Temporomandibular Disorders and Orthodontic Treatment Need in Orthodontically Untreated Children and Adolescents

Stjepan Špalj[1], Martina Šlaj[2], Athanasios E. Athanasiou[3], Irena Žak[4], Martina Šimunović[5] and Mladen Šlaj[2]

[1] University of Rijeka, School of Medicine, Department of Orthodontics, Rijeka, Croatia
[2] University of Zagreb, School of Dental Medicine, Department of Orthodontics, Zagreb, Croatia
[3] Aristotle University of Thessaloniki, Department of Orthodontics, School of Dentistry, Thessaloniki, Greece
[4] Dental Office Nova Gradiška, Nova Gradiška, Croatia
[5] Dental Office Split, Split, Croatia

ABSTRACT

The aim of this study was to explore the association between signs and symptoms of temporomandibular disorders (TMD) and orthodontic treatment need in orthodontically untreated children and adolescents. One thousand five hundred and ninety-seven subjects aged 11–19 years, without previous orthodontic history, from sixteen randomly selected public schools in Zagreb, Croatia, were examined. Malocclusion characteristics were assessed by using the criteria proposed by Bjork et al., the Dental Aesthetic Index, and the Aesthetic Component of Index of Orthodontic Treatment Need. Data on TMD signs / symptoms and parafunctional behaviour were obtained by means of questionnaire and clinical examination, respectively. Multiple logistic regression models were used for analysis. Twenty-two percent of children and young adolescents had one or more signs of TMD, ranging from 17% in age of 11 years up to 24% in age of 19. There was poor correlation between presence of TMD and orthodontic treatment need. Multiple logistic regression models showed that Class III, crowding and spacing were related to mandibular deflection on opening. Ectopic eruption was related to TMJ clicking, and severely tipped teeth with reduced mouth opening. Headaches presented a positive relationship with reverse overjet and severe rotations, and tooth wear with crowding, spacing and lateral openbite. Age, female gender and parafunctional habits were related to several TMD signs. Although logistic regression models were statistically significant ($p<0.05$) malocclusions, parafunctional behaviours, age and gender accounted for less than 20% of the variability in TMD signs / symptoms. TMD signs and symptoms seemed to be poorly related to malocclusions or treatment needs.

Key words: *temporomandibular disorders; malocclusion; orthodontic treatment need*

Introduction

Signs and symptoms of temporomandibular disorders (TMD) are present in children and adolescents[1–4]. However, the frequency of severe disorders accompanied by headache and facial pain, and characterized by urgent need of treatment is 1 to 2% in children and about 5% in adolescents[5].

At present, the role of occlusion in relation to the aetiology of TMD is widely considered as contributory by initiating, perpetuating or predisposing to the disorders[6]. It is estimated that occlusal factors contribute about 10 to 20 percent to the total spectrum of multifactorial factors, which differentiates between healthy individuals and patients with TMDs[3,7–9]. Some correlations between TMD and certain types of malocclusions exist, but correlation does not imply causality[10–13]. Signs of dysfunction may be the result of how the individual uses the occlusion and not a result of its structural features[14]. Thus the term non-physiologic occlusion does not imply a cause and effect relationship.

Orthodontic treatment cannot be justified as an effective means of preventing TMD. The development of TMD cannot be predicted and no method of TMD prevention has been demonstrated[16]. However, orthodontic treatment may be indicated to reduce existing signs and symptoms of TMD in certain carefully selected cases[17] or to provide a morphologically and functionally optimum occlusal envi-

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ronment following successful management of TMD[18]. According to existing literature, the relationship of the TMD to occlusion and orthodontic treatment is minor. The important question that still remains to be answered is how this minor contribution can be identified within the population of TMD patients[11]. Furthermore, orthodontists should always have in mind the existence of certain important biomechanical relationships between functioning dentition and various components of the stomatognathic system. Therefore, signs and symptoms of TMD must be identified in patients without and with malocclusions. In reference to the later group, correlations should be made in accordance to the severity of malocclusion and the need for orthodontic treatment. Orthodontic treatment is relatively frequent and in most countries it is subsidised by public insurance systems up to the age of 18 years. Therefore, it is of great importance to assess the prevalence of TMD in relation to the need of orthodontic treatment in order to estimate how potentially beneficial the correction of malocclusion in childhood and early adolescence could be to the elimination of one of possible contributing factors for development of TMD later on. Consequently financial resources could be simultaneously used for treatment of both malocclusion and TMD.

The purpose of this study was to estimate the prevalence of TMD in non-orthodontic patients, to study its relation to the severity of malocclusion in children and adolescents, and to assess associated risk factors.

Subjects and Methods

One thousand five hundred ninety seven children and adolescents aged from 11 to 19 years (mean age 15±2.1 years; 870 females and 727 males from sixteen randomly selected public schools, in four different urban and suburban areas of the City of Zagreb, Croatia, were examined during the period from September 2006 until February 2007. There were 105 elementary schools, 20 general-program schools and 34 trade schools in Zagreb. Cluster sampling procedure was used considering type of school and location. Two elementary schools were selected from the each of the four administrative sections of the City of Zagreb, and eight secondary schools were selected considering type of school regardless of location (four general and four trade schools).

Individuals with history of orthodontic treatment (previous or present at the time of examination) were excluded as well as those with syndromes or craniofacial anomalies. In the initial sample of 2365 subjects without craniofacial anomalies or syndromes 330 have had orthodontic therapy and 438 were undergoing orthodontic treatment. Therefore 32.5% of subjects were excluded due to orthodontic treatment, ranging from minimal rate of 23.8% at the age of 11 to maximal rate of 46.9% at the age of 18. The initial sample size was considered adequate concerning the following parameters: around 8.800 subjects in each age group, an expected prevalence of TMD signs of 20% (based on data from the pilot study), alpha type 1 error of 5% and confidence level of 95%. University and governmental boards of ethics approved the examination and patient and parental informed consents were obtained.

Malocclusion characteristics were registered according to the criteria proposed by Bjork et al.[19]. Orthodontic treatment need was assessed by both the Dental Aesthetic Index (DAI)[20,21] and the Aesthetic Component of Index of Orthodontic Treatment Need (IOTN-AC)[22]. Subjective and objective data on TMD and parafunctional behaviours were obtained by means of questionnaire and clinical examination, respectively. The questionnaire focused on the presence of headaches, oral parafunctions as well as temporomandibular joint (TMJ) and masticatory muscles pain and dysfunction. Clinical examination comprised measurements on mandibular motion, registration of TMJ internal derangements and masticatory muscles dysfunction. These parameters were used to calculate Clinical Dysfunction Index (CDI)[23]. Dental wear was registered as evidenced by the presence of facets in enamel or visible dentine. Number of decayed, missed and filled teeth (DMFT) was also recorded.

Five orthodontic residents, previously trained and calibrated, performed the intraoral examination using special manual CPI probe[21], sliding calliper, mouth mirror and artificial light placed on examiners heads. No radiographs, study casts or stethoscopes were utilized. Ten individuals were re-examined within a seven-day interval to check inter- and intra-examiner variability. Good reproducibility (intraclass correlation coefficient: 0.65–0.91) and respectable agreement (83–92%) were found. Reproducibility of maximal interincisal opening was in range of 1.22–5.96 mm and was calculated from ANOVA table using the formula $Rp=\sqrt{2} \times 1.96 \times$ residual mean square[24].

The differences in prevalence of TMDs between subjects with different malocclusion types and orthodontic treatment needs were analysed by means of non-parametric statistical methods – χ^2 and Fisher test for nominal categorical variable and Kruskal–Wallis and Mann-Whitney for ordinal and scale. As a measure of association Spearman's correlation was used. Multiple logistic regression models were applied to establish the correlation between particular TMD sign or symptom and malocclusion characteristics. Presence of a particular TMD sign or symptom or malocclusion type was used as dichotomized variable (0 = absent, 1 = present). Overjet, overbite, diastema mediana and age were included in the analyses as a continuous independent variable. Effect of gender was also considered as independent dichotomized variable (0 = girls, 1 = boys). TMD components were used as dependent variables and malocclusion components, age, gender and parafunctional behaviors as predictor variables. The significance of the effects in the model was performed via the Wald statistics and checked by Likelihood-ratio test. The Goodness-of-fit Chi-square statistics and Nagelkerke's pseudo R^2 were used to assess how well a model fits the data. The odds ratios (OR) with 95% confidence interval limits (CIL) were used as a measure of the strength of the association between the presence of a factor and the occurrence of an event indicating statistically significant relationships if both values were either greater or less

than 1. All analyses were performed using statistical software (SPSS Release 10.0; SPSS Inc., Chicago, Illinois, USA). An alpha level of 0.05 was considered statistically significant.

Results

Table 1 presents malocclusion and functional characteristics of the sample as well as their associations. According to the DAI classification, 65% of subjects had normal occlusion or very mild occlusal problems while 19% severe or very severe malocclusions. The most common signs of TMD were mandibular deflection during opening and altered joint function (clicking, locking, and luxation) that characterized up to 20% of the sample. Tenderness on palpation in the TMJ and the temporal and/or masseter muscles were rare. TMD signs, headache and dental wear were equally distributed among different malocclusion severity levels. Only TMJ function was significantly more frequently altered in subjects with very severe malocclusions (25%) than in those with normal occlusion or minor

TABLE 1
MALOCCLUSION AND FUNCTIONAL CHARACTERISTICS OF THE SAMPLE AS WELL AS THEIR ASSOCIATIONS

	Malocclusions – Dental aesthetic index (DAI)				Total	p
	Normal / minor	Definite	Severe	Very severe	1597	
	1043 (65.3%)	264 (16.5%)	136 (8.5%)	154 (9.6%)		
Age ($\overline{X}$±SD)#	15.1±2.2	14.7±2.2	15±2.1	15.3±2	15±2.1	0.008
Gender*						
Male	459 (44.0%)	124 (47.0%)	69 (50.7%)	75 (48.7%)	727 (45.5%)	
Female	584 (56.0%)	140 (53.0%)	67 (49.3%)	79 (51.3%)	870 (54.5%)	0.347
Maximal opening*						
Normal	992 (95.1%)	251 (95.1%)	131 (96.3%)	145 (94.2%)	1519 (95.1%)	
Moderately reduced	51 (4.9%)	13 (4.9%)	5 (3.7%)	9 (5.8%)	78 (4.9%)	0.865
Mandibular deflection*						
<2 mm	895 (85.8%)	215 (81.4%)	110 (80.9%)	123 (79.9%)	1343 (84.1%)	
2–5 mm	145 (13.9%)	48 (18.2%)	25 (18.4%)	31 (20.1%)	249 (15.6%)	
>5 mm	3 (0.3%)	1 (0.4%)	1 (0.7%)	0	5 (0.3%)	0.227
TMJ function*						
No impairment	887 (85.0%)	219 (83.0%)	110 (80.9%)	118 (76.6%)	1334 (83.5%)	
Palpable clicking	132 (12.7%)	39 (14.8%)	16 (11.8%)	30 (19.5%)	217 (13.6%)	
Evidently clicking, locking, luxation	24 (2.3%)	6 (2.3%)	10 (7.4%)	6 (3.9 %)	46 (2.9%)	0.006
TMJ pain*						
No pain	1022 (98.0%)	260 (98.5%)	135 (99.3%)	150 (97.4%)	1567 (98.1%)	
Palpable pain	21 (2.0%)	4 (1.5%)	1 (0.7%)	4 (2.6%)	30 (1.9%)	0.64
Muscle pain*						
No pain	1011 (96.9%)	255 (96.6%)	132 (97.1%)	150 (97.4%)	1548 (96.9%)	
Palpable pain	23 (2.2%)	6 (2.3%)	2 (1.5%)	3 (1.9%)	34 (2.1%)	
Palpebral reflex	9 (0.9%)	3 (1.1%)	2 (1.5%)	1 (0.6%)	15 (0.9%)	0.982
Functional occlusion (RCP-MIP) *						
0 mm	926 (88.8%)	240 (90.9%)	119 (87.5%)	133 (86.4%)	1418 (88.8%)	
1 mm	78 (7.5%)	17 (6.4%)	11 (8.1%)	13 (8.4%)	119 (7.5%)	
≥2 mm	39 (3.7%)	7 (2.7%)	6 (4.4%)	8 (5.2%)	60 (3.8%)	0.838
Headaches*						
Absent	1016 (97.4%)	257 (97.3%)	130 (95.6%)	150 (97.4%)	1553 (97.2%)	
Present	27 (2.6%)	7 (2.7%)	6 (4.4%)	4 (2.6%)	44 (2.8%)	0.676
Dental wear*						
Absent	756 (72.5%)	180 (68.2%)	89 (65.4%)	103 (66.9%)	1128 (70.6%)	
Facets in enamel	279 (26.7%)	81 (30.7%)	47 (34.6%)	51 (33.1%)	458 (28.7%)	
Visible dentine	8 (0.8%)	3 (1.1%)	0	0	11 (0.7%)	0.183

*χ^2-test. # Kruskal-Wallis test

malocclusion (15%; p=0.006, Table 1). Most of the signs and symptoms of TMD were of mild character.

Table 2 presents the distribution of age, gender, DMFT and the parafunctional habits in the groups with and without TMD signs. Twenty-two percent of schoolchildren had one or more TMD signs ranging from 17% at the age of 11 years up to 24% at 19 years. In general, TMD presented a tendency to become more frequent with increasing age (p<0.001) and in females (p=0.003; Table 2). Orthodontic treatment needs assessed by DAI and IOTN indices were equally distributed in groups with and without TMD signs / symptoms (Figure 1). There was very poor correlation between TMD and orthodontic treatment need as assessed by CDI and DAI (Spearman's ρ=0.1, p=0.017). Doctors' evaluation and individuals' self-assessment showed no correlation between CDI and IOTN-AC scores (Spearman's ρ=0.04, p=0.106 and Spearman's ρ=0.01, p=0.702, respectively).

For multivariate analysis nine multiple logistic regression models were created with following dichotomized TMD components (0 = absent, 1 = present) as dependent variables: (1) reduced mouth opening, (2) mandibular deflection on opening ≥2 mm, (3) retruded contact position – maximal intercuspal position slide (RCP-MIP) ≥2 mm, (4) TMJ clicking / locking / luxation, (5) TMJ pain, (6) masseter pain, (7) temporalis pain, (8) headaches, and (9) dental wear. Twenty seven independent variables representing malocclusion type, age, gender and oral parafunctions were included in each multiple logistic regression models. One model was not statistically significant (RCP-MIP slide). Logistic regression analyses indicated that from all types of malocclusions and signs / symptoms of TMD only Class III, crowding and spacing were related to mandibular deflection on opening (Table 3). Ectopic teeth were related to TMJ clicking, and tipped teeth to reduced mouth opening. Headaches presented a positive relationship with reverse overjet and rotations, and tooth

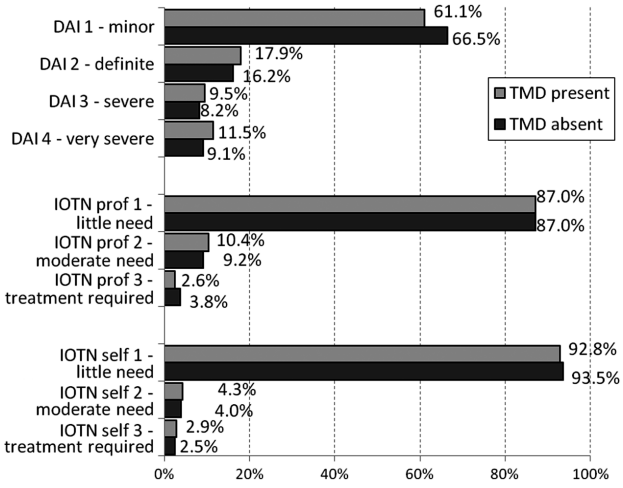

Fig 1. Distribution of orthodontic treatment needs assessed by Dental Aesthetic Index (DAI) and Index of Orthodontic Treatment Need – Aesthetic Component (IOTN) in the group with and without TMD signs and sypmtoms. IOTN was assessed by professional examinator (prof) and examinee (self).

TABLE 2
DISTRIBUTION OF AGE, GENDER, DMFT AND PARAFUNCTIONAL HABITS IN THE GROUPS WITH AND WITHOUT TMD SIGNS AS ASSESSED BY THE CLINICAL DYSFUNCTION INDEX (CDI)

	TMD sign / symptom			
	TMD absent (CDI = 0) 1250 (78.3%)	TMD present (CDI ≥1) 347 (21.7%)	Total 1597	p between groups
Age ($\overline{X}$±SD)#	15.5±1.8	16±1.7	15.6±1.8	0.001
Gender †				
Male	593 (47.4%)	134 (38.6%)	727 (45.5%)	
Female	657 (52.6%)	213 (61.4%)	870 (54.5%)	0.003
DMFT ($\overline{X}$±SD)#	4.8±3.6	5.5±3.6	4.9±3.6	0.002
Parafunctional habits*$				
None	708 (56.6%)	182 (52.4%)	890 (55.7%)	
Finger sucking	7 (0.6%)	2 (0.6%)	9 (0.6%)	0.615
Mouth breeding	35 (2.8%)	6 (1.7%)	41 (2.6%)	0.179
Infantile swallowing	99 (7.9%)	33 (9.5%)	132 (8.3%)	0.199
Bruxism	13 (1.0%)	2 (0.6%)	15 (0.9%)	0.335
Lip/cheek biting	166 (13.3%)	69 (19.9%)	235 (14.7%)	0.003
Nail biting	245 (19.6%)	67 (19.3%)	312 (19.5%)	0.486
Pencil biting	40 (3.2%)	17 (4.9%)	57 (3.6%)	0.002

* χ^2-test. † Fisher exact test. # Mann-Whitney test
$ The sum does not correspond to the number of subjects as the habits do not exclude one another

TABLE 3
ASSOCIATIONS BETWEEN TMD SIGNS / SYMPTOMS AND MALOCCLUSION COMPONENTS AND PARAFUNCTIONAL HABITS, CONSIDERING THE EFFECT OF GENDER (0= FEMALES, 1= MALES) AND AGE, AS ESTIMATED BY THE MULTIPLE LOGISTIC REGRESSION MODELS

Dependent variable	Independent variable	Logistic coefficient	Standard error	p	Odds ratio (95% Confidence interval)
Deflection*	Intercept	–3.891	0.715	<0.001	
	Class III	0.639	0.263	0.015	2.0 (1.13–3.17)
	Crowding frontal	0.509	0.180	0.005	1.7 (1.20–2.37)
	Crowding posterior	0.638	0.207	0.002	1.9 (1.26–2.84)
	Spacing posterior	0.791	0.260	0.002	2.2 (1.32–3.67)
	Age	0.103	0.045	0.022	1.1 (1.02–1.21)
TMJ pain†	Intercept	–8.358	2.005	<0.001	
	Age	0.276	0.123	0.025	1.3 (1.04–1.68)
TMJ clicking$	Intercept	–5.488	0.759	<0.001	
	Ectopic eruption	0.790	0.257	0.002	2.2 (1.33–3.65)
	Nails biting	0.455	0.198	0.022	1.6 (1.07–2.33)
	Lip / cheek biting	0.444	0.223	0.047	1.6 (1.01–2.41)
	Age	0.203	0.047	<0.001	1.2 (1.12–1.34)
	Female gender	0.455	0.177	0.010	1.6 (1.11–2.23)
Reduced opening&	Intercept	–3.500	0.244	<0.001	
	Tipped tooth (>30°)	0.852	0.343	0.013	2.4 (1.20–4.59)
	Female gender	0.597	0.244	0.041	1.8 (1.03–3.22)
Temporalis pain%	Intercept	–4.925	0.377	<0.001	
	Tipped tooth (>30°)	1.187	0.602	0.049	3.3 (1.01–10.67)
	Lip / cheek biting	1.262	0.566	0.026	3.5 (1.16–10.72)
Masseter pain#	Intercept	–4.174	0.244	<0.001	
	Pencil biting	2.046	0.532	<0.001	7.7 (2.73–21.97)
Headaches**	Intercept	–9.065	1.617	<0.001	
	Rotations (>45°)	1.453	0.451	0.001	4.3 (1.77–10.36)
	Reverse overjet	1.360	0.620	0.028	3.9 (1.16–13.13)
	Crowding frontal	–1.029	0.452	0.023	0.4 (0.15–0.87)
	Age	0.215	0.097	0.026	1.2 (1.03–1.50)
	Female gender	1.957	0.621	0.002	7.1 (2.09–23.93)
Tooth wear***	Intercept	–3.167	0.448	<0.001	
	Crowding frontal	0.703	0.138	<0.001	2.0 (1.54–2.65)
	Crowding lateral	0.815	0.160	<0.001	2.3 (1.65–3.09)
	Spacing posterior	0.603	0.162	<0.001	1.8 (1.33–2.51)
	Spacing posterior	0.548	0.211	0.009	1.7 (1.14–2.62)
	Open bite posterior	0.668	0.227	0.003	2.0 (1.25–3.04)
	Rotations (>45°)	–0.500	0.142	<0.001	0.6 (0.46–0.80)
	Age	0.121	0.029	<0.001	1.1 (1.07–1.19)
	Female gender	–0.345	0.124	0.005	0.7 (0.56–0.90)

*R^2=0.064. †R^2=0.028. $$R^2$=0.066. &$R^2$=0.027. %$R^2$=0.052. #$R^2$=0.052. **$R^2$=0.171. ***$R^2$=0.108. (Nagelkerke's Pseudo R-Square). Only statistically significant variables are listed.

wear with crowding, spacing and lateral openbite. Age, female gender and parafunctional habits were related to several TMD signs. Although eight models were statistically significant ($p<0.05$), malocclusions, parafunctional behaviours, age and gender accounted for 2.7–17.1% of the variability in TMD signs/symptoms. This leaves over 92% of the variability still to be accounted for by other variables.

Discussion

This study was undertaken to determine the prevalence of signs and symptoms of TMD in a population of children and adolescents without history of orthodontic treatment. It was also aimed to study relationship of TMD with the severity of malocclusion and specific occlusal trait as well as to assess associated risk factors. In Croatia, at the time of the study, the government health insurance agency covers all orthodontic therapy costs up to age of 18 years. Since every child receives orthodontic treatment when indicated, it is of great importance to know whether children with severe malocclusion are under higher risk of development of TMD and whether correction of malocclusion in that age could be beneficial to treatment of TMD. That kind of data could be used in public health planning in allocation of financial resources to make calculations how to reduce expenditures for oral health care. This study elaborated a large and representative sample, utilized valid registration methods and indices that were applied by calibrated and limited in number examiners, and controlled the errors of the methods. On the other hand, this cross-sectional investigation could not describe the dynamic and changing aspects of TMD signs and symptoms, which may diminish, deteriorate or just fluctuate in the same individuals over time. Since the study was not longitudinal we could not assess initial malocclusions and treatment need of orthodontically treated patients, therefore they were excluded from examination. Considering the fact that DAI and IOTN indices are primary based on psychosocial impact of altered aesthetic in assessing orthodontic treatment need, Bjork's method for more precise registration of particular malocclusion components was also used to facilitate statistical logistic regression analysis.

Interpretation of the results of this investigation indicates some clear patterns of associations between TMD and orthodontic treatment need. Prevalence of TMD seems not to have a specific relation to malocclusion type. Of all occlusal irregularities that were evaluated only few of them – crowding (including ectopic eruption, severely rotated and tipped teeth), spacing, posterior openbite, mesial occlusion and reverse overjet were associated with some TMD signs, producing the odds ratios of 1.7 to 4.3, but with low explanatory values of 2.7–17%. These findings are similar to the conclusions of recent evidence-based systematic reviews[7,10,25,26]. Greater orthodontic treatment need appears not to be linearly correlated with more severe TMD. It also seems that there is poor association between repetitive parafunctional behaviours like bruxism and every kind of biting, trusting and sucking. This report suggests only that the prevalence of lip/cheek biting could be associated with TMJ clicking and temporalis pain, pencile biting with masseter pain and nails biting with TMJ clicking, producing the risks of 1.6 to 7.7, but with low explanatory values of less than 7% and wide confidence interval limits. Although some studies consider certain parafunctional habits, like bruxing and clenching, an important factor related to TMD[1,27] according to recent review, that has made an overall judgement of most scientific evidence available, the relationship between bruxism and TMD seems to be controversial and unclear[28]. Indirect assessments of presence of parafunctional habits and symptoms by means of questionnaires and self-reports have provided conflicting reports.

In the present multiple logistic regression models the explanatory and predictive values of the malocclusion components, parafunctional behaviours, age and gender as risk indicators of the TMD were rather small and accounted for less than 20% of the variability. This indicates that the aetiology of TMD is multifactorial, and no single factor is of major importance, corroborating the findings of previous studies and evidence-based systematic reviews[3,7–9].

Occlusal morphological characteristics do not mostly reflect on the dynamics of functional occlusion. Functional occlusal parameters such as distribution, symmetry and intensity of occlusal contacts in the posterior occlusion are of importance in relation to temporomandibular function[29] and frequent headaches[30].

In this study females seem to be more prone to the occurrence of TMD signs / symptoms than boys. The risks are 1.6 to 7.1 times higher in females than males, lower for TMJ clicking and reduced mouth opening (1.6–1.8x), and higher for headaches (7.1x). Studies of prevalence of the signs and symptoms of TMD have found that mild problems are equally distributed among men and women of the general population. Severe problems are much more common among women in clinical populations and more women than men seek care for TMD by about 8-to-1[31].

Since this investigation was not longitudinal, it did not assess TMD changes during the period of dentofacial growth and development in which the process of adaptation plays an important role in maintaining physiologic function. However, its findings may indicate that prevalence of TMD was increasing with age, particularly during adolescence. Subjects with malocclusion over a long period of time tend to report more symptoms of TMD and show a higher dysfunction index. This was the conclusion of a 20-year follow-up study in subjects with and without orthodontic treatment in childhood[32].

In reference to the prevalence of signs and symptoms of TMD, the presence of great methodological variations in the different studies does not allow direct comparison with the present report. In fact, some of so-referred epidemiologic surveys have shortcomings in randomisation and obtaining representative sample or are basically clinical studies on patient population, and have to be interpreted with caution. Not only study design but also failure to perform multifactorial instead of simple univariate statistical analyses leads to lack of universal agreement. However, the present findings are similar to previous reports[2,33,34].

The present findings favour the opinion of a poor association between type of occlusion, need of orthodontic treatment and TMD, as indicated by recent studies and reviews[7,10,25,26,35]. Therefore, all patients, independent of their type of malocclusion and the reasons for seeking orthodontic treatment, must get the same attention during initial screening, before the initiation of therapy. This must include a thorough temporomandibular and medical history and head and neck clinical examination[18].

Conclusion

The present results support the opinion of poor association between type of occlusion, need of orthodontic treatment, parafunctional behaviour and TMD signs or symptoms.

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REFERENCES

1. CONTI A, FREITAS M, CONTI P, HENRIQUES J, JANSON G, Angle Orthod, 73 (2003) 411. — 2. THILANDER B, RUBIO G, PENA L, DE MAYORGA C, Angle Orthod, 72 (2002) 146. — 3. HENRIKSON T, NILNER M, J Orthod, 30 (2003) 129. — 4. PAHKALA R, QVARNSTROM M, Eur J Orthod, 26 (2004) 367. — 5. BAKKE M, MOELLER E, Scand J Dent Res, 100 (1992) 32. — 6. MCNEILL C, MOHL ND, RUGH JD, TANAKA TT, J Am Dent Assoc, 120 (1990) 253. — 7. RINCHUSE DJ, MCMINN JT, Am J Orthod Dentofacial Orthop, 130 (2006) 715. — 8. PULLINGER AG, SELIGMAN DA, J Prosth Dent, 83 (2000) 66. — 9. VELLY AM, PHILIPPE P, GORNITSKY M, J Oral Rehabil, 29 (2002) 969. — 10. GESCH D, BERNHARDT O, KIRBSCHUS A, Quintessence Int, 35 (2004) 211. — 11. MCNAMARA JA JR, SELIGMAN DA, OKESON JP, J Orofac Pain, 9 (1995) 73. — 12. MOHLIN BO, DERWEDUWEN K, PILLEY R, KINGDON A, SHAW WC, KENEALY P, Angle Orthod, 74 (2004) 319. — 13. SELAIMEN CM, JERONYMO JC, BRILHANTE DP, LIMA EM, GROSSI PK, GROSSI ML, Angle Orthod, 77 (2007) 471. — 14. OKESON J, Fundamentals of occlusion and temporomandibular disorders (CV Mosby Company, St. Louis, 1989). — 15. OKESON J, Management of temporomandibular disorders and occlusion (CV Mosby Company, St. Louis, 1993). — 16. GRABER TM, The clinical implications of the unique metabolic processes in the human temporomandibular joint. In: SACHDEVA RCL, BANTLEON H-P, WHITE L, JOHNSON J (Eds) Orthodontics for the next millennium (Ormco, Gendora, 1997). — 17. MOHLIN B, KUROL J, Swed Dent J, 27 (2003) 1. — 18. ATHANASIOU AE, GRABER TM, Temporomandibular disorders and orthodontics. In: GRABER TM, ELIADES T, ATHANASIOU AE (Eds) Risk management in orthodontics: experts' guide to malpractice (Quintessence Publishing Co, Chicago, 2004). — 19. BJORK A, KREBS A, SOLOW B, Acta Odontol Scand, 22 (1964) 27. — 20. CONS NC, JENNY J, KOHOUT FJ, DAI: the dental aesthetic index (University of Iowa, Iowa City, 1986). — 21. WORLD HEALTH ORGANISATION, Oral health surveys – basic methods (WHO, Geneva, 1997). — 22. EVANS R, SHAW WC, Eur J Orthod, 9 (1987) 314. — 23. HELKIMO M, Swed Dent J, 67 (1974) 102. — 24. BLAND JM, ALTMAN DG, BMJ 313 (1996) 744, — 25. MOHLIN B, AXELSSON S, PAULIN G, PIETILA T, BONDEMARK L, BRATTSTROM V, HANSEN K, HOLM AK, Angle Orthod, 77 (2007) 542. — 26. LUTHER F, Br Dent J, 202 (2007) E3. — 27. CELIC R, JEROLIMOV V, PANDURIC J, Int J Prosth, 15 (2002) 43. — 28. BARBOSA TDE S, MIYAKODA LS, POCZTARUK RDE L, ROCHA CP, GAVIAO MB, Int J Pediatr Otorhinolaryngol, 72 (2008) 299. — 29. GIANNIRI AL, MELSEN B, NIELSEN L, ATHANASIOU AE, J Oral Rehabil, 18 (1991) 49. — 30. WANMAN A, AGERBERG G, J Craniomandib Disord, 5 (1991) 35. — 31. RUGH JD, SOLBERG WK, J Dent Educ, 49 (1985) 398. — 32. EGERMARK I, MAGNUSSON T, CARLSSON GE, Angle Orthod, 73 (2003) 109. — 33. DENG Y, MIN KUI F, HAGG U, Eur J Orthod, 17 (1995) 305. — 34. MONTEGI E, MIYASAKI H, OGUKA I, Angle Orthod, 62 (1992) 249. — 35. KASELO E, JAGOMAGI T, VOOG U, Stomatologija, 9 (2007) 79.

S. Špalj

University of Rijeka, School of Medicine, Department of Orthodontics, Krešimirova 40, 51 000 Rijeka, Croatia
e-mail: stjepan.spalj@medri.uniri.hr

TEMPOROMANDIBULARNI POREMEĆAJI I POTREBA ZA ORTODONTSKIM TRETMANOM U ORTODONTSKI NETRETIRANE DJECE I ADOLESCENATA

SAŽETAK

Cilj studije je bio istražiti povezanost između znakova i simptoma temporomandibularnih poremećaja (TMP) i potrebe za ortodontskim tretmanom u ortodontski netretirane djece i adolescenata. Pregledano je 1597 ortodontski netretiranih ispitanika dobi 11–19 godina iz 16 nasumično izabranih javnih škola u Zagrebu, Hrvatska. Karakteristike malokluzije procijenjene su po kriterijima Bjorka i sur., Indeksa dentalne estetike (DAI) i Estetske komponente Indeksa potrebe za ortodontskim tretmanom. Podaci o znakovima i simptomima TMP-a te nepogodnim navikama prikupljeni su pomoću upitnika i kliničkim pregledom. Za analizu su rabljeni modeli multiple logističke regresijske analize. 22% djece i mladih adolescenata imalo je jedan ili više znakova TMP-a, u rasponu od 17% u dobi od 11 godina do 24% u dobi od 19. Korelacija između prisustva TMP-a i potrebe za ortodontskim tretmanom je bila slaba. Modeli multiple logističke regresije ukazali su da su klasa III, zbijenost i rastresitost povezane sa skretanjem mandibule pri otvaranju usta. Distopija je bila povezana sa škljocanjem temporomandibularnog zgloba, a izrazito nagnuti zubi s reduciranim otvaranjem usta. Glavobolje su bile pozitivno povezane s obrnutim pregrizom i izraženim rotacijama zubi, a abrazije zubi sa zbijenošću, rastresitošću i lateralnim otvorenim zagrizom. Dob, ženski spol i nepogodne navike su bile povezane s nekoliko znakova TMP-a. Iako

su modeli logističke regresije bili statistički značajni ($p<0,05$) malokluzije, nepogodne navike, dob i spol opisuju manje od 20% varijabiliteta znakova i simptoma TMP-a. Izgleda da su znakovi i simptomi TMP-a loše povezani s malokluzijama i potrebom za ortodontskim tretmanom.