

The Correlation Between Temporomandibular Disorders and Morphological Occlusion

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Summary

Contradictions in the field of epidemiology, etiology, diagnosis and treatment of temporomandibular disorders continue, especially because such disorders rarely appear as individual entities, but as multiple problems with overlapping signs and symptoms. The purpose of this study was to establish the prevalence of temporomandibular disorders in a population of younger male subjects (nonpatients) in relation to interarch relationships in the intercuspal position, to establish a correlation between signs and symptoms and morphological occlusion (Angle classification) and to compare results with known clinical studies. The study comprised 230 male subjects aged from 19 to 28 years, who were examined based on a questionnaire (clinical functional analysis according to Gutowski).

From the total number of subjects, 44.3% of subjects had at least one sign, and 38% of subjects had at least one symptom of a temporomandibular disorder. Analysing signs and symptoms of temporomandibular disorders individually, 91 subjects (39.6%) had jaw joint clicking, 3 subjects (1.3%) had crepitation in jaw joints, a total of 78 subjects (33.9%) had pain in jaw joints at palpation and functional loading, a total of 58 subjects (25.2%) had pain in the muscles of mastication at palpation and functional examination, 43 subjects (18.7%) had a lower jaw deviation exceeding 2 mm and 30 subjects (13%) had tension-type headache. By the calculation of Spearman's correlation rank, a correlation between signs and symptoms of temporomandibular disorders and interarch relationships in the intercuspal position, especially in the group with disturbed interarch relationships (class II/1, class II/2, class III and crossbite), was established.

Key words: *temporomandibular disorders, morphological occlusion*

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Introduction

Temporomandibular disorders is a collective term that embraces a number of clinical conditions that involve muscles of mastication, teeth, jaw joints and associated structures. Clinical signs and symptoms associated with temporomandibular disorders include fatigue and masticatory muscle pain, headache, limited and irregular lower jaw motion, attrition of teeth, facial pain, earache, neck ache, jaw joint pain and jaw joint sounds like popping, clicking and crepitation (1, 2, 3).

Contradictions in the field of epidemiology, etiology, diagnosis and treatment of temporomandibular disorders continue, especially because such disorders rarely appear as individual entities, but as multiple problems with overlapping signs and symptoms (4).

However, from a comparison of findings of previous studies it can be concluded that social, cultural, demographic, psychological (depression, stress), sexual and age differences help in answering questions of temporomandibular disorders. Studies indicate that signs and symptoms of temporomandibular disorders can be found in the majority of males and females of all age groups, even in children. However, signs and symptoms generally increase in frequency and severity in the second decade of life (5-11).

A number of etiologic factors influence and change the dynamic balance of normal or adaptive health and function of constituent parts of the masticatory system according to dysfunction and pathology. Traumatic, anatomical (occlusal), pathophysiological (systemic) and psychosocial factors support the general consensus on complex and multifactorial etiology of temporomandibular disorders (3, 4, 12, 13).

Riolo, Brandt and TenHave (14) propose that subjects with Angle class II, Angle class III, crossbite, open bite, were positively associated with subjective symptoms and clinical signs (joint clicking, painful tenderness of jaw joints and muscles of mastication) of temporomandibular disorders.

The purpose of our study was to establish prevalence of signs and symptoms of temporo-

mandibular disorders in the population of younger (male) subjects (nonpatients), to establish a correlation between signs and symptoms and morphological occlusion (Angle classification) and to compare results with known clinical studies.

Material and method

The study comprised 230 subjects of a specific group (soldiers doing national service from the "Stjepan Ban Lacković" barracks, Križevci) that needed conservative-endodontic and surgical (extraction) treatment (subjects with an acute clinical condition were not included in the study) or a control within the prevention program. The subjects were examined based on a questionnaire that included data from history and clinical functional analysis.

All subjects were male in the age group from 19 to 28 years (the mean age was 21.3 years).

Clinical functional examination in the present study includes assessment of the morphological occlusion (Angle classification), assessment of jaw joint conditions (preauricular and intraauricular palpation, assessment of joint capsule, distal and lateral ligament with passive movements), assessment of masticatory muscle condition (palpation of masticatory muscles, functional loading of masticatory muscles), assessment of clinical signs and symptoms of temporomandibular disorders (jaw joint clicking, jaw joint crepitation, jaw joint tenderness to palpation and functional loading, tenderness and pain in the muscles of mastication during palpation and functional loading, tension headache and lower jaw deviation on opening and closing of mouth exceeding 2 millimeters) and based on a standardized questionnaire subjective assessment of the severity of signs and symptoms (1 = no or minimal discomfort; 2 = slight discomfort; 3 = moderate discomfort and 4 = severe discomfort) (15).

The criteria used for the group with normal occlusion (Angle class I) represents the relationship of the mesiobuccal cusp of the first upper molar with the mesiobuccal and mediobuccal cusp of the first lower molar.

Distocclusion (Angle class II) denotes the relationship of the mesiobuccal cusp of the first upper molar which is in contact with the distal surface of the second lower premolar and mesial surface of the first lower molar. Angle class II/1 is characterised by the prolonged upper dental arch with protrusion of upper incisors. Angle class II/2 is characterised by the distal position of the first molars and retrusion of upper incisors followed by a deep vertical overbite.

Angle class III or mesiocclusion indicates the relationship in which the mesiobuccal cusp of the first upper molar is in contact with the distal part of the first lower molar and mesial part of the second lower premolar.

Crossbite is a unilateral or bilateral occlusal anomaly where there is an irregular relationship between lateral teeth in a buccoral direction (16).

Data processing. The results of statistical data processing used in this study were achieved by means of STATISTICA for Windows, Release 5.1 H ('98 Edition)* and SPSS for Windows, Release 7.5**. Contingency tables were used in order to examine the relationship between a number of variables, after which the differences between the two distributions were examined by 2 test. The division of the individual influence of interarch relationships in the intercuspal position (class I, class II/1, class II/2, class III and crossbite) on variables that describe prevalence of signs and symptoms of temporomandibular disorders, was conducted by a nonparametric method (Spearman's correlation rank).

* StatSoft, Inc. Tulsa, OK, U.S.A.

** SPSS Inc. Michigan Avenue, Chicago, Illinois 60611, U.S.A.

Results

The distribution of subjects in relation to the observed categories of interarch relationships in the intercuspal position (Angle classification) indicates that 108 (47%) subjects have class I; 46 (20%) subjects class II/1; 36 (15.7%) subjects class II/2; 15 (6.5%) class III and 25 (10.9%) crossbite (Figure 1).

Clinical signs and symptoms of temporomandibular disorders included jaw joint clicking, jaw joint crepitation, jaw joint tenderness to

palpation and functional loading, tenderness and pain in the muscles of mastication during palpation and functional loading, tension headache and lower jaw deviation on opening and closing of mouth exceeding 2 millimeters.

Table 1 shows the prevalence of signs and symptoms of temporomandibular disorders in relation to the group with normal and disturbed interarch relationships in the intercuspal position.

From the total number of subjects 55.7% were without any symptoms, and 44.3% had at least one symptom of a disturbed function of jaw joints and/or masticatory muscles. In the symptomatic group it was found that subjects with disturbed interarch relationships in the intercuspal position statistically considerably differ ($p < 0.001$) from subjects with normal interarch relationships, which is presented in Table 2.

Table 3 shows descriptive-statistical properties of the total number of signs and symptoms of temporomandibular disorders in relation to interarch relationships in the intercuspal position. The number of signs and symptoms of temporomandibular disorders ranged from 0 to 8, whereby 6 (2.6%) subjects had one sign/symptom of a dysfunction; 20 (8.7%) subjects two signs; 26 (11.3%) subjects three; 22 (9.6%) subjects four; 10 (4.3%) subjects five; 7 (3%) subjects six; 8 (3.5%) subjects seven, and 3 (1.3%) subjects had eight clinical signs and/or symptoms of temporomandibular disorders.

The results of variance analysis of the total number of signs and symptoms of temporomandibular disorders in relation to interarch relationships in the intercuspal position indicate that there is a statistically important difference ($p < 0.001$) in the mean values of the total number of signs and symptoms of temporomandibular disorders (Table 4). The group with normal interarch relationships in the intercuspal position was found to have on average 0.935 signs and symptoms of temporomandibular disorders for each subject, while, for example, subjects with crossbite had three times more.

A subjective assessment of severity of signs and symptoms of temporomandibular disorders indicated that 143 subjects (62.2%) had no or minimal discomfort, 33 subjects (14.3%) slight discomfort, 21 subjects (9.1%) moderate discomfort and 33

subjects (14.3%) severe discomfort. Subjects with normal interarch relationships in the intercuspal position considerably differ ($p = 0.002$) from the group of subjects with disturbed interarch relationships in relation to subjective assessment of severity of signs and symptoms of temporomandibular disorders (Table 5).

Spearman's correlation coefficient showed a positive correlation between interarch relationships in the intercuspal position (class I, class II/1, class II/2, class III and crossbite) and jaw joint clicking ($p = 0.390$, $p < 0.01$), pain in jaw joints at palpation ($p = 0.179$, $p < 0.01$), pain in jaw joints caused by functional loading ($p = 0.332$, $p < 0.01$), pain in the muscles of mastication at palpation ($p = 0.131$, $p < 0.05$) and pain in the muscles of mastication caused by functional loading ($p = 0.177$, $p < 0.01$), and it showed a negative correlation with a low jaw deviation exceeding 2 mm ($p = -0.228$, $p < 0.01$), whereas for headache no statistically significant correlation was established. By means of this nonparametric method the initial hypothesis was proved, that the prevalence of signs and symptoms of temporomandibular disorders is correlated with the occlusal condition, especially in the group of subjects with disturbed interarch relationships in the intercuspal position (class II/1, class II/2, class III and crossbite).

Discussion

One of the most common signs and symptoms of the mentioned disorder is jaw joint clicking. In their review of the literature, Stockstill and Mohl (17) found that jaw joint clicking is a most commonly registered jaw sound present in 42% of the nonpatient population and in 27% of symptomatic patients, which shows that the percentage of 39.6% subjects in this study correspond to the percentage of the nonpatient population. The frequency of clicking and crepitation as clinical sounds and symptoms of an internal jaw joint disorder varies in the studies of various authors, depending on the population (patients or nonpatients) and their age. In the study of prevalence of temporomandibular disorders in the population of asymptomatic subjects ($N=1000$), examined during routine controls, 31.2% of subjects were found to have clicking, 4.1%

crepitation and 6% clicking and crepitation in jaw joints (18). The frequency of jaw joint crepitation (1.3%) in this population of nonpatients corresponds to the frequency of crepitation established also by other authors, and ranges from 0.8% to 11% (18-21).

Painful tenderness in the jaw joint area varies in different studies from 4% to 5% in the study by Gross and Gale (22), Pullinger, Seligman and Solberg (19) found 6%, Henrikson, Ekberg and Nilner (23) 18%, Gelb and Bernstein (24) 28.5%, Rieder, Martinoff and Wilcox (18) 31%, Weinberg and Chastain (25) 64% and Grgurević (26) 80.2%, depending on the population and diagnostic criteria. In this study, the clinical findings of frequency of pain in the jaw joint area of 33.9% corresponds to the findings of lower frequency in studies on nonpatients.

Painful tenderness of masticatory muscles ranges from 13% in the study by Ingervall, Mohlin and Thilander (20), 17% in the study by Molin, Carlsson, Friling and Hedegaard (27), 19.7% in the study by Capurs (28), 34% in the study by Jagger and Wood (29), 41% in the study by Wanman and Agerberg (21) and in the study by Schiffman, Friction, Haley and Shapiro (30), 48% in the study by Pullinger, Seligman and Solberg (19), to 76% in the study by List and Dworkin (31).

Ingervall, Mohlin, Thilander (20), as well as Solberg, Woo and Houston (32) established a deviation exceeding 2 mm on mouth opening in 18% of subjects, Pullinger, Seligman and Solberg (19) in 22% of subjects, Henrikson, Ekberg and Nilner (23) in 12% of the class I group and in 24% of the class II group, and therefore, the clinical findings of a lower jaw deviation in this study (18.7%) is in accordance with the aforementioned results.

Ingervall, Mohlin and Thilander (20) found only 5% of subjects with headache complaint in a group of 389 Swedish males. Henrikson, Ekberg and Nilner (23), as well as Pullinger, Seligman and Solberg (19) in their nonpatient populations established the same percentage of 11%. A slightly higher frequency was reported in two epidemiological studies by Abdel-Hakim (33) and Abdel-Hakim et al. (34), where in the first study comprising a male population the frequency of headache amounts to 29%, in the second study comprising adolescents it amounts to 33.6%. Gelb and Bernstein (24) found also high percentages of

prevalence of headache in 41.5% of patients, Delfin and Eppley (35) in 62% and Blood (36) in 82% of patients. A lower frequency in male groups of subjects and nonpatient populations corresponds to the clinically diagnosed frequency of headache of 13% found in this study.

A number of epidemiological studies on specific nonpatient populations indicate that in an average 60% of subjects of such populations there is at least one sign of joint dysfunction (irregular movement, joint sound, tenderness to palpation, etc.) and that in an average 40% of subjects there is at least one symptom (facial pain, jaw joint pain, etc.) of temporomandibular disorders, which probably suggests that the same percentage exists also in the general population (3, 12).

This study indicated that 38% of subjects had at least one symptom of a temporomandibular disorder (subjects with slight, moderate and severe discomfort), while in relation to diagnostic criteria 44% of subjects had at least one sign of temporomandibular disorders.

Pullinger, Seligman and Solberg (19) examined a group of nonpatients embracing 222 students (the mean age was 23.9 years) and found that in 39% of students there was one symptom, and in 48% of students one sign of temporomandibular disorders.

Rieder et al. (18) examined 1000 subjects seeking conservative treatment, and not complaining about a temporomandibular disorder. They found the prevalence of temporomandibular disorders for symptoms 33% and for signs 50%.

Ingervall, Mohlin and Thilander (20) observed 389 Swedish males (the mean age was 32 years) and found a somewhat lower percentage for symptoms (15%), while the percentage for signs of a disorder was within average (60%).

Based on the observed categories of interarch relationships in the intercuspal position (Angle classification), subjects were divided into a group with normal relationships (class I, 47% of subjects) and a group with disturbed occlusal relationships (class II/1, 20% of subjects; class II/2, 15.7% of subjects; class III, 6.5% of subjects; crossbite, 10.9% of subjects).

The frequency of morphological occlusal conditions (Angle classification) in this study differs

from other studies to the extent in which these differences are determined by racial and ethnic variations between populations. The dental profession has always presented malocclusion as a primary etiologic factor of temporomandibular disorders. Some epidemiological studies of a correlation between signs and symptoms of temporomandibular disorders and occlusal conditions (Angle classification) reveal a positive relationship, while others do not.

Egermark-Eriksson, Ingervall and Carlsson (37), Riolo, Brandt and TenHave (14), as well as Gazit, Lieberman et al. (38) point to class II, class III, crossbite and open bite, Seligman and Pullinger (39) suggest an association between class II division 1, al-Hadi (40) class II, division 1 and class III, Pullinger, Seligman and Solberg (41) class II division 2, Henrikson, Ekberg and Nilner (23) class II (in the control group class I subjects also had a temporomandibular disorder, but in a considerably lower percentage), and Thilander (42) suggests an association between class III and crossbite and the prevalence of temporomandibular disorders. It can be concluded that the results of our research correspond to all the aforementioned studies that confirmed a correlation between signs and symptoms of temporomandibular disorders and morphological malocclusion.

Conclusions

After a clinical functional analysis of the masticatory system was conducted, the following was found:

1. The distribution of subjects according to interarch relationships in the intercuspal position (Angle classification) indicates that 108 subjects (47%) have normal interarch relationships (class I), and 122 subjects (53%) disturbed interarch relationships (class II/1, class II/2, class III and crossbite).
2. From the total number of subjects, 44.3% of subjects had one sign of temporomandibular disorders, while in relation to subjective assessment, 38% of subjects (subjects with slight, moderate and severe discomfort) had at least one symptom of temporomandibular disorders. The

- prevalence of signs and symptoms of temporomandibular disorders in the specific population of younger male subjects (the mean age 21.3 years) corresponds to the findings from the literature.
3. Analysing signs and symptoms of temporomandibular disorder individually, 91 subjects (39.6%) had jaw joint clicking, 3 subjects (1.3%) had crepitation in jaw joints, a total of 78 subjects (33.9%) had pain in jaw joints at palpation and functional loading, a total of 58 subjects (25.2%) had pain in the muscles of mastication at palpation and functional examination, 43 subjects (18.7%) had a lower jaw deviation exceeding 2 mm and 30 subjects (13%) had tension-type headache.
 4. In the group with normal interarch relationships in the intercuspal position (class I) on average 0.9 signs and symptoms of temporomandibular disorder was found for each subject, in class II/1 subjects 1.9 signs and symptoms, in class II/2 subjects 2.4, in class III subjects 2.3 and in crossbite subjects on average 2.8 (three times more) signs and symptoms of temporomandibular disorder for each subject. This result indicates that in subjects with disturbed interarch relationships in the intercuspal position signs and symptoms occur more often.
 5. Signs and symptoms of temporomandibular disorders are correlated with occlusal conditions, especially in the group of subjects with disturbed interarch relationships in the intercuspal position (class II/1, class II/2, class III and crossbite).