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EFFECTIVENESS OF GaALAs PHOTOTHERAPY ACCORDING TO DIAGNOSTIC CRITERIA FOR TEMPOROMANDIBULAR DISORDERS

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Summary. The objective of this study was to test the clinical effectiveness of the combined gallium-aluminum-arsenide laser (GaAlAs; 785 nm) and superluminiscent diods (SLD; 633 nm) phototherapy (MedX 1100 device) for the treatment of 62 patients with 7 of the most common pain-related temporomandibular disorders with highest sensitivity and specificity according to diagnostic criteria DC/TMD. Using paired samples t-test a positive effect in the pain relief for all tested conditions was demonstrated. The most manifested and statistically significant reduction of pain was found in arthralgia attributed to osteoarthritis and systemic (rheumatoid) arthritis ($p = 0.0000001$), and disc displacement without reduction with limited opening ($p = 0.0000002$). Similar levels of pain reduction were found in arthralgia attributed to subluxation, myofascial pain with referral, local myalgia (p values vary between 0.000001 and 0.000284); the lowest values were recorded for myofascial pain ($p = 0.001789$) and hypermobility-related myalgia ($p = 0.018443$). The combined laser and SLD phototherapy can be defined as very effective treatment option particularly in pain reduction of internal derangement disorders as well as in some myogenic-related pain conditions affected by TMJ dysfunction.

Key words: *gallium-aluminum-arsenide laser, temporomandibular disorders, DC/TMD*

INTRODUCTION

Temporomandibular disorders (TMD) are the most common cause of pain in the maxillofacial area following odontogenic pain, affecting approximately up to 12% of the population [4, 7, 8]. Nearly 5-15% of the patients

have chronic symptoms of pain that have repetitive nature for at least 6 months and have clinically palpable trigger points. The International Consortium for research of TMD accepted in 2014 new Diagnostic Criteria for Temporomandibular Disorders (DC/TMD), which is a modification of the Research Diagnostic Criteria for TMD (RDC/TMD) from 1992. The Axis I diagnostic algorithms were assessed for validity and for reliability by the Validation Project and the TMJ Impact Project. Axis I protocol includes both a valid screener for detecting any pain-related TMD as well as a valid diagnostic criteria for differentiating the most common pain-related TMD (sensitivity ≥ 0.86, specificity ≥ 0.98) and excellent inter-examiner reliability (kappa ≥ 0.85). The American Association for Orofacial Pain (AAOP) has included 12 most common pain-related TMDs in a new revision of their Guidelines manual such that the DC/TMD and the AAOP taxonomic system for TMDs are now consistent [1, 2, 3, 5].

The most commonly used low-level light sources operate in the 780-870 nm spectral range but there is limited information on the clinical outcome of low level laser therapy (LLLT) of patients with typically chronic TMDs. Most of the studies use various parameters and calibration techniques. Various studies report positive clinical effects of LLLT on TMD pain; the analgesic effect achieved with wavelengths of 780 nm and 830 nm is moderate to superior [9, 10, 11].

Publications regarding the application of combined infrared and red light phototherapy in patients with chronic temporomandibular disorders and myofascial pain are basically lacking. Former research have reviewed the subject on laser therapy effectiveness as a single treatment option, and the results are mainly on the analgesic effect for definite muscle groups and the TMJ. Up till now the cold laser therapy has not been introduced in the context of concrete clinical diagnose based on the latest diagnostic criteria or according to the etiopathogenetic factors.

AIM OF THE STUDY

The aim of this study is to evaluate the clinical effectiveness of combined gallium-aluminum-arsenide laser (GaAlAs; 785 nm) and superluminiscent diods (633 nm) phototherapy (MedX 1100 device) on the intensity of pain reduction in 62 individuals with 7 of the most common pain-related chronic temporomandibular disorders, which are characterized with the highest specificity and sensitivity according to the DC/TMD.

MATERIAL AND METHODS

This study included 62 patients – 7 men and 55 women, aged between 21-74 years (avg. – 42,77; Std Dev – 13,94). All cases had clinical signs of chronic joint and/or myofascial pain of various etiologies. The aim was to examine the effect of the combined phototherapy amongst the 7 most common TMDs that have high sensitivity and specificity. These disorders are arthralgia, local myalgia, myofascial pain, myofascial pain with referral, disc displacement without reduction with limited

opening, degenerative joint diseases, and subluxation. Data was collected based on the examination protocol that requires a presence of pain on palpation in the TM joint, temporal and masseter muscles, and the regional orofacial structures. The assessments were based on Axis I of the DC/TMD protocol, which includes questionnaire about the history of the disease, clinical and laboratory examination and the following instruments: DC/TMD Symptom Questionnaire, Graded Chronic Pain Scale (v2), Patient Health Questionnaire – 9, GAD – 7 and Oral Behaviors Checklist. The trigger points were diagnosed through palpation of the lateral pole of the joints and the preauricular areas, the muscles of mastication and the cervical muscles in order to confirm familiar pain during function. The degenerative joint disorders were confirmed in accordance with the clinical DC/TMD criteria; a presence of hypomobility, mandibular deviations and specific crepitus detected with palpation during maximum unassisted opening, maximum assisted opening, lateral, or protrusive movements during function; x-rays-panoramic or joint centered for the presence of erosions, osteophytes, subchondral sclerosis or subchondral cysts, and for certain cases – CT and MRI. When defining the appropriate imaging examinations, the Principe of ALARA [6] was observed (as low as reasonably achievable). The presence of systemic arthritis like rheumatoid arthritis were confirmed after complying with the diagnostic criteria and verification of official documentation proving the disorder.

Trigger point oriented combination of laser (MedX 1100 console with three GaAlAs laser diodes, 785 nm, 3 x 33 mW, 100 s, 8 J/cm 2 per spot) and SLD red light sessions (633 nm, 200 mW, 300 s, 8 J/cm 2 per spot) was applied for temporomandibular joints and affected muscles. The outcome measurements for pain intensity before and after treatment included visual analogue scale (VAS) scores. In cases of disc displacements, degenerative disorders and subluxations, the changes in the pain intensity were recorded separately for the joints and muscles. A similar approach was used in cases of arthralgia, where the results were recorded separately for unilateral and bilateral pain complaints. The pain intensity measurements were taken before and after the completion of six sessions (3 times per week) of photo therapy. Student's t-tests of paired samples for each diagnosis before and after therapy were used for statistical analysis. STATISTICA software was utilized.

RESULTS

The most statistically manifested pain reduction was found for arthralgia attributed to degenerative joint disease, followed by arthralgia attributed to disc displacement without reduction with limited opening. Similar results were found for myalgia attributed to disc displacement without reduction with limited opening, myalgia attributed to degenerative joint disease, and arthralgia. The data proved that arthralgia and myalgia attributed to pain-related degenerative joint disorders and disc displacements are best influenced by combined phototherapy. Conditions such as arthralgia attributed to subluxation, myofascial pain with referral and local myalgia are influenced by the low level laser therapy in the above order, and the weakest ef-

fect is detected with phototherapy in the cases of myofascial pain and myalgia as a consequence of hypermobility (luxation and subluxation).

Table 1. Statistical results for pain reduction according to the seven most common TMD

TMD according to DC/TMD Criteria	Pain intensity Mean VAS scores	Std. Dv.	N	t	p	Conf -95,00%	Conf +95,00%
Local myalgia before treatment	0.935	2.102					
Local myalgia after treatment	0.032	0.254	11	3.489	0.000905	0.385	1.420
Myofascial pain before treatment	1.774	4.282					
Myofascial pain after treatment	0.274	1.369	14	3.266	0.001789	0.581	2.418
Myofascial pain with referral before treatment	2.274	4.763					
Myofascial pain with referral after treatment	0.322	1.036	15	3.851	0.000284	0.938	2.964
Arthralgia attributed to disc displacement without reduction with limited opening before treatment	5.409	3.333					
Arthralgia attributed to disc displacement without reduction with limited opening after treatment	1.090	1.444	18	7.187	0.0000002	3.068	5.567
Myalgia attributed to disc displacement without reduction with limited opening before treatment	6.863	4.843					
Myalgia attributed to disc displacement without reduction with limited opening after treatment	0.954545	2.298	18	6.714	0.000001	4.078	7.739
Arthralgia attributed to osteoarthritis (OA) or systemic (rheumatoid) arthritis (SA) before treatment	7.000	3.677					
Arthralgia attributed to OA or SA after treatment	1.045	1.132	11	8.649	0.0000001	4.522	7.386
Myalgia attributed to OA or SA before treatment	7.727	5.633					
Myalgia attributed to OA or SA after treatment	0.863	1.521	11	6.904	0.000001	4.796	8.931
Arthralgia attributed to subluxation before treatment	5.000	1.914					
Arthralgia attributed to subluxation after treatment	1.307	1.702	13	7.406	0.000008	2.606	4.778
Myalgia attributed to subluxation before treatment	4.076	4.957					
Myalgia attributed to subluxation after treatment	1.000	2.768	13	2.724	0.018443	0.616	5.537
Arthralgia, unilateral, before treatment	6.131	1.711					
Arthralgia, unilateral, after treatment	1.052	1.012	38	19.163	0.000001	4.541	5.615
Arthralgia, bilateral, before treatment	6.476	1.600					
Arthralgia, bilateral, after treatment	1.142	1.276	21	13.807	0.000001	4.527	6.139

DISCUSSION

This study shows that GaAlAs photo therapy, following the mentioned therapeutic algorithm, frequency of applications and dosage provides statistically significant reduction of pain symptoms in the most common pain-related temporomandibular disorders which are characterized with the highest sensitivity and specificity according to diagnostic criteria DC/TMD. It should be emphasized that combined laser and

SLD phototherapy is very effective particularly in the reduction of internal derangements as well as in myogenic pain-related conditions, which are strongly affected by TMJ dysfunction with various etiology.

The exact diagnosis of chronic myofascial and temporomandibular pain conditions is often quite a challenge for the clinicians. Unlike most studies that present data for the effect of the laser therapy on different organs like TMJ and masticatory muscles – the present investigation provide findings for the effectiveness of the LLLT, reviewed in the light of the nature of the DC/TMD classification system. At this stage, the comparability of the data is hampered by the fact that previous studies have been conducted in accordance with RDC/TMD published in 1992. The changes in diagnostic criteria require new clinical studies allowing us to refine the picture of laser treatment effectiveness for TMD in accordance with the latest views on the matter.

CONCLUSION

The findings about combined phototherapy pain reduction are of particular importance for the application of adequate laser treatment algorithm and strategy at chroniclers regarding the new diagnostic criteria changes for most common TMD. It may be of a great benefit to clinicians in planning symptomatic and etiopathogenetic treatment of these complex cases.

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