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The relationship between pathological wear of teeth and temporomandibular joint dysfunction

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SUMMARY

Objective. Temporomandibular joint dysfunction (TMJD) is quite frequent pathology in population. In scientific literature pathological tooth wear (PTW) is listed among the predisposing factors of it.

Material and Methods. During the survey 189 primary patients of dental department in polyclinic of Panevezys city were examined. According to the tooth wear degree 2 groups have been formed: control group (grade 0-1) withouth TMJ dysfunction; and experimental group (grade 2-4) with presumable TMJD.

Results. In experimental group tooth wear of anterior and posterior region increases with age respectively ($p<0.05$). It was also found that centric occlusion (CO) and relative rest heights difference increases with age in the control group ($p<0.05$) as well as the experimental group ($p=0.001$). In patients with diagnosed TMJD the difference between heights in CO and relative rest was bigger than in patients without TMJD ($p=0.039$). In the experimental group TMJD was diagnosed the most of patients grade-4 in 90%. The most common symptom is joint sounds was observed in 72.2%.

Conclusions. 35-50 and over 50 age groups of patients had a higher first molars degree of wear than the younger ones. In patients with diagnosed TMJD the difference between heights in CO and relative rest was bigger than in patients without TMJD. TMJD symptoms and of posterior teeth pathological wear interface hypothesis confirmed. In the experimental group TMJD was diagnosed the most common in 90% of patients grade–4. The most common symptom is ”Nutcracker” of experimental group patients 77.2%.

Key words: dental wear, temporomandibular joint dysfunction.

INTRODUCTION

Wear of teeth considered the one of the physiological processes that are common to the human body. However, increased mechanical tooth surface wear leads to pathological tooth wear (PTW). Mechanical tooth surface wear is caused by harmful or parafunctional mandibular movements (1-3). Van't Spijker's and other studies (2015) state that the tooth wear prevalence ranging from 3% to 17% between 20 and 70 years of age. Also epidemiological studies have shown that etiological factors of pathological tooth wear may be explained only in about 40% of cases (4). Tooth wear process can progress and cause temporomandibular joint dysfunction, changes in masticatory muscle tone, facial pain, aesthetic and phonetic disorders. This may result in negative mental and social changes (5). Temporomandibular joint (TMJ) diseases relevance proves the data provided in researches. It was found that from 50% to 75% of the population suffered from temporomandibular joint dysfunction on the one side at least once, and 33% of the respondents complain of continuing or lingering of at least one symptom (6). Both tooth wear and TMJ dysfunction matters are analyzed in clinical practice and scientific studies. However, there is still no common opinion about the relationship between pathological tooth wear and TMJ dysfunction.

The aim of this work is to investigate and to identify relationship between the pathological tooth wear and TMJ dysfunction symptoms. In this research correlations between patients' age, gender and

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tooth wear degree; tooth wear degree and lower third of the face height; lower third of the face height and TMJ dysfunction; tooth wear and TMJ dysfunction symptoms; as well as TMJ dysfunction prevalence and gender have been evaluated.

MATERIAL AND METHODS

Before the start of the study, consent was obtained from the Center for Bioethics (No. BC-OF-835). Patients participated in this research voluntarily.

The study used the following materials: digital calipers and simple ruler. During the examination patients were in a sitting position on the dental chair.

The study took place in dental department of Panevezys city clinics. For the study there are selected 129 patients, of whom 64 (50%) were female and 65 (50%) were male. The respondents were divided into two groups – control 62 (48%) and experimental 67 (52%). The experimental group consisted of respondents with TMJ dysfunction clinical symptoms (only in experimental group). TMJ dysfunction was diagnosed if at least one of following symptoms was present (according to S. Bajorskas, 2002): muscle sensitivity, TMJ pain, joint sounds (clicking), the mandibular movement symptoms regarding the mandibular movement extent and it' s type. Masticatory muscles sensitivity and pain were evaluated by palpation technique. Mandibular sounds were analyzed by auscultation (9). Mandibular movement type was determined visually. Alterations of the opening trajectory were classified as (according to Crincoli *et al.*, 2015): deviation – any shift of the jaw midline during opening that disappears with continued opening; deflection – any shift of the midline to one side that becomes greater with opening and does not disappear at maximum opening. Maximal magnitude of mandibular movements was measured with electronic caliper. Reduced opening (according to B. O. Crincoli *et al.*, 2015): in a healthy system, the mouth opens by between 53-58 mm. Taking into account overbite, a restricted mandibular opening is considered to be any distance of <40 mm. Lateral excursions, measured from midline to midline, were recorded as distance lower than 8 mm. Also a mandibular protrusion was recorded when <7 mm (9).

Tooth wear was evaluated by clinical examination method. The tooth wear measured with scale of grades from 0 to 4. The following criteria were used for scoring dental wear: grade 0 – no tooth wear to minimal facets; grade 1 – pronounced wear facets limited in enamel; grade 2 – mild to moderate wear

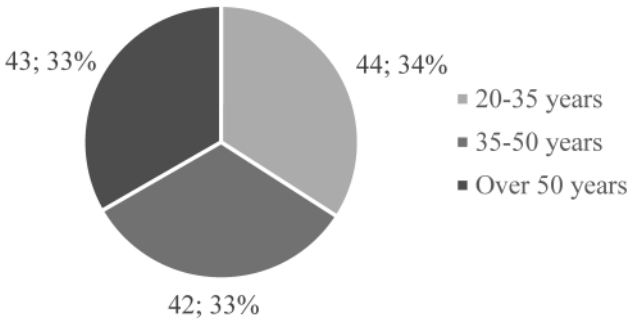

Fig. 1. Age group distribution

with exposure of dentine; grade 3 – advanced wear into dentine to loss of occlusal anatomy; grade 4 – pulp exposure to cervical level wear (9). Relation between tooth wear degree and lower third of the face height evaluation was performed with electric caliper by measuring the heights of CO and relative rest position. According Akinbami B. O. *et al.*, the nasal still at the point of attachment of the columella to upper lip was market with a pen. On the lower lip, the point just below the depression between the free upper part and the attached lower part of the lip which corresponds to the level of the mandibular alveolar bone was also market. Each participant was asked to bring the upper and lower teeth into contact, while distance between these two points was measured. This represented the occlusal vertical dimension (OVD) (10).

Patient selection was based on the following criteria:

1. Age from 20 to 65 years;
2. No or single tooth defects; if at least ten functioning teeth are remaining; existing dental arch defects are restored with fixed dental prostheses, with condition that the teeth necessary for investigation have not been restored;
3. For research at least one maxillary tooth of different group was necessary: anterior segment – central incisor (11, 21); posterior segment – first premolars or first molars (14, 16, 24, 26); having natural teeth antagonists; the farthest tooth was evaluated in case of a few teeth present in posterior region (sequence would be: 16th. and 26th., in their absence is 14th. and 24th.); when the upper jaw has more than one tooth in the same group (for example, remaining the left and the right) – studied the one that is more affected by the tooth wear;
4. Subjects with physiological orthognathic bite;
5. Patients who agreed to participate in the study.

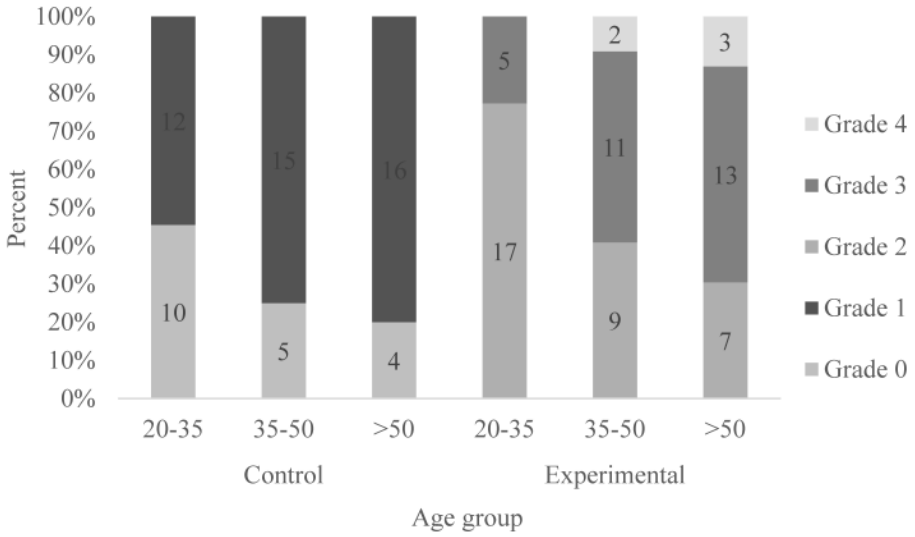

Fig. 2. Upper jaw of the first tooth pathological tooth wear distribution in different age groups

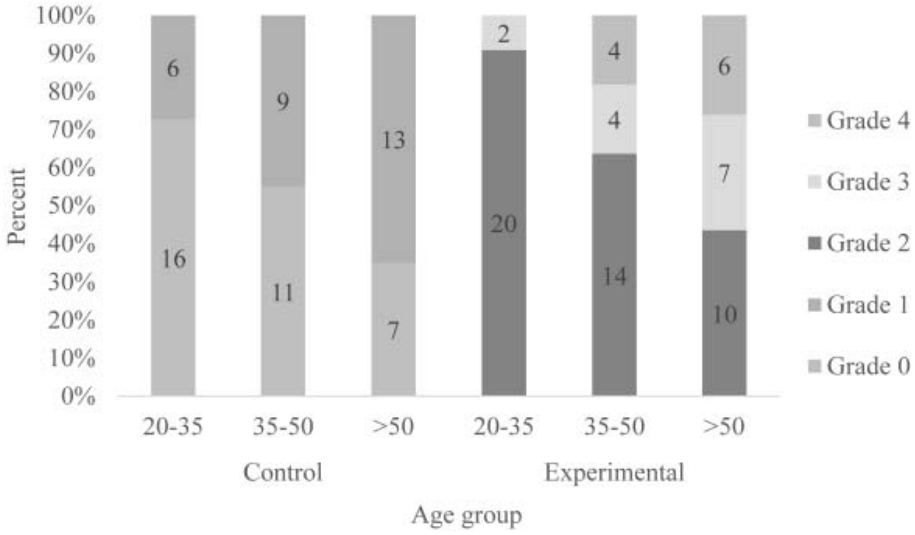

Fig. 3. Upper jaw molar tooth wear pathological distribution of different age groups

Exclusion criteria:

1. Patients with bruxism;
2. Patients with systemic or congenital diseases that cause joint structure or function disorders and masticatory muscle pathology;
3. Patients experienced facial and jaw injuries;
4. Patients with bigger dentition defect, when less than ten functioning teeth were remaining and/or with restored teeth that were necessary for investigation.

Patients were examined and data was collected and analyzed by the same one researcher. To analyze the acquired data, the statistical package "SPSS 22" was used. The descriptive statistics were performed for the study variables. Chi - square test was used to assess the quantitative traits and analysis of variance used for comparison. Correlation coefficients were evaluated to determine the statistical link between the variables. A value of $p<0.05$ was considered significant.

RESULTS

Respondents tooth wear and social analysis

The study included 129 patients, of whom 64 (50%) were female and 65 (50%) – male. During the study, respondents were divided into two groups according to TMJ dysfunction symptoms: control group (grade 0-1) without clinical symptoms and experimental group (grade 2-4) with presumable clinical TMJ dysfunction symptoms. In the control group there were 62 (48%) patients and in experimental group – 67 (52%). The gender distribution of the experimental and control groups were nearly equal. Respondents who participated in the survey analysis, were divided into 3 age groups – 20-35 years, 30-50 years and over 50 years (Fig. 1).

Analysis of tooth wear in different teeth groups in patients with orthognathic occlusion has been performed. Tooth wear of anterior as well as posterior segments has been evaluated.

Age group and central incisor pathological wear rate were statistically significant in the experimental group ($p=0.022$), but were not significant in the control group ($p=0.162$). In experimental group it was observed that older patients have a higher degree of tooth wear in central incisor than younger patients. 80% of young adults (20-35 years old) had a mild to moderate tooth wear with exposure of dentine. The rest 2 age groups (35-50 years and over 50 years) had dominating advanced tooth wear involving the dentine and loss of occlusal anatomy (Spearman correlation coefficient 0.394). Although there was no statistical significance in control group, the same trend continued. 45% of young adults (20-35 years) had no tooth wear or minimal facets, while in the older age groups central incisor wear was more pronounced. Only 20% of patients over 50 years old did not have any depreciation (Spearman correlation coefficient 0.230) (Fig. 2).

In the upper jaw pathological tooth wear degree of central incisor and patient gender correlation were not statistically significant: in the control group (p=0.783); and experimental groups (p=0.153).

Age groups and molar pathology depreciation rates were statistically significant in the experimental (p=0.018) and control groups (p=0.049). 73% of young respondents had no tooth wear to minimal facets, in middle-aged group (35-50 years) – 55% of patients and only 35% patients over 50 years had no molar tooth wear. (Spearman correlation coefficient 0.311). In the experimental group 91% of young adults (20-35 years old) respondents had a mild to moderate wear with exposure of dentine. Although in senior patient groups also dominated such as depreciation, but many were characterized by a higher degree of upper molar tooth wear (Spearman correlation coefficient 0.415) (Fig. 3).

Posterior region tooth wear degree related to the gender was not significant in both control and experimental group.

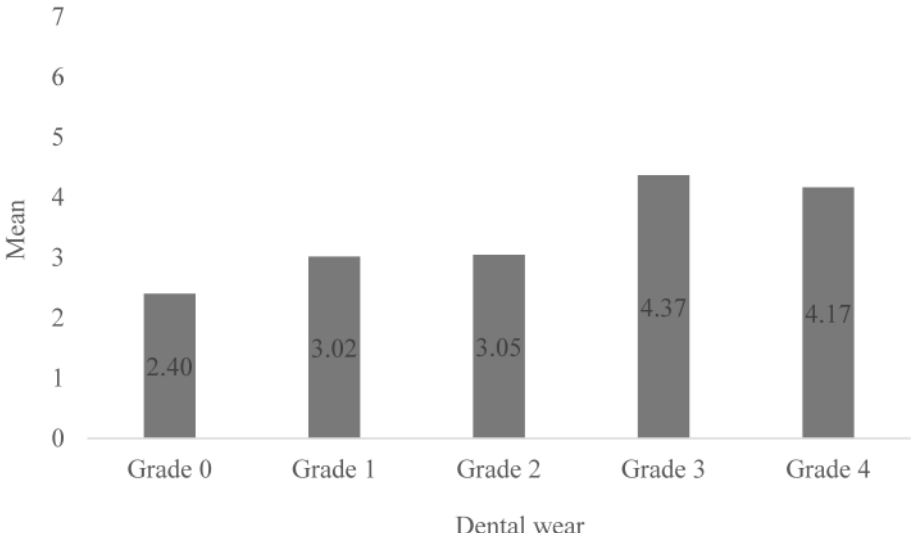

Fig. 4. Data differences of Centric occlusion (CO) and the relative calm in averages and standard deviations for molar pathological tooth wear

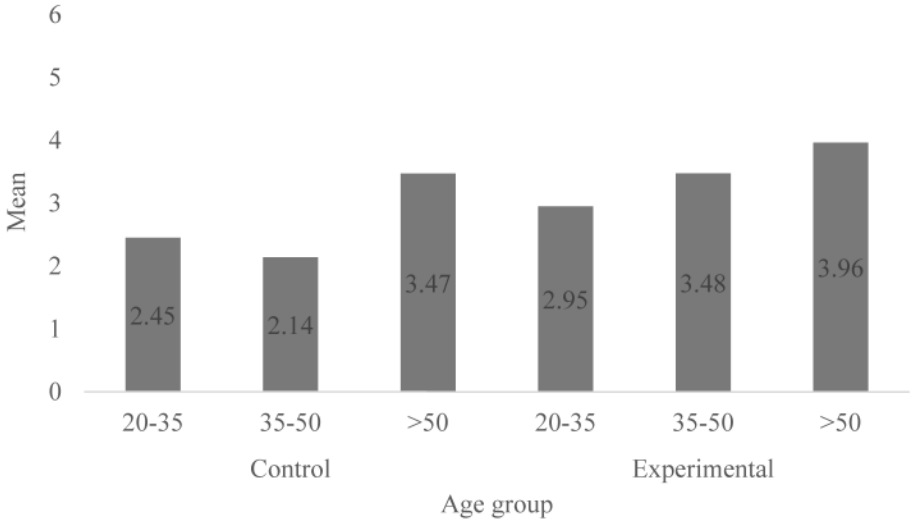

Fig. 5. Data differences of Centric occlusion (CO) and the relative calm in averages and standard deviations for age groups

Tooth wear and the lower third of the face height analysis

Analyzing height difference between CO and relative rest position with different degree of central incisor tooth wear relationship, statistical significance was found in experimental group.

However different wear degree of the molar and the difference between the centric occlusion (CO) and the relative rest position were statistically significant in exploratory group (p=0), but were not in control group (p=0.067). In case of higher lateral teeth pathological tooth wear degree, CO and relative tranquility data gap is widening. Although this hypothesis was disproved in the control group, but it was approved combining the control and exploratory groups (p=0) (Fig. 4).

Different age groups and data about the difference between the centric occlusion and the relative rest were statistically significant in control group (p=0), and the in experimental group (p=0.001) (Fig. 5).

Compulsive tooth wear and TMJ dysfunction analysis

Further statistical analysis was carried out only of the experimental group patients, since respondents had TMJ dysfunction clinical symptoms only in experimental group. TMJ dysfunction is diagnosed if at least one of following symptoms is present (according to S. Bajorskas, 2002): muscle sensitivity on palpation, TMJ pain, joint sounds (clicking), symptoms regarding the mandibular movement extent and it' s type.

TMJ dysfunction diagnosis frequency and age groups were statistically significant (p=0). Young, 20-35 years of age, patients were rarely diagnosed

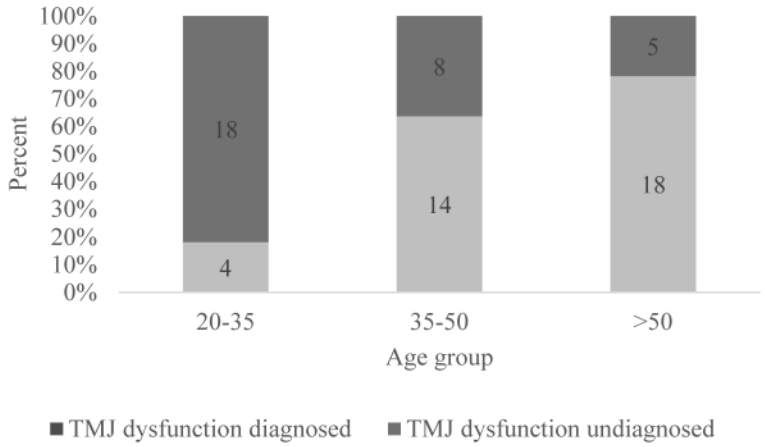

Fig. 6. TMJ dysfunctions diagnosed distribution of different age groups

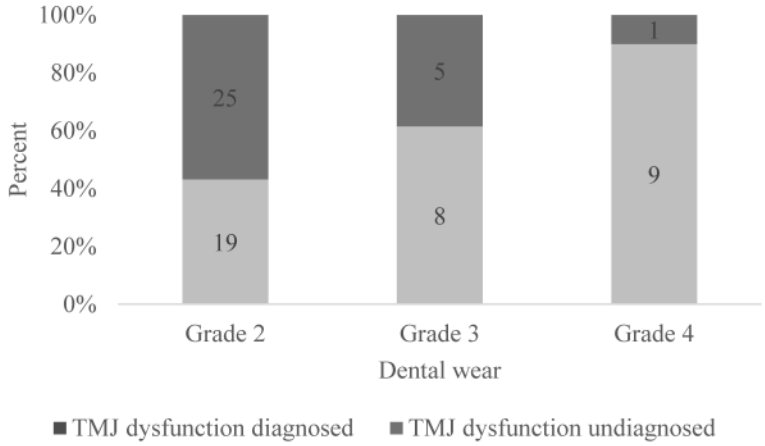

Fig. 7. TMJ dysfunctions diagnosed distribution of molar teeth pathological degree of wear

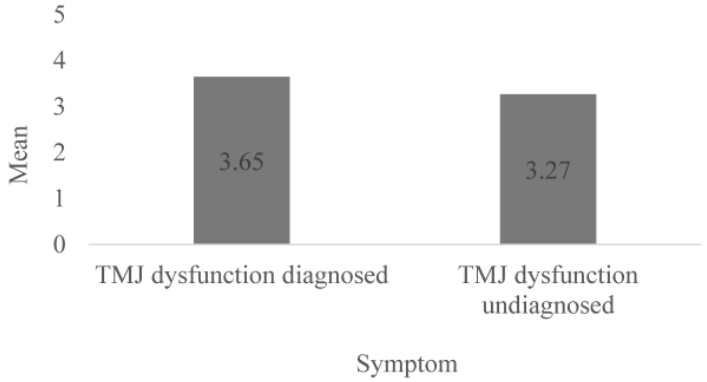

Fig. 8. Central occlusion (CO) and the relative rest of data differences in averages and standard deviations for TMJ dysfunction symptoms

with one of rare TMJ dysfunctions (18%). In patients 35-50 years of age it was diagnosed more frequently (64%). And in patients over 50 years TMJ dysfunction has been diagnosed the most frequently (78%). Spearman correlation coefficient is 0.491 (Fig. 6).

In upper jaw pathological tooth wear degree of lateral teeth and TMJ diagnosed dysfunctions frequency were statistically significant (p=0.023). In the experimental group TMJ dysfunction was diagnosed in 43% of patients with mild to moderate wear with exposure of dentine; in 62% of patients with advanced wear into dentine to loss of occlusal anatomy; and in 90% of patients with pulp exposure to cervical level wear. Spearman correlation coefficient of 0.320 (Fig. 7). Pathological tooth wear of anterior teeth degree and TMJ diagnosed dysfunctions frequency was not statistically significant (p=0.407).

TMJ diagnosed dysfunctions frequency according to height measurements difference between the centric occlusion and the relative rest was statistically significant (p=0.039). In patients who had TMJ dysfunction CO and relative rest height difference was higher than in patients who had not. (Pearson correlation coefficient 0.181) (Fig. 8).

There was no statistically significant relationship between TMJ dysfunction and maximal magnitude of mandibular movement such as protrusion (p=0.199), laterotrusion to the left (p=0.267), and laterotrusion to the right (p=0.573). However there is slight correlation with mandibular retrusion as p<0.05 (Fig. 9).

The most common symptom is joint sounds (,,Nutcracker") was observed in 72.2% (p=0.094), next muscle sensitivity 13.89% (p=0.941), TMJ pain 8.33% (p=0.062), symptoms regarding the mandibular movement extent 16.67% (p=0.051) and it' s type 8.33% (p=0.516). Women is more often diagnosed with TMJ dysfunction joint sounds (42%) than men (35%). This hypothesis was statistically significant (p=0.037). Spearman correlation coefficient – 0.131 (Fig. 10).

DISCUSSION

After the evaluation of the research results, the hypothesis that pathological tooth wear and temporomandibular joint dysfunction are related was confirmed. A statistically significant association (p<0.05) is explained by advanced molars pathological depreciation.

Similar research results has also been mentioned in Francisco and others (2012) (11) Al-Zare (2012) (12) and Levartovsky *et al.* (2015) studies. However, gender is not related to the TW. This was confirmed and by Levartovsky Turn (2015) (9).

In our study we observed significant relationship between the centric occlusion and relative rest height difference measurements and pathological tooth wear in orthognathic occlusion. PTW increases with the age thus the lower third of the face height is being decreased. However, Levartovsky and others (2015) in their studies denied that the lower third of the face height decreases due to tooth wear (9, 13). He stated, that decreased teeth coronal height was compensated by alveolar hypertrophy, so the height of lower third of the face would not change (13). Nevertheless, this research results let to determine that progression of tooth wear in posterior region may cause lower third of the face height decrease and TMJ dysfunction symptoms.

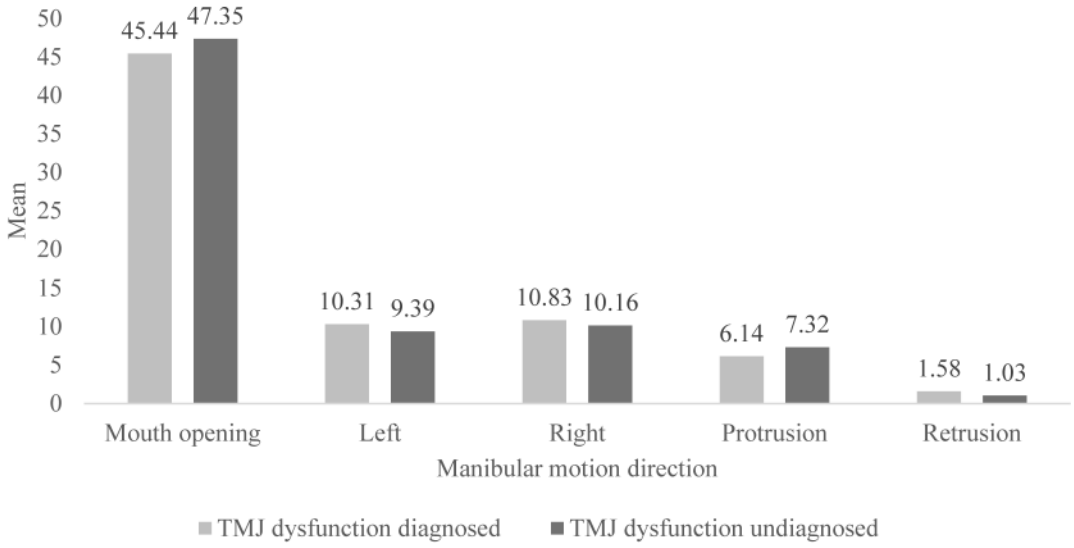

Fig. 9. Mandibular maximum motion amplitude averages for TMJD symptoms

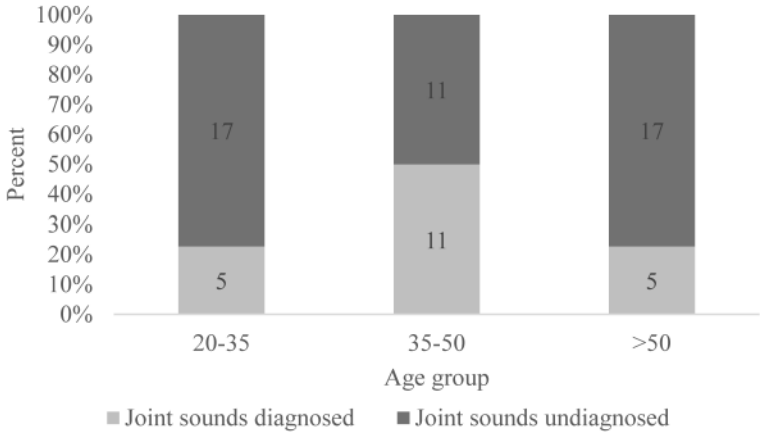

Fig. 10. Diagnosed symptoms of joint sounds of different age groups

In other studies, the authors found conflicting opinions on the TW and TMJ dysfunction interface. This connection Cunha-Cruzsu with his peers (2010) approved by the North West in the United Kingdom (14). However, a limited number of studies reveal a link between tooth wear and TMJ dysfunction. Yadav (2011) found a significant link between tooth wear and muscle sensitivity ($p<0.00$), pain when wide mouth opening ($p<0.05$) and jaw deviation when wide mouth opening ($p<0.00$). However TMJ dysfunction symptoms such as tenderness, pain, sounds and movement restrictions were not associated with worn teeth (15).

Renecker (2011) argued that TMJ dysfunction can occur in humans of all ages, but most often it occurs in the 20-40 age group and 4 times more common in women than in men (6). This trend is evident in this study. Moreover, the most common symptom of dysfunction TMJ was the joint sound, which was more often diagnosed for women (42%) than men (35%).

Summarizing the results of this study the close connection between the pathological tooth wear and temporomandibular joint dysfunction was revealed. However, in order to obtain more reliable results of the relation between following features larger research is required.

CONCLUSIONS

1. 35-50 and over 50 age groups of patients had a higher first molars degree of wear than the younger ones. The difference among genders was not found.

2. Among the different age groups and the differences between the CO and the relative rest connection established linear relationship. When tooth wear degree of posterior segment increases with age, it leads to increase of difference between heights in CO and relative rest.

3. In patients with diagnosed TMJ dysfunction the difference between heights in CO and relative rest was bigger than in patients without TMJ dysfunction ($p=0.039$).

4. TMJ dysfunction symptoms and of posterior teeth pathological wear interface hypothesis

confirmed (p=0.023). In the experimental group TMJ dysfunction was diagnosed the most in 90% of patients grade – 4.

5. The most common symptom is joint sounds (,,Nutcracker") was observed in 72.2% of experimental group patients.

6. Female individuals, who have pathological tooth wear, are diagnosed with TMJ dysfunction clinical symptoms more often than males (p=0.037).

STATEMENT OF CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

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