8% in functional deviation subjects and 4,7% in anatomic deviation ones (?2=1.555;; p=0.05). Prevalence of TMDs was 12,6% in subjects with bilateral chewing and 28% in unilateral chewing.** ***Conclusions.*** **TMDs seem to be not associated to age, to gender, Angle Class, cross-bite and chewing side.**

Key words: epidemiological study, temporomandibular disorders, dental malocclusions, skeletal discrepancy.

Introduction

Temporomandibular disorders (TMD), a sub-classification of musculoskeletal disorders, has been defined as a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joints and associated structures or both of them (1).
The aetiology and the pathophysiology of TMD are poorly understood. It is generally accepted that the aetiology is multifactorial, involving a large number of direct and indirect causal factors. Among such factors, occlusion is frequently cited as one of the major aetiological factors causing TMD (2). Other aetiological factors are: unstable occlusion, stress and other psychologic factors, trauma, individual predisposition, and structural conditions (3).
In the past, TMD were considered like a typical degenerative disease of the adult and so many epidemiological studies were performed in adult population. Frequencies of TMD signs and symptoms were between 12% to 57% (4-13).
Since the end of the 1970s, several epidemiological studies of signs and symptoms of TMD in children and adolescents have been performed. In these studies, the prevalence varies from 5,9% to 66% (14-28).
There are several reasons for the diverging results in previous epidemiological studies. Differences in the composition of the material, the examination methods and the definitions and criteria for the chosen variables are some of the reasons.

The inevitable inter and intra-individual variations between examiners are other explanations. Another important, yet frequently overlooked reason, is that examination methods designed for adults have been used for children, without proper consideration of the difficulties and limitations that exist in the examination of children (29).
The reasons for interest about these diseases in children stems from the need for early identification the conditions responsible for the TMD symptoms because they might lead to serious injury to stomatognathic.
Therefore, the aim of this investigation was to evaluate the prevalence of TMD signs and symptoms in a sample of Caucasian young subjects.

Materials and methods

In the period from October 2011 to November 2012, a researcher has proposed to newly arrived 800 subjects to participate in this investigation, but only 580 (279 males and 301 females, mean age was 13.4 years) acceded to it.
Inclusion criteria were:

- Caucasian subjects (age range: 6-16 years)
- Newly arrived patients
- No history of orthodontic treatments
- No history of acute traumatic injury or motor vehicle accidents
- No cranio-facial syndromes, metabolic diseases, neurological disorders, neoplasia
- No social or demographic differences.

The social and demographic information, TMD signs and symptoms, and occlusal features were recorded by a well–trained clinical researcher on the case history based on the standardized Research Diagnostic Criteria for Temporomandibular Disorders (30).
Case history consists in a history questionnaire (Fig.1) filled in by young subjects with the help of own parents and in a second part called examination form filled in by a researcher with records coming from clinical evaluation (Fig. 2).
The subjects were divided into 6 groups according to gender, age, angle dental class, presence of crossbite; midline deviation; chewing side in Caucasian population.
The sample was first classified into two groups according to their age: 1) 6-11 years (185 subjects), 2) 12-16 years (395 subjects) and according to their gender, which included 279 males and 301 females.
The subjects were then divided according to Angle Dental Class into four groups**:**
Class I: Molar and canine bilateral Class I (311 subjects)
Class II: Molar and canine bilateral Class II (192 subjects)
Class III: molar and canine bilateral Class III (77 subjects)
Subdivision Class: different classes in the two sides (0 subjects).
The classifications are based on the relationship of the mesiobuccal cusp of the maxillary first molar and the buccal groove of the mandibular first molar. In Class I, the mesiobuccal cusp of the maxillary first molar is aligned with the buccal groove of the mandibular first molar. In Class II, the molar relationship shows the buccal groove of the mandibular first molar distally positioned when in occlusion with the mesiobuccal cusp of the maxillary first molar. In Class III, the molar relationship shows the buccal groove of the mandibular first molar mesially positioned to the mesiobuccal cusp of the maxillary first molar when the teeth are in occlusion.
The sample were then divided into two groups based on the existence of cross bite: 1) absence of cross-bite (unilateral or bilateral; anterior or posterior) (533 subjects), 2) presence of crossbites (47 subjects).
After these classifications, the TMD signs and symptoms were evaluated using the Research Diagnostic Criteria for Temporomandibular Disorders.

Palpation of muscles and TMJ

It was necessary to find myofascial pain and arthralgia.
Palpation was accomplished mainly by fingertips of the index and third fingers or the spade-like pad of the distal phalanx of the index finger only with standardized pressure, as follows: palpation will be done with 2 lbs of pressure for extraoral muscles, 1 lb of pressure on the joint and intraoral muscles. During palpation of one side muscles, it was used the opposite hand to brace the head to provide stability.
Myofascial Pain: pain of muscle origin, including a complaint of pain as well as pain associated with localized areas of tenderness of palpation in muscles.
It was report pain or ache in the jaws, temples, face, preauricolar area or inside the ear at rest or during function and pain reported by the subject in response to palpation of three or more of following of 20 muscles sites: posterior temporalis, middle temporalis, anterior temporalis, origin of masseter, body of masseter, insertion of masseter, posterior mandibular region, submandibular region, lateral pterygoid area, and tendon of temporalis.
Arthralgia: pain or tenderness in the joint capsule and/or the synovial lining of the TMJ.
1) Pain in one or both joint sites (lateral pole and /or posterior attachment) during palpation;
2) one or more of the following self-reports of pain: pain in the region of the joint, pain in the joint during maximum unassisted opening, pain in the joint during lateral excursion;
3) for a diagnosis of sample artralgia, coarse crepitus must be absent.

Auscultation of TMJ

Using a stethoscope, it was possible to find TMJ sounds. These sounds may occur as a single click, or may consist of multiple sounds or crepitus.
Clicking consists of a single joint sound of short dura-

NAME	PLACE OF BIRTH
SURNAME	GENDER
ADDRESS	JOB
DATE OF BIRTH	RACE

Please read each question and respond accordingly. For each of the questions below, circle only one response.

1. Would you say your health in general?
Excellent
Very good
Good
Fair
Poor

2. Would you say your oral health in general?
Excellent
Very good
Good
Fair
Poor

3. Have you got?
Genetic disease
Metabolic disease
Psychiatric disease
Anxiety
Rheumatoid arthritis
Lupus
Systemica arthritic disease
Headache
Noises or ringing in your ears

4. Have you ever had acute traumatic injury or motor vehicle accidents?
YES
NO

5. Have you ever had othodontic treatment?
YES
NO

6. Have you had pain in the face, jaw temple, in front of ear or in the ear in the past mouth?
YES
NO
If yes, how many months ago did your facial pain begin for the first time?
months _____

7. Does your jaw click or pop when you open or close your mouth or when chewing?
YES
NO

8. Have you ever had your jaw lock or catch so that it won't open all the way?
YES
NO

9. Have you ever told, or do you notice, that you grind, your teeth or clench your jaw while sleeping at night?
YES
NO

10. Have you a favourite chewing side?
YES
NO
If yes, what?

Figure 1. History questionnaire.

Opening patterns				
Straight				
Right Lateral Deviation (Uncorrected)				
Right Corrected (S) Deviation				
Left Lateral Deviation (Uncorrected)				
Left Corrected (S) Deviation				
Functional Deviation				
Anatomic Deviation				
Vertical range of motion				mm
Unassisted opening without pain				
Maximun unassisted opening				
Maximun assisted opening				
Vertical incisal overlap				
Joint sounds				
a) Opening		Right	Left	
	None			
	Click			
	Crepitus			
b) Closing		Right	Left	
	None			
	Click			
	Crepitus			
Exursions				mm
Right lateral excursion				
Left lateral excursion				
Protrution				
Joint sounds on excursions				
Right Sounds				
	None	Click	Crepitus	
Excursion right				
Excursion left				
Protrusion				
Left sounds				
	None	Click	Crepitus	
Excursion right				
Excursion left				
Protrusion				

Figure 2. Examination form.

tion. It is loud and may be referred to as a pop. Crepitation is a multiple rough gravel-like sound described as grating.

Mandibular excursive moviments

It was used a millimeter calipers (precision 0,01 mm)

Extraoral muscle pain with palpation
0= No Pain 1= Mild Pain 2= Moderate Pain 3= Severe Pain

	Right	Left
Temporalis (posterior) Back of temple	0 1 2 3	0 1 2 3
Temporalis (middle) Middle of temple	0 1 2 3	0 1 2 3
Temporalis (anterior) front of temple	0 1 2 3	0 1 2 3
Masseter (origin) cheek/under cheejbone	0 1 2 3	0 1 2 3
Masseter (body) cheek/side of face	0 1 2 3	0 1 2 3
Masseter (insertion) cheek/jawline	0 1 2 3	0 1 2 3
Posterior mandibular region (stylohyoid/posterior digastric region)	0 1 2 3	0 1 2 3
Submandibular region (medial pterigoyd/suprahyoid/anterior digastric region)	0 1 2 3	0 1 2 3

Joint pain with palpation

	Right	Left
Lateral pole outside	0 1 2 3	0 1 2 3
Posterior attachment	0 1 2 3	0 1 2 3

Intraoral muscle pain with palpation

	Right	Left
Lateral pterigoyd area (behind upper molars)	0 1 2 3	0 1 2 3
Tendon of temporalis	0 1 2 3	0 1 2 3

Figure 2. (cont.) Examination form.

for measuring mandibular excursive moviments: right lateral excursion, left lateral excursion, protrusive and midline deviation.
It was necessary for evalueting reduced opening, lateral and protrusive movements.
A restrictive mandibular opening is considered to be of any distance < 40 mm.
The lateral movements were noted when they were <8 mm and the protrusive movements were also evaluated in a similar manner.
The sample was then divided into three groups according to midline deviation that can be classified in:
1) absence of deviation when midline is aligned both in closed mouth and in open mouth (446 subjects);
2) functional deviation when midline is deviated in closed mouth but aligned in open mouth (64 subjects);
3) anatomic deviation when midline is deviated both in closed mouth and in open mouth (70 subjects).
Finally it was divided in two groups according to chewing side: 1) unilateral chewing (47 subjects) and 2) bilateral chewing (533 subjects).

Statistical analysis

The data regarding the prevalence of signs and symptoms in the groups were analyzed considering the six categories of groups before described.
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 Chi-square analysis.
These calculations were performed for each of the six categories of the groups using Sigma Stat 3.5, Systat Software Inc, Point Richmond, California, USA.

Results

In this study, the prevalence of signs and symptoms of TMD was 13,9%. TMD were represented by TMJ sounds. It was not found others like muscle and/or TMJ pain or limitation of mandibular moviments.

Gender and age range

Prevalence of TMD signs and symptoms within the sample classified on the basis of gender was 16,6% among females and 10,8% among males, with no significant difference with respect to gender distribution (χ^2=0.556; p=0.456).
Prevalence of TMD signs and symptoms within the sample classified on the basis of age was 7,3% among subjects who were 6-11 years old and 16,1% among those who were 12-16 years old, with no significant difference between the two subgroups (χ^2=1.634; p=0.201).

Angle Dental Class

The prevalence of TMD signs and symptoms in subjects classified according to the Angle Dental Class was 14% among subjects who had class I, 15% among subjects who had Class II and 9% among subjects who

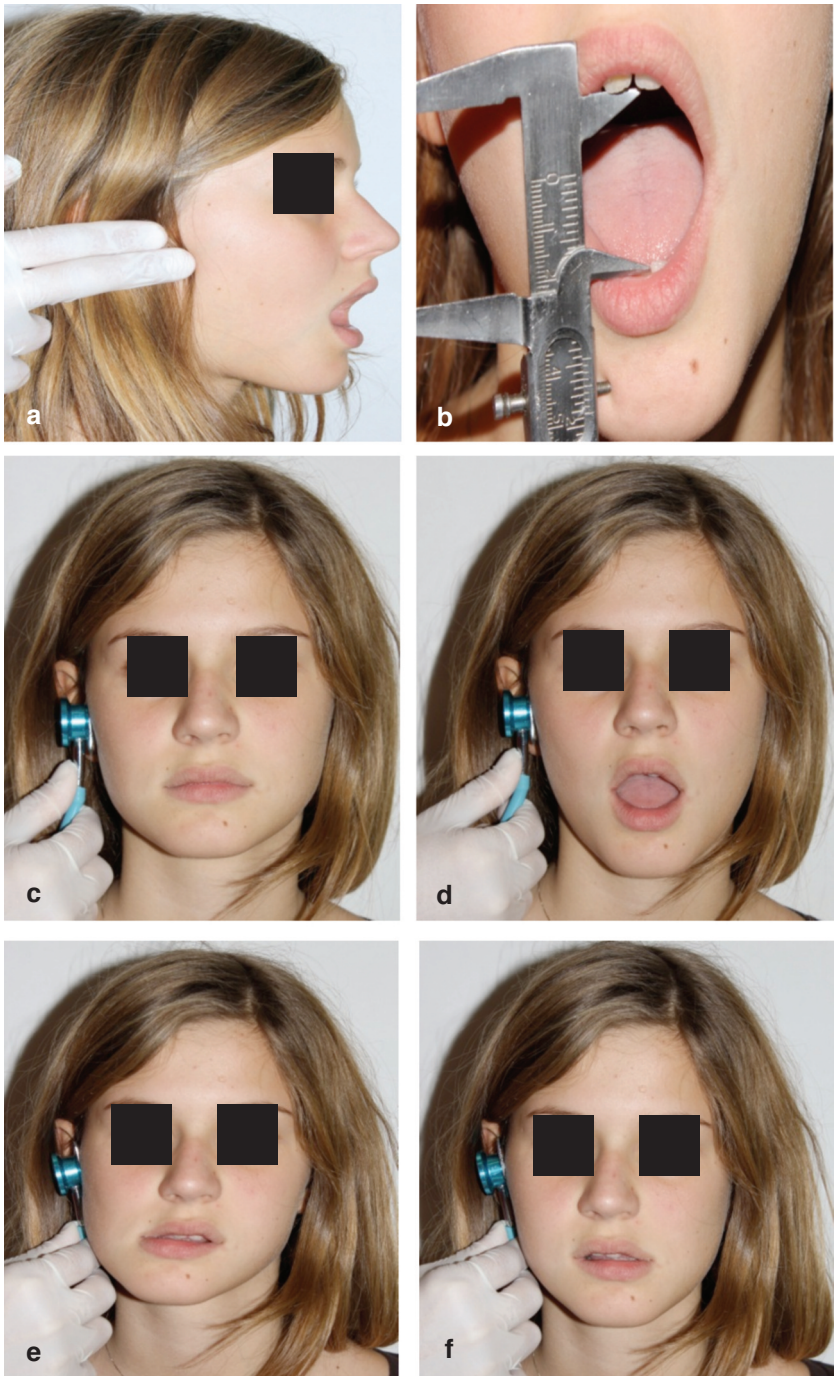

Figure 3. CLINICAL EXAMINATION a) TMJ Palpation; b) Opening Patterns; c,d,e,f) TMJ Auscultation

had Class III. In this analysis, there were no observed significant differences in the prevalence of any of the considered TMD signs and symptoms among the different groups (χ^2=0.540; p=0.763).

Crossbite

According to presence or absence of crossbite, prevalence of TMD signs and symptoms was 13,8% among subjects without crossbite and 14,3% among subjects with crossbite, with no significant difference between the two subgroups (χ^2= 0,047619; p=0.050).

Midline deviation

According to midline deviation, prevalence of TMD was 15% among subjects who had no midline deviation, 15,8% among subjects who had a functional deviation

and 4,7% among subjects who had anatomic deviation (χ^2= 1.555556; p=0.050).

Chewing

According to chewing side, prevalence of TMD was 12,6% among subjects who had a bilanced chewing and 28% among subjects who had unilateral chewing (χ^2=2,18181; p=0.050).

Discussion

TMD distribution according to gender and age

In this epidemiological investigation we found no significant differences between the DTM and gender and age group. According to gender, our result is similar to those of some authors (18, 22, 26). Motegi et al. examined 7337 Japanese subjects (3219 F and 4118 M) aged between 6 and 18 years and found an incidence of DTM, consisting mainly of joint sounds (97.2%), 12.2%. The incidence of DTM is 11% for males and 13% for females without a statistically significant difference (18).

If we consider pain symptoms, the situation changes. According Walhund K, 2003; Hirsch et al. 2006, Nilsson IM et al., 2007, females are more severely affected by the pain symptoms than males and this can be explained by considering the different hormonal functions (23, 27, 31, 32). Walhund K analysed 864 adolescents and found a higher prevalence of pain symptoms in females than in males (23). Hirsch has reached the same conclusion, analysing a sample of 1011 subjects aged 10-18 years (31). In our sample, the pain does not appear statistically significant (0 subjects) probably because of the young age of the subjects (mean age 13.4 years) due to a prepuberal growth stage.

In relation to age, our study showed no significant differences between the DTM and age in contrast to other studies in which the prevalence of DTM increases with increasing age (22, 26, 33, 34).

Magnusson T, in a prospective study, followed 402 subjects 7, 11 and 15 years randomly selected for a period of 20 years. The author has observed that the prevalence of DTM increases from childhood to adolescence (34).

Studying 101 adolescents (aged 11-17) with a cross-sectional study, Le Resche has concluded that the prevalence of TMD is linked more to pubertal development rather than to age (33).

Our hypothesys because, in relation to age, our study showed no significant differences could be the mean age of 12y-16y sample near to 13 years and so due to a preadolescent stage.

TMD distribution according to occlusal factors

In our analysis significant differences between the DTM and the different Angle dental classes were not found. In accordance with this conclusion there is the study carried out by Tecco et al., in 2011, who analyzed a sample of 1134 subjects (5-15 years) (28).

Other authors instead consider some Angle dental classes like risk factors predisposing to TMD. Szentpteteri et al., in 1986; Selaimen in 2007 consider Class II malocclusions as an important risk factor (13, 35).

Selaimen has analyzed a group of 72 subjects with TMD, myofascial pain, with or without restriction in the opening and artalgia comparing with a control group. His analysis showed that the absence of a canine in lateral excursions (crude OR = 3.9, CI = 1.6 to 9.7) and the Class II malocclusion (crude OR = 8.0, confidence interval [CI] = 2.2 to 29.3) can be considered as potential risk factors (35).

Many authors consider class III malocclusion, especially those characterized by the presence of scissor-bite and open bite, a condition of potential risk both in children and in adult because frequently associated with occlusal interferences.

Among occlusal variables, cross-bite, especially the unilateral one, has a significant role in the development of the TMD.

In support of this thesis, there are in fact several authors (9, 28, 34, 36). Myers et al. found that in children with functional posterior cross-bite, the condyle can be displaced upwardly from the side of the cross-bite and bottom side without cross-bite (36).

Motegi has instead showed a higher correlation between TMD with crowding (24.9%) and excessive overjet (20.1%). Instead, the correlation with other occlusal variables was lower: deep bite (6.8%), bite the head-to-head (6.3%), anterior cross-bite (5.4%) and posterior cross-bite (3.8%) (18).

People with an excessive overjet, tend to protrude the mandible (37). This tends to cause a double closure (dual bite), which over time could affect the function of the masticatory muscles, increase muscle tension and overload the TMJ (38). Occlusal crowd tends to cause occlusal interference and seems to be a critical factor in the genesis of TMD.

Other authors believe that to contribute to the onset of DTM, it is not malocclusion conceived as a static occlusal relationship but conceived by the functional point of view. Therefore, any alteration of the occlusal function as parafunction, habits, premature, interference, unilateral chewing, may result in TMD (39, 40).

The cross-sectional study conducted by Casanova-Rosado on a sample of 506 Mexicans aged 14-25 years actually showed as significant risk factors gender (Female Odds Ratio (OR) = 1.7), bruxism (OR = 1.5) and unilateral chewing (OR = 1.5) (40).

Conclusions

The results in the current study, in a Caucasian sample of 6-16 years old (580 subjects), indicate that there is not any association among TMD signs and symptoms and the analysed features.

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