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Temporomandibular joint disorder and headache – one-year-follow-up

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Abbreviations:
DC/TMD – diagnostic criteria/temporomandibular disorders
DD – disc displacement
MFA – manual functional analysis
MRI – magnetic resonance imaging
TMJ – temporomandibular joint
VAS – visual –analogue scale

Key words: temporomandibular joint, magnetic resonance imaging, headache, osteoarthritis

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Abstract

Background and Purpose: *Aim of this study was to compare the clinical characteristics of patients from the subgroup with osteoarthritis (G-1) and patients with disc displacement (DD) (G-2) of TMJ related types of headaches and with one-year-follow-up after treatment.*

Patients: *G-1 included 70 patients who were treated for signs and symptoms of OA of TMJ. Pain intensity (at first examination T0) in TMJ was shown on the visual-analogue scale (0, no pain; 10, the worst pain) as well as headaches. They were treated by an occlusal splint and/or physical therapy with a six-month(T1) and one-year (T2) follow-up. G-2 included 35 patients from a subgroup with DD. Definitive TMJ-diagnoses were confirmed by magnetic resonance imaging.*

Results: *There was a significant age difference ($p<0.001$) between the two subgroups of TMJ diagnoses, however there were no differences in pain during the follow-up period. In the beginning, the pain amounted to T0: G-1 6.5 / G-2 6.1 and at T2: G-1 1.6 / G-2 1.7. The applied treatment modalities at T1/T2 achieved TMJs without pain in 27.14%/64.29% of patients from G-1 and in 28.57%/57.15% of patients from G-2. There were equal shares of patients without headache (G-1 54.3%; G-2 48 %). The share of tension headaches was G-1 10%, G-2 11.4%, migraines G-1 15.2%, G-2 22.9%, TMJ-related headache G-1 4.3%, G-2 11.4% and cervicogenic headache G-1 15.7%, G-2 5.7%.*

Conclusions: *Pain intensity and treatment success do not vary within the observed groups. Migraine and TMJ-related headaches are more common in patients from G-2.*

INTRODUCTION

Craniofacial pain is a medical issue related to several diagnostic and pain treatment specialist fields which include neurologists, physiatrists as well as doctors of dental medicine*(1, 2)*. The most common types of non-odontogenic orofacial pain are temporomandibular pain and musculoskeletal pain related to masticatory muscles and temporomandibular joints *(3, 4)*.

TMJ disorder is an umbrella term for several TMJ diagnoses, the most common being osteoarthritis (OA) and disc displacement (DD) *(5–8)*. Apart from the musculoskeletal pain of the orofacial region, headaches are the most common neurological pain *(9–11)*. Also, musculoskeletal diseases can develop in other anatomically-topographically approximate areas, particularly in the form of cervicogenic and cervicocephallic syndromes *(12–14)*.

Clinical diagnostics of TMJ disorders are related to the existence of another type of headache, particularly since a special diagnosis of TMJ-related headache according to research criteria for temporomandibular disorders (RC/TMD) was introduced *(15, 16)*. On the other hand, cervicogenic orofacial disorders (headaches) can be viewed in co-morbidity with TMJ disorders. Other most common primary headaches (migraine, tension headache) were also found in TMJ patients *(17–22)*.

Magnetic resonance imaging (MRI) is the gold standard in TMJ disorder diagnostics *(23–25)*. Reversible treatments are the primary choice for the treatment of TMJ disorders, with the occlusal splint and TMJ physical therapy both equally successful *(26–28)*.

The aim of this study was to compare the relationship between clinical characteristics of the patients from the subgroup with osteoarthritis (G–1) and patients with disc displacement (G-2) of TMJ related types of headaches and with one-year-follow-up after treatment.

MATERIAL AND METHODS

The study included 105 patients (mean age 37.8±12.8, 90% women) diagnosed with a TMJ disorder that came to the Department of Removable Prosthodontics at the School of Dental Medicine in Zagreb where their treatment and recalls were carried out. The patients were divided into two subgroups according to different diagnoses of TMJ disorders; the G1 subgroup consisted of 70 patients with OA of TMJ (mean age 48.8±14.5, 94.3% women). These patients were compared to the G2 subgroup of 35 patients who only had DD of TMJ (mean age 27.6±11.1, 85.7% women).

Clinical part of the study

Clinical examination was performed based on the DC/TMD protocol and by manual functional analysis (MFA) according to Bumann and Groot Landeweer *(15, 29, 30)*. The main clinical symptoms were pain in the TMJ (that is in the preauricular region) with limited mouth opening and noticing of noise (crepitation, clicking). Patients with the following traits were excluded: previous trauma resulting in mandibular and/or maxillary fractures, rheumatoid or psoriatic arthritis, facial or jaw anomalies, severe acute, chronic or malignant illnesses or wearing an orthodontic appliance during the diagnostic period. The entire study was approved by the Ethics Committee of the School of Dental Medicine, University of Zagreb and all of the patients gave a written consent for the participation in the study.

The duration of TMJ pain from the onset until the first examination was recorded (in months). Pain in the TMJ was measured on a visual-analogue scale (VAS, 0 – no pain, 10 – strongest experienced pain). Occurrence of TMJ noise was recorded on active mandibular movements and it was recorded during dynamic and passive mandibular manipulations within the MFA. The G1 subgroup of patients with OA was determined by crepitations, whereas the patients from subgroup G2 who were diagnosed with DD had previous clicking in medical history with limited mouth opening and no current clicking and current clicking in the TMJ.

Diagnoses of headache and cervical syndromes (cervicobrachial syndrome, cervicocranial syndrome, cervical syndrome) were made based on previous medical history, examination and diagnosis by a neurologists and physiatrist-rheumatologist. Special attention was paid to the occurrence of headache related to TMJ disorder symptomatology, according to RC/TMD criteria *(15)*.

Definitive diagnoses

Definitive clinical diagnoses of all the patients' TMJs were made by MRI imaging of joints at the Department of Diagnostic and Interventional Radiology, Clinical Hospital Center 'Sestre milosrdnice'. The criteria for OA were subchondral sclerosations with or without preserved cortical bone contours. DD was determined according to disc position within the articular fossa, that is, by the anterior position with respect to the narrowest distance between the condylar head and posterior contour of the tuberculum.

The superconductive magnet device 'Avanto' with 1.5 T magnetic field by Siemens (Erlangen, Germany) was used. MRI parameters for the oblique sagittal view of TMJ for T1-weight image were the followng: time of echo 9.4–15 ms, time of repetition 380–410 ms, field of view 180x180, and matrix 410x512, and proton density image with: time of echo 90 ms, time of repetition 2800 ms, fiel of view 160x160, and matrix 320x320.

Treatment and follow-up

The patients from both subgroups were treated in the same way using the occlusal splint and physical therapy (*27, 28*). Recall was carried out 6 and 12 months after the first examination at the Department of Removable Prosthodontics, School of Dental Medicine, University of Zagreb.

Statistical analysis

The collected data were encrypted and organized as a Microsoft Office Excel 2010 file on a personal computer. Statistical analysis was performed by using SAS software. Descriptive statistics was used for determining the basic statistical parameters (average values, standard deviations, medians, minimum and maximum values). The following statistical methods were used: t-test, chi-squared test, and Fischer's exact test *(31)*.

Clinical variables (numerical and normative) were compared between the two groups (G1 and G2) as well as within the total number of patients (G1+G2) for particular clinical features in the period of the first examina-

TABLE 1

Distribution of the share of patients according to treatment success after 6 months (recall T1) and after 12 months (recall T2) between the examined patient subgroups.

Subgroup of patients	Recall	No discomfort	Discomfort	Minor pain	Pain without improvement	Total
G-1	T1	18 (25.71%)	15 (21.43%)	26 (37.14%)	11 (15.71%)	70 (66.67%)
	T2	24 (34.29%)	21 (30%)	14 (20%)	11 (15.71%)	
G-2	T1	3 (8.57%)	7 (20%)	14 (40%)	11 (31.43%)	35 (33.3%)
	T2	7 (20%)	13 (37.15%)	9 (25.71%)	6 (17.14%)	

G-1, patients with osteoarthritis; G-2 patients with disc displacement of temporomandibular joint

TABLE 2

Distribution of patients between the examined subgroups according to the types of headache.

Subgroup of patients	No headache	Tension headache	Migraine	Cervicogenic headache	Headache related to TMJ	Total
G-1	38 (54.29%)	7 (10.00%)	11 (15.71%)	11 (15.71%)	3 (4.29%)	70 (66.67%)
G-2	16 (45.71%)	5 (14.29%)	8 (22.86%)	2 (5.71%)	4 (11.43%)	35 (33.3%)

TABLE 3

Distribution of the total number of patients according to the occurrence of headache and diagnosis of cervical disorder.

Variable	No cervical disorders	Cervical disorders	Total
No headache	38 (36.19%)	17 (16.19%)	55 (52.38%)
Headache present	18 (17.14%)	32 (30.48%)	50 (47.62%)
Total	56 (53.33%)	49 (46.67%)	105 (100%)

TABLE 4

Distribution of certain types of headaches depending on cervical spine disorders in the total sample of both patient subgroups.

Variable	No headache	Tension headache	Migraine	Cervicogenic headache	Headache related to TMJ	Total
No cervical disorders	37 (35.24%)	5 (4.76%)	10 (9.52%)	1 (0.95%)	3 (2.86%)	56 (53.33%)
Cervical disorders	17 (16.19%)	7 (6.67%)	9 (8.57%)	12 (11.43%)	4 (3.81%)	49 (46.67%)
Total	54 (51.43%)	12 (11.43%)	19 (18.10%)	13 (12.38%)	7 (6.67%)	105 (100%)

tion (T0) and on two recalls: after 6 months (T1) and after one year (T2).

Previous pain duration (in months), pain on VAS in TMJs, active mouth opening (in mm), bruxist activity (no, yes), occurrence of headache (no, yes; and certain types of headache: tension headache, migraine, cervicogenic headache, TMJ-related headache), existence of cervical syndromes and polyarthritis (no, yes) were recorded

at T0. Pain on VAS was measured at T1 and T2. Subjective treatment success was determined as: condition without discomfort, discomfort in TMJ, less pain than at T0, unchanged pain intensity compared to T0.

The reliability of MRI assessment was evaluated for each diagnosis of DD on the basis of two researchers' (a radiologist's and a dentist's) inspection by means of Kappa statistics (*31, 32*), which was conducted on MRI images independently of the clinical signs of 12 patients, twice on the same MRIs of both TMJs. Using Cohen's kappa statistics, the interexaminer agreement was measured between 0.8 and 1.0 for MRIs.

RESULTS

There was a significant age difference (t-test=7.632 (df103) with p<0.001) between the two subgroups of TMJ diagnoses, however there were no differences in pain during the follow-up period. In the beginning, the pain on VAS at T0 for G-1 amounted to 6.5 and for G-2 it was 6.1 (t-test=1.3977 (df103) with p=0.2175). During the first recall (T1) pain on VAS for G1 was 2.3, and for G2 it was 3.3, which had borderline statistical significance (t-test=–1.9155 (df103) with p=0.0582). During the T2 recall pain intensity was much lower but without significance in the subgroups: pain on VAS for G1 was 1.6, and for G2 was 1.7 (t-test=–0.2984 (df103) with p=0.7660).

The applied treatment modalities at T1/T2 achieved TMJs without pain in 47.14%/64.29% of patients from G-1 and in 28.57%/57.15% of patients from G-2 (Table 1). There were equal shares of patients without headache (G-1 54.3%; G-2 48 %; chi-squared test (df1)=0.3055 with p=0.5805). The share of certain types of headaches in both groups was 55 tension headaches (52.38%), 11 migraines (10.48%), 13 cervicogenic headaches (12.38%), and headache related to TMJ-disorder in 7 patients (6.67%). There was no statistical significance in the distribution between the G-1 and G-2 subgroups of patients (Fisher's Exact p=0.2792; Table 2).

In the subgroup with OA (subgroup G-1), 51.4% of patients suffered from cervical spine disorders whereas only 34.3% of patients from G-2 suffered from the same disorders. There was a statistically significant difference (chi-squared test (df1)=11.5227, with p<0.0007; Table 3) regarding the total sample of patients (G-1+G-2) depending on the occurrence of headache. The distribution of certain types of headaches depending on diagnosed cervical disorder is statistically significant (Fisher's Exact Test p=0.001; Table 4).

DISCUSSION

The term TMJ disorder encompasses a series of different diagnoses involving musculoskeletal diseases manifested in the stomatognathic system.Although clinical diagnostics is of primary importance to musculoskeletal disease diagnostics, the variability of symptomatology, apart from the generally present joint pain, makes the final diagnosis difficult (*2–4, 33*). On the other hand, the use of MRI and other radiological procedures is impossible in everyday practice. Due to that, a system of unified diagnostics has been developed and in the latest revision it was called RC/TMD (*15, 16*).

There are two main diagnoses in the unique population of patients with TMJ disorder, DD and OA (*6–8*). This study also confirmed that patients with OA of TMJ had higher mean age. As opposed to clinical studies, there is a problem with determining the diagnosis in joints with only arthralgia and therefore MRI remains the gold standard in TMJ diagnostics. Manfredini *et al. (7)* determined the mean age for the subgroup with DD which was 32.7 and the mean age for OA patients which was 54.3 years, both values higher than the age values in this study. Also, the predominance of females was confirmed, up to 91.3%.

Along with the main symptoms of TMJ, secondary diagnostic symptoms are also mentioned, otalgia being one of the more significant ones, but also headaches. However, those are not pathognomonic symptoms and the symptoms related to the ear are also viewed as a part of otorhinolaryngological diagnostics (*33*), whereas headaches have a greater significance for neurological diagnostics of orofacial and craniomandibular pain (*9*). Primary headaches are mainly related to myogenic TMDs and not arthrogenic ones (*20*) and this is supported by the results of the recent study: more than half (52.5%) of all patients do not have headaches at all and cervicogenic headache is typical for OA patients.

Headache as a symptom was significantly more frequent in TMD patients than in the group of non-TMD subjects (*20*). Plesh *et al.* (*19*) mention the five times greater prevalence of migraine (20%) in female patients who are twins which is connected to the occurrence of TMDs, also predominant in women and it has a genetic background *(22).*

Two groups of arthrogenic TMD patients were compared in this study and there were no differences between them although more patients with DD of TMJ (G-2 subgroup) had migraine and TMJ-related headache. The results of this study are not completely comparable to previous studies with the same subject because a recent study used a new diagnosis of 'TMJ contributed or related headache' which better explains orofacial pain bordering between TMJ arthralgia and tension headache. The complex nature of the trigeminal system sensory features is obvious in the mandibular and maxillary involvement in migraine pain and this should be taken into account in differential diagnostics (*21*).

The neuroanatomical basis for the interaction between the orofacial (trigeminal sensory area) and the cervical region is evident from the assumption that the sensory nerve fibers in the centrifugal tract of the trigeminal nerve interact with sensoryfibers from the upper cervical roots belonging to the trigeminocervical nucleus. Cervicogenic headache is often related to myofascial disturbances which can also affect masticatory muscles. The prevalence of cervicogenic headache in the sample of patients at pain management clinics was around 20% and four times higher in women (*12*); which was also shown in our study for patients with OA of TMJ (15.7%).

There was no consensus for the confirmation of the interdependence between TMJ disorder and cervical spine disorders (*14*). Hyperlordosis of cervical spine was determined in patients with TMDs but without definitely confirming the risk of its occurrence *(18).*

There is an existing opinion that there was potential interdependence between asymptomatic DD of TMJ, which would correspond with cervical spine disc prolapse (*34*). Parallel follow-up of TMJ treatment by occlusal splint and of the spinal parameters (spinal pain and mobility) revealed simultaneous significance of healing (*17*). Michigan occlusal splint is considered to be the optimal reversible means of occlusal orthosis and it has been shown to significantly reduce pain in the TMJ along with physical therapy. However, similarly to our study, there were no differences in the influence of TMJ treatment on the entire treatment success (*26–28*). Patients of younger age with lesser cervical spine disorders (patients with DD, subgroup G-2) have equal possibilities of treatment success as the subgroup of patients who are older and with greater cervical spine involvement in painful syndromes.

Although TMD diagnostics using the standardized DC/TMD protocol enables us to compare different researches, in order to make a definitive diagnosis, MRI is needed (*23–25*).

In conclusion, among patients with TMJ disorder there are two age groups: patients with OA (G-1) are significantly older. Pain intensity and treatment success do not vary within the observed groups. Cervical disorders and the related headache are dominant in G-1 patients. Migraine and TMJ-related headaches are more common in patients from G-2. Treatment failure in both patient groups was almost equal, between 15.7% and 17.1%. The analysis of the total sample showed that patients with cervical spine disorders had more headaches.

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