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SELF-MASSAGE AND LOW-LEVEL LASER IN TREATMENT OF MASSETER MYALGIA: SHORT-TERM EFFECT

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SUMMARY

Introduction: *The aim of this study was to explore the efficiency of massage in the treatment of masseter myalgia compared with biostimulatory laser.*

Materials and methods: *The instrument Diagnostic Criteria for Temporomandibular Disorders was used to select subjects and monitor treatment outcome. 54 subjects with masseter myalgia of more than 3 months in duration were invited to participated and 42 cases were available at the end and analyzed. Age range was 16-67 years (median 33, interquartile range 25-53), 36% subjects was ≥40 years and there were 62% females in both groups. Both treatment groups (self-massage and laser) had 21 participants and were monitored one months after the start of treatment. Age, gender, distress, somatization, catastrophizing, hypervigilance, health competence and oral parafunctions were also assessed as factors that could influence effectiveness of treatment.*

Results: *Laser and massage are effective in reducing symptoms of chronic myalgia of the masseter in self-reported limitation of jaw function and reducing pain intensities ($p<0.001$). Increase of mouth opening was present in both groups, but mainly significant in laser group. The differences in the amount of change between groups were not significant. Psychological characteristics and parafunctions, present before the treatment, age and gender did not have major affect the effectiveness of treatment.*

Conclusion: *Both treatment modalities are effective in treatment of chronic myalgia in short-term.*

Key words: *facial pain - temporomandibular joint disorder - physical therapy – distress - catastrophizing*

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INTRODUCTION

Temporomandibular disorders (TMD) include clinical conditions involving the masticatory muscles and / or jaw joints and surrounding structures (Dworkin 1999, Okeson 2015). Symptoms include muscle pain, joint pain, and headache at rest, localization and spread of pain, and changes in function-related pain (pain onset or pain reduction) (Spalj 2019). Epidemiological studies indicate that 40–75% of people in the population have at least some sign of impaired stomatognathic function during life, and that 20–25% of people have significant symptoms of temporomandibular disorders (Okeson 2007, Scrivani 2008). The prevalence of temporomandibular disorders and pain begins to increase in adolescence, growing until the age of forty, and then decreesing. Therefore, the prognosis is favorable, as the condition will still tend to decrease with age (Lovgren et al. 2016). In addition to the prevalence of TMP and pain being twice as high in women as in men, women are also more sensitive to pain than men are. The reason is probably in estrogen that can act pronociceptively in chronic pain (Berger et al. 2015). Myalgia can be a direct disorder of muscles and fascia, but also a centrally generated pain that is only felt in the masticatory muscles. Excessive sensitivity to pain may be due to the response of the hypothalamic-adenohypophysis-adrenal cortex axis to chronic exposure to stress (Smith & Vale 2006). Increased emotional stress may exacerbate myofascial pain due to increased activity of gamma efferent neurons on muscle spindles or due to increased activity of the sympathetic nervous system (Pierce 1995). Local factors affecting muscle activity such as habits, posture, and tension can affect myofascial pain (Gerwin 2001). Systemic factors such as hypovitaminosis, poor physical condition, fatigue, and viral infections can affect or even cause myofascial pain (Gerwin 2001). The effect of psychological stress appears to be manifested primarily through disorders in the masticatory muscles (Pallegama 2005). Psychological stress is thought to act on muscles through the endocrine and neural mechanisms that are influenced by the limbic system and motor cortex that

convert emotional and cognitive processes into a motor response, which ultimately leads to spasm. Diagnosis of myofascial pain is based on anamnestic data and clinical examination. There are currently no specific laboratory tests or radiological tests that could diagnose myofascial pain. Therapeutic procedures are mainly interdisciplinary and include patient self-care and education, cognitive-behavioral therapy, pharmacological treatment, occlusal splint therapy, occlusal therapy, physical therapy, and surgical treatment. In order to achieve a cure, it is necessary to eliminate maintenance factors as well. The main goals of physical therapy in the treatment of TMP are reflected in the reduction of pain and reduction of muscle hyperactivity, enabling their relaxation and the restoration of muscle function and mobility of the temporomandibular joint. Physical therapy consists of electro physical modalities (ultrasound, microwave therapy, laser), electro analgesic modalities (transcutaneous electrical nerve stimulation, interference current, biological feedback), and dressing, acupuncture, excercise and manual techniques (Morell 2016, Medlicott & Harris 2006). The efficacy and effectiveness of physical therapy in the treatment of TMP has been studied and evaluated for many years, and success ranges from 15-79%, depending on the modality (Feine & Lund 1997, McNeely 2006). The main effects of low-level laser therapy are a reduction in the inflammatory process, modulation of growth factors and myogenic regulatory factors, and increased angiogenesis (Alves et al. 2014). The aim of this study was to explore the efficiency of massage in the treatment of masseter myalgia compared with biostimulatory laser.

MATERIALS AND METHODS

The research was conducted in the Private practice of Oral Surgery Dr. Fetai in Medulin and the Orofacial Pain Clinic at the Clinic for Dental Medicine, University Hospital Center Rijeka, and Reference Center for Orofacial Pain of the Ministry of Health of the Republic of Croatia. Subjects were persons diagnosed with chronic myestergic muscle myalgia (unilateral or bilateral) seeking treatment, and included all forms of chronic masseur myalgia according to the DK / TMP protocol (local myalgia, myofascial pain, transmitted myofascial pain). Excluding criteria were admission to the dental office due to periodontitis, caries, extraction or trauma. Recruitment of respondents took place in 2018 and 2019. We examined 194 subjects who were referred by a specialist primary dentist (prosthetic, oral surgeon, maxillofacial surgeon, or orthodontist) for long-term jaw joint dysfunction or orofacial pain. Painful TMP was present in 78 subjects, of whom 54 had myalgia for more than three months and were invited to participate. 52 subjects agreed to participate, and by the end of the study, 42 subjects remained who were gender and approximately age-matched (21 in each treatment group). The age of the subjects ranged from 16-67 years (median 33, interquartile range 25-53), of which 62% were women. The proportion of women was equal in both treatment groups, and 36% of subjects were ≥40 years of age. Research participants were informed about the nature and purpose of the research and were asked to sign the Informed Consent. The aim and purpose of the research were explained to each respondent, and the course and methods of the research were briefly explained to them. The Ethics Committee of the Faculty of Dentistry, University of Zagreb (number 05-PA-15-12/2017), approved the research. Diagnostic criteria standardized by the International Network for the Methodology of Orofacial Pain and Related Disorders in 2014 were used. Assessment instruments Diagnostic criteria for temporomandibular disorders (DK / TMP) were translated into Croatian using the forward-backward method, under the supervision of a team of experts from the University of Rijeka and the University of Zagreb. In subjects diagnosed with chronic myalgia of the masticatory muscles, the effectiveness of two treatment methods was examined: 1. massage and 2. bio stimulation InGaAsP diode laser (Biolase Epic X (Biolse Inc, Irvine, USA)) The initial laser power was 6 W, wavelength 940 nm , energy 1800 J, positioning of the probe in the area of skin pain (area 4 cm^2) with continuous circular motion and exposure time of 7 minutes. During treatment, participants were advised not to use analgesics. The study was designed to be a randomized controlled trial, and for randomization was Internet source http://www.randomization.com was used At the beginning of the study (T0) a clinical examination was performed, mandibular dynamics were recorded (DK / TMP questionnaire Axis I) and assessed symptomatology and psychological dimensions (DK / TMP questionnaire - Axis II) (Schiffman et al. 2014) Respondents completed the Symptom Questionnaire (Pain, Headache, Sounds, Braking), Chronic Pain Grading Scale, Jaw Function Limitation Scale, List (Schiffman et al. 2014) and reported the intensity of three types of pain - pain at rest, pain when chewing and headache on a 100-mm visual analog scale (Schiffman et al. 2014, Ohrbach & Larsson & List 2008, Ohrbach et al. 2008).

Instruments assessed psychological traits: Perceived Health Competence Scale, Somatosensory Gain Scale, Short Hypervigilance Scale, Excessive Pain Severity Scale, General Anxiety Disorder, and Patient Health Questionnaires (Smith et al. 1995, Kroenke et al. 2001, Spitzer et al. 2006, Kroenke et al. 2002, Barsky et al. 1990, Bernstein et al. 2015, Maric et al. 2011.). After randomization, subjects in the laser-treated group came to the outpatient therapy for four weeks (every other day), and the home self-massage group did not come at that pace. After 4 weeks (last day of therapy; T1), a clinical examination was performed again with analysis of mandibular dynamics (Os I DK / TMP). The patient reported symptomatology with instruments: Chronic

pain grading scale, Jaw function limitation scale, and visual analog scale for assessing pain at rest and chewing, and headache. The Shapiro-Wilkov test was used to assess the normality of the data distribution. For the data that followed the normal distribution in the statistical analysis of the effectiveness of the types of physical therapy and the duration of the effect, a mixed type of analysis of the variant with the Bonferroni post-hoc test was used. Otherwise, the Kruskal-Wallis and Mann-Whitney test with Bonferroni correction was used for multiple comparisons for independent samples, and for repeated measurements, the Friedman and Wilcoxon test. The moderating effect of gender, age, oral parafunctions, and psychological dimensions was examined by linear regression analysis. χ^2 and Fisher's exact test were used to compare frequencies. The strength of the effect was quantified by partial η^2, Cramer V, correlation coefficients and the formula $r = t / \sqrt{N}$. An intra-class correlation coefficient was used to test the reproducibility of the tester. All analyzes were performed in the commercial program IBM SPSS 21.0 (IBM Inc., Armonk, USA).

RESULTS

The characteristic pain intensity estimated by the Chronic Pain Grading Scale is significantly reduced in both therapeutic groups, and the strength of the effect is greater with laser than self-massage ($p<0.001$; $\eta^2=0.954$ and 0.453; Figure 1). The result of pain incapacity is significantly reduced also in both groups, more significantly in the laser-treated group ($p\leq0.035$; $\eta^2=0.751$ and 0.154; Figure 2). And the number of days of incapacity decreases significantly with a greater effect in the laser group ($p\leq0.014$; $\eta^2=0.790$ and 0.249; Figure 2). It can be seen that with home self-massage therapy, the effect of reducing pain and disability decreases after three months of therapy, which is not the case after laser therapy.

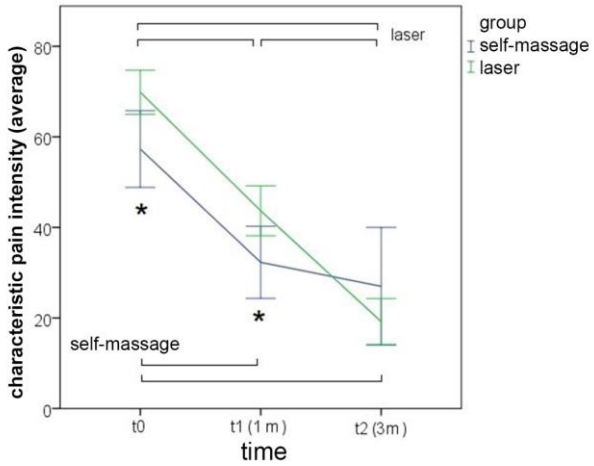

Figure 1. Comparison of changes in characteristic pain intensity assessed by the Chronic Pain Grading Scale between treatment groups

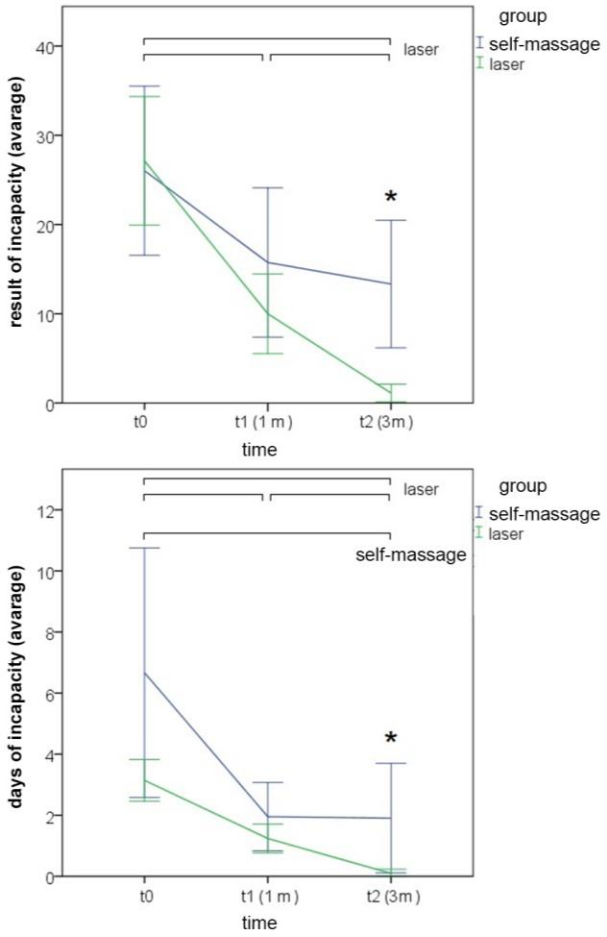

Figure 2. Comparison of disability change assessed by the Chronic Pain Grading Scale between treatment groups

After three months, the laser achieves a stronger effect than self-massage, and the difference is significant in the results of incapacity and the average number of days of incapacity ($p\leq0.049$; $r=0.545$ and 0.323).

Analysis of specific types of pain assessed by a visual analog scale confirms that pain intensities at both rest and chewing and headaches in both groups are significantly reduced with greater effect in lasers ($p\leq0.006$; $\eta^2=0.315$-0.942) than in self-massage ($p\leq0.013$; $\eta^2=0.206$-0.404; Figures 3 and 4). In both groups, the greatest effect was in the reduction of chewing pain ($p<0.001$; $\eta^2=0.404$-0.942), and the smallest in headache ($p\leq0.013$; $\eta^2=0.206$-0.315). The intensity of all three types of pain in the laser decreases in the short term and continues to decrease in the long term, and the degree of reduction is equal in the short and long term. With massages, there is a greater reduction in pain when resting and chewing in the short term, while in the long term there is no additional reduction in pain, and with headaches, there is even a recurrence (Figure 3). The difference between treatment groups is present only after three months where all three types of pain (at rest, chewing and headache) are smaller after laser therapy ($p\leq0.013$; $r=0.511$-0.516).

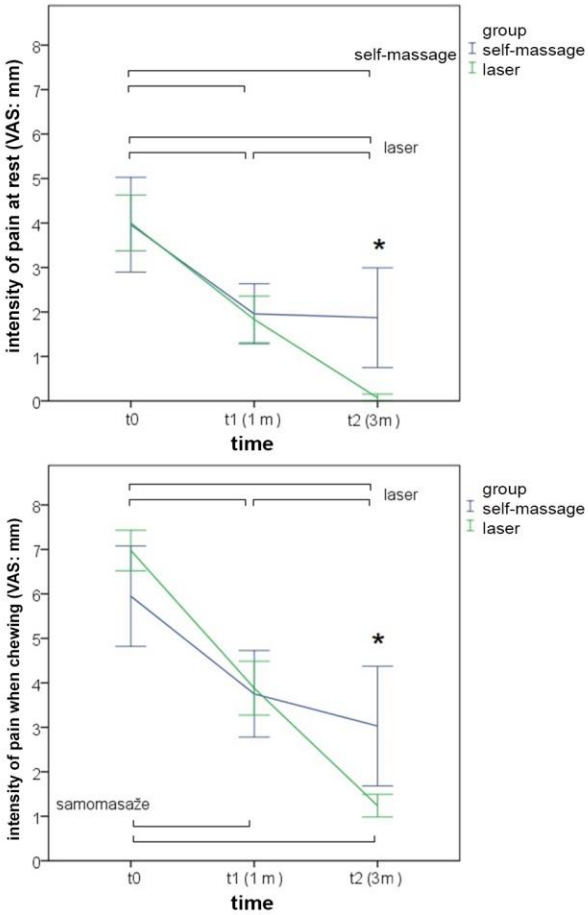

Figure 3. Comparison of change in headache intensity between treatment groups

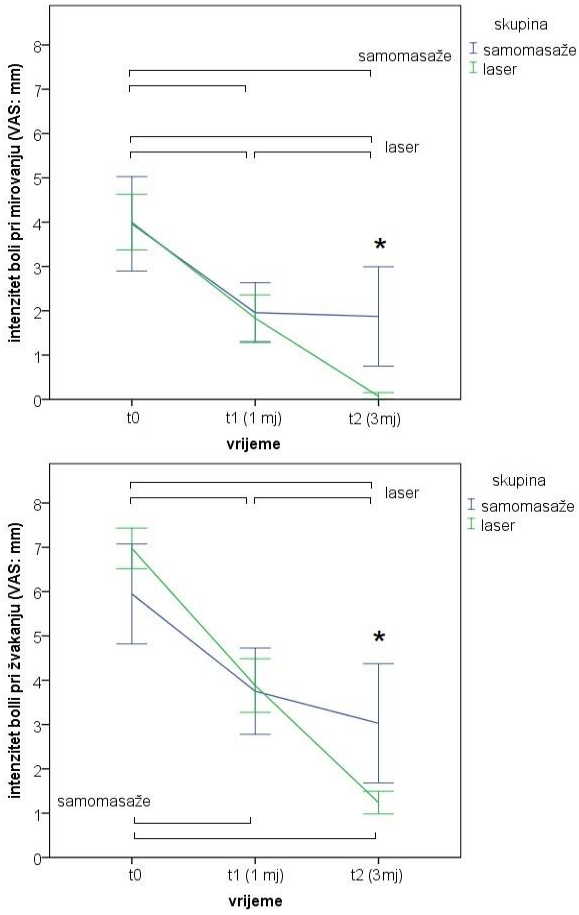

Figure 4. Comparison of changes in pain intensity at rest and chewing between treatment groups

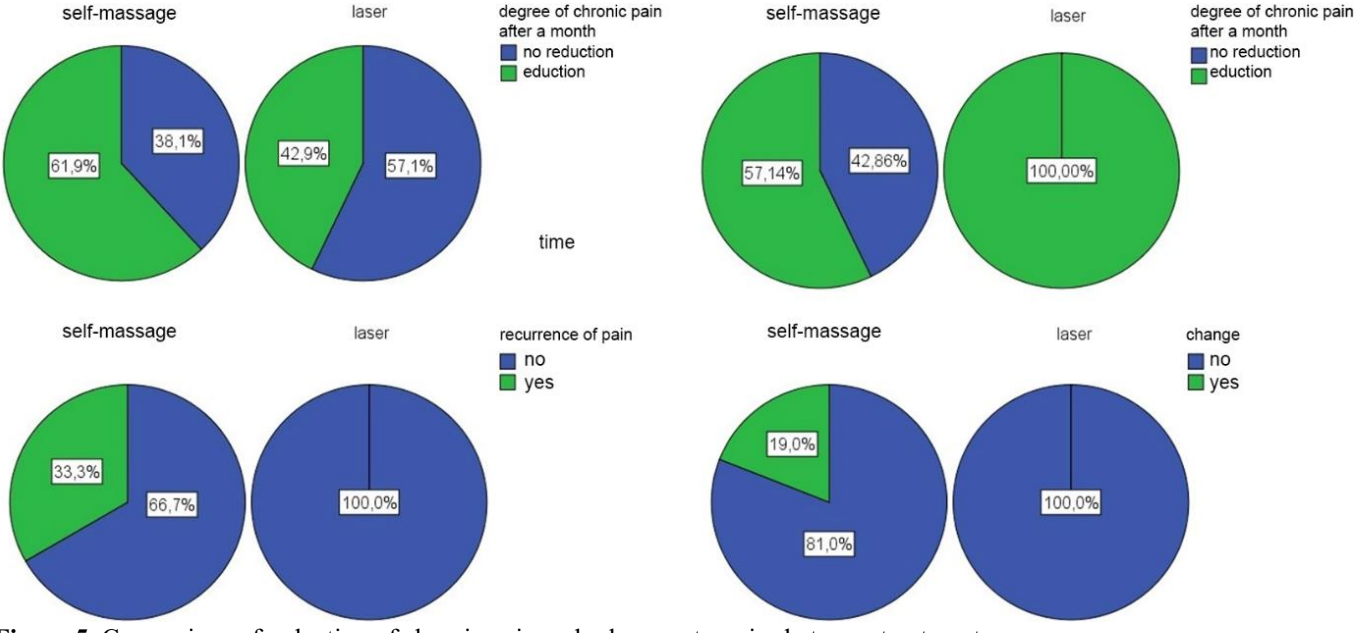

Figure 5. Comparison of reduction of chronic pain and relapse categories between treatment groups

Self-massages are more likely to reduce the degree of chronic pain than laser in the short term, but not statistically significantly (62% vs. 43%), while laser is more common than long-term self-massage (100% vs. 57%; $p<0.001$; $V=0.522$; Figure 5). One third of the persons treated with self-massages in whom there was a reduction in pain relapsed, and none in the group of lasers (Figure 5). In 19% of people treated with self-

massage there was no reduction in the degree of chronic pain, and in all with laser, there was a reduction. It can be seen from Figure 6 that in both groups there is a decrease in the number of subjects in higher degrees of chronic pain and an increase in lower degrees after one month and after three months. The shift to lower degrees is more visible in the laser-treated group.

The amount of short-term pain change (after one month) did not correlate linearly with any of the examined variables but correlated marginally with somatosensory amplification, catastrophization, and pain duration (Table 1).

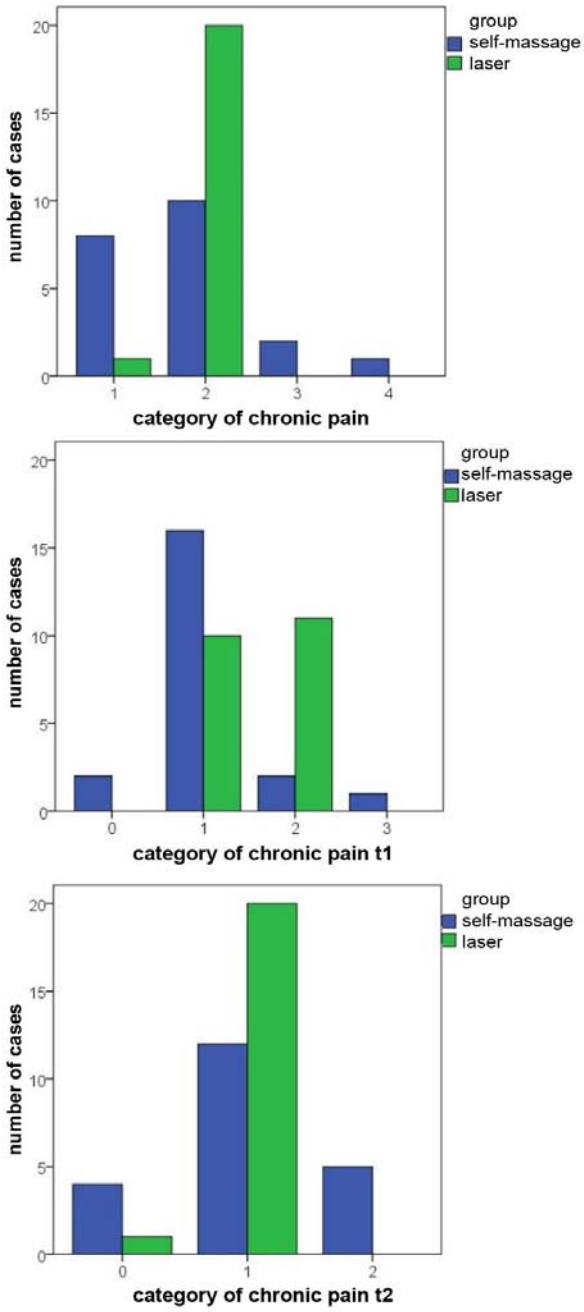

Figure 6. Comparison of changes in chronic pain categories between treatment groups

DISCUSSION

This research shows that both laser and home self-massage therapy are effective in the treatment of masseur myalgia but that low-intensity laser therapy is more effective. Some argue that low-intensity laser may be a good alternative modality of physical therapy in the treatment of both acute and chronic myogenic TMP, but patients with acute TMP have better outcomes (Salmos-Brito et al. 2013). Both groups of patients, both acute and chronic, report a significant reduction in pain and a higher amount of mouth opening after laser therapy. Laser has been shown to be more effective than placebo in reducing pain and in arthralgia, not just myofascial pain in TMP, especially in chronic pain, but there are no differences in energy use of 10 and 15 J/cm^2 (Fikácková et al. 2007). Self-massages increase the range of mandibular movements, but mostly not statistically significantly. It has previously been reported that massages reduce pain and increase the range of mandibular movements (Gomes et al. 2014, Alfonso Gil-Martínez et al. 2018). The laser has been in use for more than a century, but it was not until forty years ago that scientific papers related to the use of lasers in the treatment of joint and muscle problems were published (Goldman et al. 1980). Although some research does not confirm that the laser is more effective than placebo, the laser at the cellular level appears to increase ATP production in mitochondria, improve cellular respiration, increase serotonin and endorphins, reduce inflammation, and improve local circulation (Emshoff et al. 2008). A meta-analysis confirms the short-term effect of the laser in reducing pain, but not the long-term one, while the improvement in function has been confirmed in both the short and long term (Xu et al. 2018). Pain is therefore to some extent, but not completely, associated with a decrease in jaw function - mobility, chewing and the ability to communicate. Psychological characteristics, based on this research, have a more significant effect on the effectiveness of treatment in the form of reducing the limitation of jaw function, or in improving function, than they are effective in reducing the intensity of pain. In recent decades, much attention has been paid to psychological factors in the etiology of TMP (Canales et al. 2019). Psychopathology, personality structure and emotional states are considered important for the development of the disorder. Symptoms in the jaw joint area are not only associated with a physical disorder, but also with emotional suffering that modulates pain (Manfredini et al. 2018). It has been observed that patients with chronic pain have emotional difficulties and are psychosocially and biochemically sensitive, 43% do not have psychiatric disorders, but 35% suffer from depression, 22% have various neurotic disorders, and a small number of personality disorders with somatization and psychosis (Buljan 2009). In patients with TMP, anxiety-depressive disorders are present in 50%

Table 1. Pearson and point-biserial correlations

		Change in the characteristic intensity of pain (t0-t1)	Change in the characteristic intensity of pain (t0-t2)
Age	r	0.224	0.130
	p	0.154	0.413
Gender (0=M; 1=F)	r	-0.142	-0.404**
	p	0.370	0.008
Therapy (0=massages; 1=laser)	r	0.043	0.435**
	p	0.787	0.004
Incapability result t0	r	0.239	0.225
	p	0.128	0.153
Parafunctions	r	-0.161	-0.608**
	p	0.308	<0.001
Narrowness	r	-0.069	-0.379*
	p	0.662	0.013
Somatization	r	0.008	-0.609**
	p	0.961	<0.001
Depressed	r	-0.123	-0.073
	p	0.436	0.645
Catastrophization	r	0.259	-0.563**
	p	0.098	0.000
Hipervigility	r	-0.215	-0.132
	p	0.172	0.404
Somatosensory amplification	r	0.269	-0.420**
	p	0.085	0.006
Health competence	r	-0.162	-0.065
	p	0.306	0.681
Joint problem (0=absent; 1=present)	r	-0.201	-0.214
	p	0.201	0.175
Pain duration (months)	r	-0.299	-0.079
	p	0.054	0.621

and depression in 32.1%, and patients with psychiatric problems have a 4.5-fold higher chance of TMP than those without psychiatric problems (Buljan 2010). Personality disorders, alone or in combination with anxiety and mood disorders, are associated primarily with the muscular form of TMP (Kight et al. 1999).

Catastrophizing is a propensity for a negative view of the world, an excessively negative orientation toward feelings of pain and painful experience (Sullivan et al. 2001, Barsky et al. 1988). Not only do people assess that the situation is worse than it really is (this often applies to future situations as well), but they also reinforce this assessment so that everything gains catastrophic proportions. If people convince themselves that they will not do something well, and then they do not, they will accept it as proof that they are generally incompetent, that they will fail in life or that people do not like them. Catastrophizing entails negative emotions, anxiety, which results in unnecessary stress and anxiety. Somatosensory amplification is a tendency to exaggerate and misinterpret bodily sensations which, based on our research, also reduces the effectiveness of treatment. It could be an important factor in health experience and functioning, and is more associated with localized than systemic symptoms (Barsky et al. 1988). Recent research suggests that somatosensory enhancement is also associated with the perception of external threats and phenomena that do not necessarily involve symptoms, such as health concerns or anticipation of symptoms of treatment side effects (Köteles & Witthöft 2017). Somatosensory amplification therefore refers to the amplification of perceived external and internal threats to the integrity of the body, and not only to the amplification of observed or actual bodily events. Amplification is neither sensitive nor specific for somatizing conditions, and somatization can be influenced by other factors such as depression, anxiety and neuroticism (Duddu et al. 2006). Although health competence was expected to be the strongest moderator of treatment success, this is clearly not the case. Health competence is related to self-efficacy, a psychological characteristic that describes the belief in one's own abilities, is the possibility that certain behavior will be performed. Self-efficacy is associated with specific behavior in a specific situation, and health competence is self-efficacy in health care that is not related to any specific health behavior. For this reason, it is not called health self-efficacy but health competence (Smith et al. 1995).

Therefore, health competence is the degree to which a person feels able to cope with their health outcomes. The validity of this psychological characteristic in different populations and the connection with different health outcomes (better health, less depressive symptoms and better quality of life), health behaviors (increased exercise, better eating habits, reduced alcohol and tobacco consumption), trust in the health system and psychosocial measures (Bachmann et al. 2016, Marks & Lutgendorf 1999, Christensen et al. 1996, Gandhi et al. 2014, Arora et al. 2002) was confirmed.

CONCLUSION

Both treatment modalities are effective in treatment of chronic myalgia in short-term.

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Conflict of interest: None to declare.

Contribution of individual authors:

Afrim Fetai made this research.

Vlatka Debeljak helped dr Fetai with the collecting of the sample.

Daniela Kovačević Pavičić worked together with prof. Debeljak.

Nataša Ivančić Jokić made a statystical analyses.

Dubravka Negovetić Vranić helped with the literature.

Zoran Kovač helped with the translation to the English language.

Daniel Komar helped with the collecting of the sample.

Željko Verzak helped with the materials and methods.

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