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Physical therapy with topical ketoprofen and anxiety related to temporomandibular joint pain treatment

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Abstract

The aim of this study was to evaluate the level of anxiety and the use of physical therapy combined with topical application of a non-steroidal anti-inflammatory drug ketoprofen gel for the treatment of temporomandibular

joint (TMJ) disorder. During an 8-month period, 32 patients were examined (mean age 38.3 years) and went to physical therapy with topically applied Fastum gel. The control group consisted of 20 students of dental medicine (mean age 23.5 years). All subjects were examined by magnetic resonance imaging. The main outcome measuring criteria were: pain intensity rated on a visual-analogue scale, maximal mouth opening capacity, and anxiety evaluated by Spielberger's State-Trait Anxiety Inventory (STAI 1 – concerning anxiety as subjective state, in a period of last week, including today, and STAI 2 – concerning anxiety as relatively stable individual characteristic). The median of active mouth opening for patients was 40.75 mm before treatment and 52.25 mm for control subjects, which was statistically significant ($p < 0.001$). The difference in all pain evaluations on AVS scale after the treatment was shown to be statistically significant (t-test with $p < 0.001$): pain upon mandibular movement was 1.5, 0.1 at rest and 1.7 during palpation. While there were no differences in anxiety levels of STAI 1 ($p = 0.0666$), there was a statistically significant difference of STAI 2 ($p = 0.0096$). Comparing asymptomatic subjects, their active mouth opening was greater than in patients before ($p < 0.0001$) and after the treatment ($p < 0.0011$). Physical therapy is a recommended modality for TMJ pain treatment. Nevertheless, even immediately after the treatment, the patients had a lower capacity of mouth opening compared to the asymptomatic group.

Key words: temporomandibular joint, physical medicine, magnetic resonance imaging, treatment, anxiety.

Povezanost liječenja bolova temporomandibularnog zgloba s anksioznošću i fizikalnom terapijom s topikalnim ketoprofenom

Sažetak

Povezanost liječenja bolova temporomandibularnog zgloba s anksioznošću i fizikalnom terapijom s topikalnim ketoprofenom

Svrha rada je evaluirati razinu anksioznosti i korištenje fizikalne terapije u kombinaciji s topikalnom primjenom nesteroidnog antireumatika ketoprofen gela u liječenju poremećaja temporomandibularnog zgloba (TMZ-a). Tijekom 8-mjesečnog perioda pregledana su 32 bolesnika (prosječna dob 38,3 godine) koja su išla na fizikalnu terapiju i topikalnom primjenom Fastum gela. Kontrolnu skupinu činilo je 20 studenata dentalne medicine (prosječna dob 23,5 godina). Svi ispitanici pregledani su magnetskom rezonancijom. Glavni kriteriji uspjeha bili su: intenzitet bolova ocijenjen na vizualno-analognoj skali (VAS), mogućnosti maksimalnog

otvaranja usta i anksioznost evaluirana po Spielbergerovom State-Trait Anxiety Inventory (STAI 1 – anksioznost smatrana kao subjektivno stanje u periodu zadnjeg tjedna uključujući i danas te STAI 2 – anksioznost smatrana kao relativno stabilna individualna karakteristika). Medijan aktivnog otvaranja usta za bolesnike bio je 40,75 mm prije liječenja i 52,25 mm nakon liječenja, što je bilo statistički signifikantno ($p < 0,001$). Razlika za sve evaluacije boli na VAS skali nakon liječenja pokazala se je statistički signifikantna (t-test with $p < 0,001$): bol pri kretnjama mandibule bila je 1,5, 0,1 u mirovanju i 1,7 na palpaciju. Pritom nije bilo razlike u razini anksioznosti za STAI 1 ($p = 0,0666$), ali je bilo statistički signifikantne razlike za STAI 2 ($p = 0,0096$). U usporedbi s asimptomatskim ispitanicima, njihovo aktivno otvaranje usta bilo je veće nego u bolesnika prije ($p < 0,0001$ i poslije liječenja ($p < 0,0011$). Fizikalna terapija je preporučeni način liječenja bolova TMZ-a. Ipak i odmah nakon liječenja bolesnici imaju manji kapacitet otvaranja usta u usporedbi s asimptomatskom skupinom.

Ključne riječi: temporomandibularni zglob, fizikalna terapija, magnetska rezonancija, liječenje, anksioznost.

Introduction

Temporomandibular disorders (TMDs) consist of a disorder of masticatory muscles and/or a disorder of temporomandibular joint (TMJ). Arthrogenic disorder is divided into two separate subgroups: osteoarthritis and disc displacement (1). The most frequent forms of disc disorder are variations of anterior disc displacement (DD). Pain, limited mouth opening, and clicking or crepitation TMJ noises are the most important symptoms and a clinical sign of myogenic and arthrogenic form of TMDs (2, 3). Secondary symptoms can be otological (most commonly otalgia) and headaches (tension type headache) (4). Apart from clinical diagnostics, magnetic resonance imaging (MRI) is the gold standard in TMJ diagnostics (5).

Due to their nonspecific etiopathogenesis, there is still no gold standard in treatment of TMDs, so the modalities include irreversible, non-invasive and mostly symptomatic procedures. The existing concepts of treatment are being developed (various types of occlusal splints) and they can complement each other or be used independently (such as physical therapy, methods of complementary and alternative medicine, etc.) in patients with TMJ disorder (6-13).

The aim of this study was to evaluate the use of physicomedical therapy combined with topical application of Fastum gel® for the treatment of TMJ disorder during an 8-month period. Apart from the patients' group, clinical parameters and anxiety levels were also compared with asymptomatic student population.

Methods

In the period from September 2008 to May 2009, 43 patients were examined (mean age 39.8 years, standard deviation 16.2, 88.4% women) for clinical signs and symptoms of TMJ at the Department of Removable Prosthodontics, School of Dental Medicine, University of Zagreb. Out of those, 32 patients were selected (mean age 38.3 years, standard deviation (SD) 17.2, 93.8% women) on the basis of their medical history and a clinical examination and treatment indicated. The control group consisted of 20 students of dental medicine (mean age 23.5, SD 1.5, range 14-67 years; 70% women). On request of the Ethics Committee, School of Dental Medicine, University of Zagreb, all subjects signed an Informed Consent confirming their voluntary participation in this research. The diagnosis of arthrogenic TMD was made based on patient's medical history data as well as on clinical examination using standardized methods contained in the Research Diagnostic Criteria (RDC) for TMD (14) and supplemented by manual functional analysis (15). An active need for TMD treatment was determined according to clinical symptoms and signs of disorder. The criteria for inclusion were: pain in the TMJ, limited mouth opening and pathologic noise. Bruxism was diagnosed based on medical history and tooth wear analysis.

Definite TMJ diagnostics was made by MRI at Clinical Department of Diagnostic and Interventional Radiology, "Sestre milosrdnice" Clinical Hospital Centre, Zagreb. The MRI diagnostics was performed by T1 weighted (TR 450/TE 12; matrix 256 x 192; 160 x 160 field of view) and T2 weighted images (TR 3000/TE 66; matrix 389 x 512; 190 x 190 field of view), and seven slices of images with a 3 mm thickness) using the magnet on a "Harmony" (Siemens, Erlangen, Germany), at magnetic field magnitude of 1T.

The following diagnosis of TMJ disorder was confirmed: anterior disc displacement in 25 (78.1%) and osteoarthritis in 7 (21.9%) patients. In collaboration with a rheumatologist-physiatrist, patients went to physical therapy (including electroanalgesia, sonophoresis, and orofacial exercise according Schulte) and topically applied Fastum gel®, a non-steroidal anti-inflammatory drug (NSAID), ketoprofen gel (16, 17).

In the period before and after treatment (8-month recall) the main outcome measuring criteria were: pain intensity rated on a visual-analogue scale (VAS) at mouth opening, at rest and during TMJ palpation; and maximal mouth opening capacity measured by gauge. The level of anxiety was evaluated by Spielberger's psychological measuring instrument State-Trait Anxiety

Inventory (STAI 1 – concerning anxiety as subjective state, feeling in a period of last week, including today, and STAI 2 – concerning anxiety as relatively stable individual characteristic in general throughout life). Elevated anxiety levels were determined according to the patient's age and gender following the borderline values according to Spielberger (18).

Statistical analysis was performed using STATISTICA (StatSoft Inc., Tulsa, Oklahoma, USA) program. Data were analyzed by t-test for independent and dependent samples, chi-squared test or Fischer's exact test, and Spearman rank correlation. Quantiles Q1 = 25% and Q2 = 75% were expressed along with median values in abnormal distribution (19). The reliability of MRI interpretation was tested for all subjects on the basis of two researchers' (D. Z. and T. B.) inspections, which were conducted independently of each other and of the patient's clinical signs in TMJs, and they were evaluated by Cohen kappa index ($\kappa = 0.80 - 1.0$).

Results

The most prominent symptom was pain in TMJ in 31 (96.9%) patients. 20 (62.5%) of the patients had clicking in TMJ, 11 (34.4%) had crepitation, 10 had pain in the cheek (31.3%), and 17 had ear pain (53.1%). 23 (71.9%) patients complained about limited mouth opening. Pain was occasional in most of the patients (26 of them, 81.2%), that is, it did not occur spontaneously or in resting position of the mandible. 15 patients had headaches (46.9%) and 7 (21.9%) had changes in pain intensity related to the weather conditions. 11 patients (73.33%) had a statistically significant connection between the symptoms of otalgia and headache (Fisher's exact test, $p = 0.0416$). 17 patients (53.10%) complained of otalgia. Bruxism was diagnosed in 19 patients (59.40%).

The values of pain intensity measured by VAS before treatment and during the 8-month recall were shown to be statistically significant (Table 1). The median value of previous pain duration before seeing a dentist was 6 months (Q1 = 2, Q2 = 24 months with range 14-67 months). Namely, chronic pain lasting longer than 3/6 months was present in 56.3%/71.9% of the patients.

The mean of active mouth opening for patients was 39.4 mm (SD 9.2, range 17-54.5) before treatment and 44.5 mm (SD 10.3, range 3-60) after treatment with statistical significance (t-test = -3.25 with $p = 0.0028$). Passive mouth opening was measured during the first examination (mean 46.8 mm, SD 8.8, range 25-64.5) and compared to the value of active mouth opening measured

VAS	movement		at rest		during palpation	
period of examination	T0	T1	T0	T1	T0	T1
mean	6.6	1.5	1.9	0.1	3.7	1.7
SD	1.3	1.6	2.3	0.4	2.3	1.9
minimum	4.0	0.0	0.0	0.0	0.0	0.0
maximum	9.5	5.0	7.3	2.0	9.5	6.6
t-test	13.61, $p < 0.0001$		4.53, $p < 0.0001$		5.63, $p < 0.0001$	

VAS, visual-analogue scale; T0 first examination, T1, 8-month recall

Table 1. Comparison of pain intensity values on VAS before and after therapy for all patients

during the same examination; this resulted in a positive correlation which was statistically significant (Spearman correlation coefficients 0.86493 with $p < 0.0001$).

Values of STAI test for patients before and after therapy were compared: there were no statistically significant differences between STAI 1 and STAI 2 values of the patients' anxiety levels (Table 2). Patients were analyzed depending on the determined anxiety and divided into those without ($n_{patients} = 15$) and those

anxiety level	STAI 1		STAI 2	
period of examination	T0	T1	T0	T1
mean	38.9	38.4	41.1	41.6
SD	10.5	13.4	8.2	11.1
minimum	21	20	18	20
maximum	55	68	60	63
t-test	0.32, $p = 0.7506$		-0.40, $p = 0.6954$	

Table 2. Comparison of anxiety values on STAI tests before and after therapy for all patients

with ($n_{patients} = 17$) elevated anxiety levels on STAI 1. Values of pain intensity on VAS were compared, active mouth opening and previous pain duration prior to the first examination. A statistically significant difference was only shown in VAS variable concerning palpation prior to treatment (t test = -2.82 with $p = 0.0072$). In the same comparison of variables for STAI 2 (no anxiety npatients = 8 and elevated anxiety $n_{patients} = 24$), a statistical significance was found for VAS at rest (t test = -3.35 with $p = 0.0024$) and VAS on palpation (t test = -2.96 with $p = 0.0064$) prior to treatment.

The comparison of patients with elevated anxiety and those without anxiety on STAI 1 (chi-squared test (df1) = 0.0046 with $p = 0.0461$) and STAI 2 (Fisher's

exact test, p = 0.1006) did not show any differences in bruxism variables. There was a statistically significant greater finding of headache ($n_{patients}$ = 11 with anxiety and $n_{patients}$ = 6 without anxiety) in patients with elevated anxiety level on STAI 1 (Fisher's exact test, p = 0.0416), but not on STAI 2 (equal $n_{patients}$ = 12 with and without anxiety (Fisher's exact test, p = 0.6911).

As much as 81.26% of the patients had no disturbances after treatment, or they experienced a significant improvement (Table 3). There was no significance in the evaluation of treatment success according to the determined anxiety of the patients (for STAI tests, Fisher's exact test, p = 1.000). During the

Evaluation of treatment success	$n_{patients}$ (%)	Clinical condition after therapy	$n_{patients}$ (%)
No disturbances	11 (34.38%)	No disturbances	12 (37.5%)
Significant improvement	15 (46.88%)	Painless noise in the TMJ	10 (31.25%)
Improvement	5 (16.63%)	Reduced pain in the TMJ	9 (28.12%)
Clinical picture unchanged	1 (3.11%)	Pain intensity without improvement	1 (3.13%)

N, number of patients; TMJ, temporomandibular joint

Table 3. Evaluation of treatment success and clinical condition at the recall examination for patients

recall clinical examination, 68.75% of the patients had no pain in the TMJs, only painless noise was present (Table 3). There was also no significance of treatment success (Table 3) depending on the determined anxiety (for STAI 1: Fisher's exact test, p = 2654; for STAI 2: Fisher's exact test, p = 0.3830).

The comparison of active mouth opening in asymptomatic subjects (mean value 52.1 mm, SD 5.5 with range 42-62) determined that in patients, prior to treatment, active mouth opening was statistically significantly smaller (t test = -5.55 with p < 0.0001), and when this difference was compared with the values obtained after the treatment it was still significant (t test = -3.48 with p < 0.0011).

In comparison of anxiety levels, STAI 1 value for asymptomatic subjects (mean value 34, SD 6.8 with range 23-48) was smaller compared to the patients, but without statistical significance (t test = 1.88 with p < 0.0666). However, there was a statistically significant difference in STAI 2 scores (t test = 2.69 with p = 0.0096) between asymptomatic volunteers (mean value 36.1, SD 5.2 with range 27-47) and patients.

Discussion

Apart from the predominant TMD treatment by occlusal splints within dental practice, there is a possibility of parallel or independent use of other treatment methods, particularly from the field of physical medicine, rehabilitation and rheumatology (20). A unique program of kinesiotherapy was promoted by the German dentist Schulte in the early 1970s of the 20th century, which was also implemented in Croatian dental practice (16, 17).

The RDC/TMD was proposed for clinical and epidemiological research; therefore, manual functional analysis was used to obtain a more complete description of the clinical findings and to define a precise diagnosis in accordance with the patients' main somatic complaints (21).

Validated measuring of pain intensity is often used as the primary outcome variable. The multidimensional feature of chronic musculoskeletal pain should particularly be taken into consideration, whereas previous pain duration is not crucial in treatment success prognostics in order to obtain satisfactory analgesic effects (6). This study even revealed a negative correlation between pain intensity and previous pain duration before seeing a dentist. Psychosocial instruments have been developed to measure the impact of disease on orofacial and general health. Although RDC/TMD also implies an evaluation of the patient's mental health, it does not include measuring anxiety levels. On the other hand, STAI is an easy-to-use tool for the evaluation of pain, oral function and patient's psychological condition (22, 23).

A clinical survey by Fernandes et al. (24) demonstrated that 58% of TMD individuals present sleep bruxism, which is in agreement with the present study. Patients with bruxism carried a greater risk of myofascial pain and TMJ arthralgia. Kerschbaum et al. (7) demonstrated the efficiency of physiotherapy: pain relief was 30% and treatment success in 90% of patients (78% female, mean age 38.6 years with range 19-79 years). The initial value of pain intensity during mouth opening was 5.3, and after treatment it amounted to 2.9. A complete treatment success was achieved in 70% of the patients and only pain reduction in 21%. In 8% of the patients, there was no improvement during the period of physical therapy. Compared to our study, the treatment success was similar and there were fewer patients without any improvement.

Demling et al. (8) verified the clinical TMJ diagnosis by MRI, and found that physical therapy is efficient as an adjunctive treatment to the Michigan splint which leads to the reduction of pain on VAS (from 5.4 before to 2.6 after

treatment) and greater mobility of the mandible (30.8 mm before and 40.8 mm after treatment). Comparing these results with the results of our study, our patients experienced more pain before treatment and better analgesic effects were achieved after. Regarding mouth opening, in this study, the patients had a greater capacity of mouth opening prior to the therapy compared to the patients in the study by Demling et al. whereas the values of mouth opening after treatment were similar in both studies (8).

Nicolakis et al. (12) researched the influence of physical therapy on patients with osteoarthritis of TMJ. The initial period without treatment served as a control period in which there was no improvement. After physical therapy, there was a significant improvement in mandibular mobility and no pain at rest in 80% and no impairment in 37% of the patients' sample.

According to Di Fabio (9), in management of TMD, physical therapy improved both the physical and emotional dimensions of health-related quality of patients' life. Clark et al. (25) used treatment protocol with occlusal splint, physical therapy (home based exercise program) procedures and NSAID Ibuprofen taken orally. Comparing the pre-treatment and post-treatment data, they found significant improvement for pain intensity (from 4 to 1.2 on VAS) and active mouth opening (from 39 to 46 mm). Contrary to our findings, using the same Spielberger's STAI, Clark et al. (25) found significantly lower level on both STAI scales, however, the anxiety level was still elevated (62 in pre-treatment versus 56 in post-treatment). Anxiety is a characteristic of TMD patients, particularly of the elderly ones (26). In this study, a connection was found between anxiety as a personality trait and TMJ pain at rest, that is, on palpation.

NSAIDs are used in treatment of musculoskeletal pain. However, the use of topical NSAIDs revealed a lack of randomized controlled and placebo-controlled trials in order to obtain sufficient data regarding their use for TMJ pain. Since oral NSAIDs carry a high risk for complications, topical forms of NSAID seem to be a useful complementary therapy of TMDs (27).

In conclusion, during an 8-month follow up it was shown that a better and mostly painless oral function was achieved. VAS, mouth opening measurement and STAI are easy-to-use tools for the evaluation of pain, oral function and patient's psychological condition. Painless joint sounds alone are generally a benign condition. Nevertheless, even after the treatment, the patients had a lower capacity of mouth opening compared to the asymptomatic group.

Conflict of interest statement

Berlin-Chemie Menarini Hrvatska d.o.o. donated free samples of Fastum gel® to the patients who participated in this study.

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