

Effectiveness of Low-Level Laser Therapy in Temporomandibular Joint Disorders: A Placebo-Controlled Study

H. FIKÁČKOVÁ, M.D.,^{1,2} T. DOSTÁLOVÁ, M.D., Prof., Dr.Sci., M.B.A.,³
L. NAVRÁTIL, M.D., Ph.D.,^{1,4} and J. KLASCHKA, R.N.Dr., Ph.D.^{1,5}

ABSTRACT

Objective: Low-level laser therapy (LLLT) treatment for pain caused by temporomandibular joint disorders (TMD) was investigated in a controlled study comparing applied energy density, subgroups of TMD, and duration of disorders. **Background Data:** Although LLLT is a physical therapy used in the treatment of musculoskeletal disorders, there is little evidence for its effectiveness in the treatment of TMD. **Methods:** The study group of 61 patients was treated with 10 J/cm² or 15 J/cm², and the control group of 19 patients was treated with 0.1 J/cm². LLLT was performed by a GaAlAs diode laser with output of 400 mW emitting radiation wavelength of 830 nm in 10 sessions. The probe with aperture 0.2 cm² was placed over the painful muscle spots in the patients with myofascial pain. In patients with TMD arthralgia the probe was placed behind, in front of, and above the mandibular condyle, and into the meatus acusticus externus. Changes in pain were evaluated by self-administered questionnaire. **Results:** Application of 10 J/cm² or 15 J/cm² was significantly more effective in reducing pain compared to placebo, but there were no significant differences between the energy densities used in the study group and between patients with myofascial pain and temporomandibular joint arthralgia. Results were marked in those with chronic pain. **Conclusion:** The results suggest that LLLT (application of 10 J/cm² and 15 J/cm²) can be considered as a useful method for the treatment of TMD-related pain, especially long lasting pain.

INTRODUCTION

Temporomandibular joint disorders (TMD) and their most common signs and symptoms such as pain, limited mouth opening, and joint sounds, could be caused by muscle disorders, intracapsular derangement of the components of the temporomandibular joint (TMJ), and degenerative changes to the bony components of the joint itself.^{1,2}

There is still a lack of consensus on the classification of TMD, largely because there is unclear etiology and clinical findings can result from different causes, including psychological causes.^{1–3} One commonly used diagnostic scheme intended for

research purposes is the Research Diagnostic Criteria for TMD (RDC/TMD).¹ This standardizes the clinical examination of patients with TMD, improves reproducibility among clinicians, and facilitates comparison of results among researchers.¹

TMD is considered to be a subgroup of musculoskeletal disorders.^{1,2} This may explain reports of the successful use of physical therapy in the treatment of TMD. Low-level laser therapy (LLLT) is one modality of physical therapy, used for its analgesic, anti-inflammatory, and stimulative effects.^{1–19} Although LLLT is a treatment method commonly used in physiotherapy of musculoskeletal disorders, there are few studies that deal with its utilization in the treatment of TMD.

¹Institute of Biophysics and Informatics, 1st Medical Faculty.

²Department of Anatomy and Biomechanics, Faculties of Physical Education and Sports

³Department of Paediatric Stomatology, 2nd Medical Faculty, Charles University, Prague, Czech Republic.

⁴Department of Radiology and Toxicology, Faculty of Health and Social Sciences, South Bohemia University, Ceske Budejovice, Czech Republic.

⁵Institute of Computer Science, Academy of Sciences of the Czech Republic, Prague, Czech Republic.

TABLE 1. THE CRITERIA FOR MYOFASCIAL PAIN AND ARTHRALGIA ACCORDING TO RDC/TMD

Clinical examination	Diagnosis	
	Myofascial pain	Arthralgia TMJ
Tenderness to palpation	Three or more of the following muscle sites: m. temporalis (posterior, middle, anterior); m. masseter (origin, body, insertion); m. digastricus (venter anterior, posterior); submandibular region, lateral pterygoid area, tendon of the temporalis	Pain in one or both lateral poles and/or posterior attachment during palpation
Characteristics of the pain	Report of pain or aching in the jaw, temples, face, preauricular area, or inside the ear at rest or during use	Pain in the region of the joint at rest or during maximum opening or lateral excursion

RDC/TMD, Research Diagnostic Criteria for Temporomandibular Joint Disorders.

The aims of this study were (1) to compare the reduction in pain in patients with TMD treated with LLLT (10 J/cm² or 15 J/cm²) or sham laser (0.1 J/cm²), and (2) to evaluate the therapeutic effect of LLLT in relation to subgroups of TMD and duration of TMD-related pain.

MATERIALS AND METHODS

Subjects

Eighty patients (9 male and 71 female) who participated in this study were selected from patients with TMD from the Prosthetic Department of Charles University, 1st Medical Faculty in Prague, and referred for LLLT to the Institute of Biophysics and Informatics, 1st Medical Faculty. The average age of patients was 41 years (range 16–70 years).

The entire treatment regimen was accomplished in agreement with the Helsinki Declaration. Ethical approval for the study was obtained from the University Ethics Committee of the Faculty Hospital of the 1st Medical Faculty of Charles University in Prague.

The criteria for patients included in the study were myofascial pain and arthralgia of the TMJ. The exclusion criteria were painless joint sounds, disc displacements with limited opening, and degenerative joint diseases related to systemic causes. Classification of TMD subgroups was made according to the Research Diagnostic Criteria for temporomandibular joint disorders (RDC/TMD) (Table 1).

The patients were divided into three groups according to the month in 2005 when they were referred for treatment:

- Group A: 33 patients treated with 10 J/cm² (from February to April)

- Group B: 28 patients treated with 15 J/cm² (May, June, and September)
- Group C: 19 patients treated with 0.1 J/cm² (October and November)

Table 2 shows the distribution of patients according to clinical diagnosis and applied energy density.

The standardized examination procedure included a questionnaire designed according to RDC/TMD criteria to record each patient's history, previous appointments with physicians and dentists, and intensity and duration of the pain.¹ Patients completed this standardized questionnaire by themselves.

LLLT was the first method of TMD treatment in 32 patients, and in 48 patients it was recommended after previously unsuccessful treatment using other conservative methods (Table 3).

Duration of TMD-related pain was recorded by patients in a self-administered questionnaire before the application of LLLT. Twenty patients had TMD-related pain for less than 6 months (acute pain) and 50 patients for more than 6 months (chronic pain).²⁰ Ten patients did not answer this question (Table 4).

Equipment

Low-level laser therapy was performed in 10 treatment sessions by a semi-conductive GaAlAs laser (BTL Beautyline Technology Laser, Brno, Czech Republic) with an output of 400 mW, emitting radiation wavelength of 830 nm. The laser delivers a spot of approximately diameter 0.2 cm².

Treatment protocol

Patients received LLLT in 10 sessions within 1 month. Groups A and B were treated by energy density of 10 J/cm²

TABLE 2. DISTRIBUTION OF PATIENTS ACCORDING TO CLINICAL DIAGNOSIS AND THE APPLIED ENERGY DENSITY

Diagnosis	Group A 10 J/cm ²	Group B 15 J/cm ²	Group C (0.1 J/cm ²)	No. of patients
Myofascial pain	14	8	10	32
TMJ arthralgia	7	10	4	21
Both myofascial pain and TMJ arthralgia	12	10	5	27

TABLE 3. LLLT AS A METHOD OF FIRST OR SECOND CHOICE IN THE TREATMENT OF TMD

	Group A 10 J/cm ²	Group B 15 J/cm ²	Group C (0.1 J/cm ²)	No. of patients
LLLT without previous conservative treatment	11	13	8	32
LLLT after unsuccessful conservative treatment	22	15	11	48

LLLT, low-level laser therapy; TMD, temporomandibular joint disorder.

and 15 J/cm², respectively. The control group C received energy density of 0.1 J/cm².

In patients with myofascial pain, the laser probe was placed over the spots of tenderness to palpation of masticatory muscles, that were detected during the clinical examination according to RDC/TMD.

In patients with arthralgia of the TMJ, the probe was placed on the sites as described by Bradley et al.⁴:

- In front of the tragus, when the mouth was open
- Through the meatus acusticus externus, when the mouth was open
- 2 cm in front of the tragus, under the zygomatic arch, when the mouth was closed

Patients with both myofascial pain and arthralgia of the TMJ were treated by both described procedures.

Evaluation of results

On the second day after the last (10th) LLLT session, the patients completed the control self-administered questionnaire, where they expressed whether their TMD-related pain was reduced, increased, or remained the same after LLLT.

Subjective evaluation of changes in intensity of pain after the application of LLLT was reported by patients in percentages from 0%, indicating no change in pain, to 100%, indicating complete relief of pain, in 10% increments.

Statistical analysis

Due to the small number of patients who reported deterioration in TMD-related pain, the result of therapy was treated as a variable with two possible categories (successful and unsuccessful) for use in statistical analysis. The categories “pain remained the same” and “increased” were for statistical purposes grouped as “unsuccessful treatment.” The patients who

reported “reduced” pain were classified as “successful treatment.”

In the statistical analysis evaluating the treatment results in relation to the duration of TMD-related pain, patients who had not answered the question “For how long have you been in pain?” were excluded (n = 10).

Fisher’s exact test was used for contingency 2 × 2 tables and the chi-square test for larger contingency tables. When a significant difference was found between the three groups, analogous post-hoc analyses of subtables for pairs of groups was followed. Test results with *p* < 0.05 were considered statistically significant.

RESULTS

Comparison of the effectiveness of LLLT and sham laser in reduction of TMD-related pain

Forty-seven of 61 patients treated with LLLT (group A 10 J/cm² or group B 15 J/cm²) reported reduction in TMD-related pain, two patients reported increased pain, and in 12 patients pain remained the same after completion of treatment.

Seven of 19 patients in the control group C (0.1 J/cm²) reported reduction in pain, and in 12 patients pain did not change (Fig. 1).

Statistical analysis showed a significant difference (*p* = 0.002) in treatment efficacy between groups A and B compared to sham laser.

Evaluation of LLLT in relation to applied energy density

Although there were more patients with TMD who reported reduction in pain in group A (10 J/cm²) than in the group B (15 J/cm²), the between-group difference in the treatment results was not significant (Fig. 2).

TABLE 4. DISTRIBUTION OF PATIENTS ACCORDING TO THE DURATION OF THEIR PAIN AND THE APPLIED ENERGY DENSITY

Duration of TMD	Group A 10 J/cm ²	Group B 15 J/cm ²	Group C (0.1 J/cm ²)	No. of patients
Acute TMD	9	10	11	20
Chronic TMD	24	18	8	50

TMD, temporomandibular joint disorder.

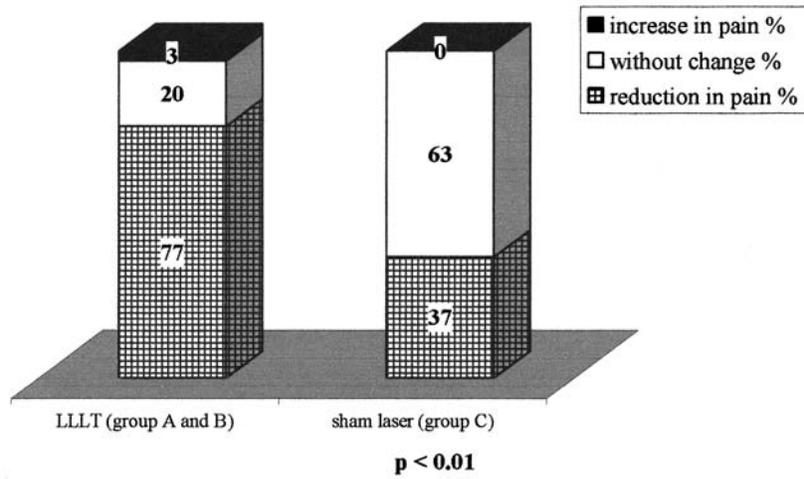


FIG. 1. The effect the LLLT and the sham laser on reduction in pain in patients with TMD (percentage analysis).

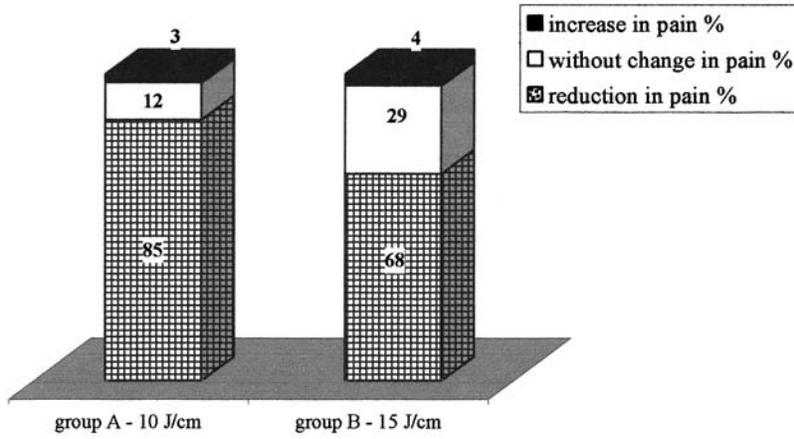


FIG. 2. The evaluation of LLLT in relation to the applied energy density (percentage analysis).

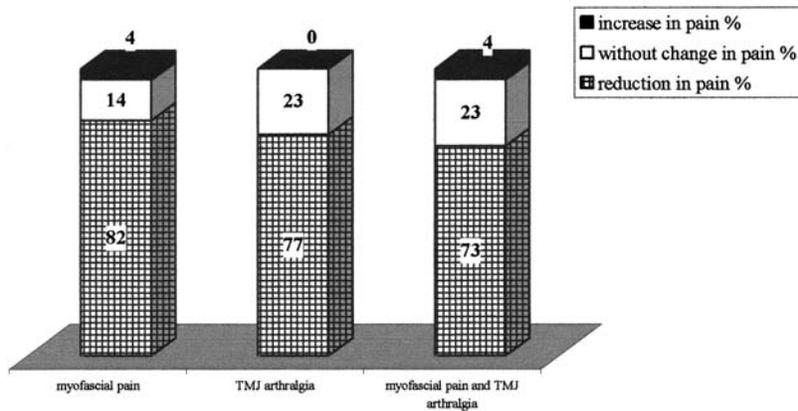


FIG. 3. The results of treatment in relation to the diagnosis (percentage analysis).

TABLE 5. EFFICACY OF LLLT IN RELATION TO THE DURATION OF DISORDERS AND THE APPLIED ENERGY DENSITY

Duration of TMD	Group A (10 J/cm ²)			Group B (15 J/cm ²)			Placebo (0.1 J/cm ²)		
	Worse	Without change	Better	Worse	Without change	Better	Worse	Without change	Better
Acute pain	0 (0%)	1 (11%)	8 (89%)	0 (0%)	3 (30%)	7 (70%)	0 (0%)	4 (34%)	7 (66%)
Chronic pain	1 (4%)	3 (12%)	20 (84%)	1 (6%)	5 (28%)	12 (67%)	0 (0%)	8 (100%)	0 (0%)
p value		0.8150			0.7493			0.0045	

Evaluation of the therapeutic effect of LLLT in patients who did not respond to previous conservative treatment of TMD-related pain

Twenty-nine of 37 patients whose TMD-related pain did not diminish after previous conservative treatment reported reduction in pain after LLLT (10 J/cm² or 15 J/cm²); in two patients the pain increased, and in six patients the pain did not change. There was no statistically significant difference in the treatment effects between application of 10 J/cm² and 15 J/cm².

Evaluation of LLLT in diagnostic subtypes of TMD

In the combined groups A and B, no significant difference was found in the therapeutic effects of LLLT comparing the patients with myofascial pain and TMJ arthralgia (Fig. 3). Similarly, analysis within groups A and B revealed no significant differences between patients with myofascial pain and/or TMJ arthralgia.

Evaluation of LLLT in relation to duration of TMD

Although there was no significant difference between the effects of applied energy density of 0.1 J/cm², 10 J/cm², and 15 J/cm² in patients with acute pain, different results were obtained in patients with chronic pain, whose treatment results depended on the applied energy density (Table 5). Patients treated with LLLT (group A or B) reported significantly better results than patients treated with sham laser (group C; *p* = 0.0003). There

was no difference between application of 10 J/cm² or 15 J/cm² in patients with chronic pain.

Assessment of progress of therapy of TMD-related pain by LLLT

Ongoing evaluation of the results showed that a decrease in pain occurred in the majority of TMD patients between the second and fourth treatment sessions (Fig. 4).

More than half (25 of 47) of patients who reported reduction in TMD-related pain reported 70% or more improvement of TMD after completing LLLT (Fig. 5).

DISCUSSION

When evaluating a successful treatment of TMD, it is not easy to determine whether a decrease in pain is a real result of the treatment or a cyclic spontaneous remission of symptoms or a placebo effect.^{3,21} In order to clarify this, the treatment results of the patients treated with LLLT and sham laser were compared and evaluated according to the duration of TMD.

For the control group, we used an energy density of 0.1 J/cm², the lowest setting on the energy device. The application of 0.0 J/cm² was not possible because of an automatic control that is a fixed part of the laser. Although even very small amounts of laser energy may result in cellular responses, we considered this group as a placebo, because for an analgesic ef-

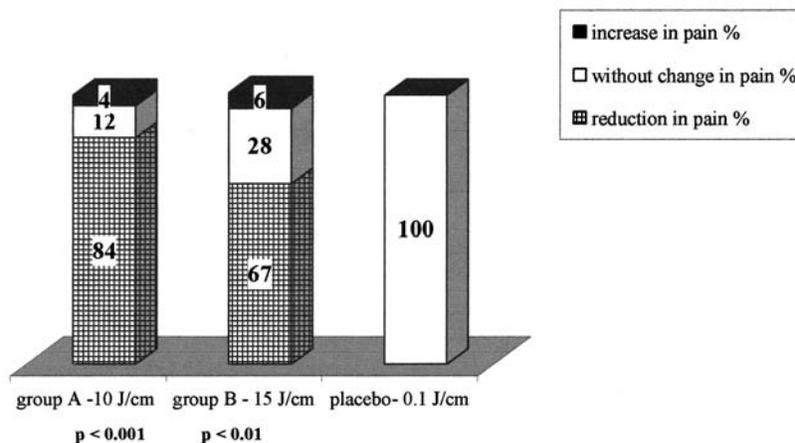


FIG. 4. The efficacy of the LLLT and the sham laser on reduction in pain in patients with chronic TMD (percentage analysis).

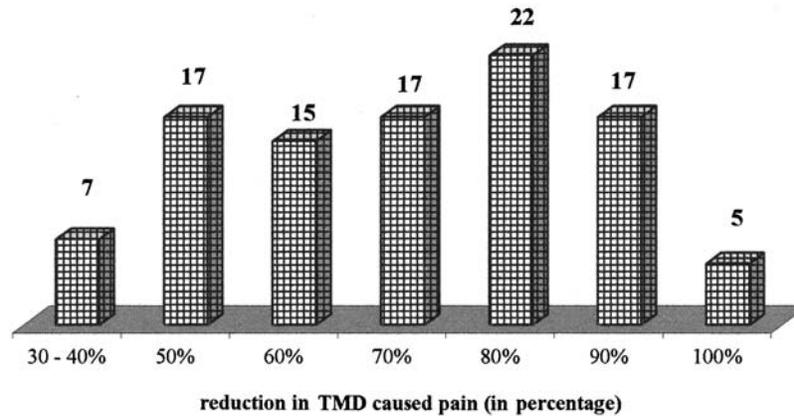


FIG. 5. The level of decreasing TMD caused pain after finishing the LLLT.

fect to occur, it is necessary to achieve sufficient energy density in the irradiated tissue.⁵ Tunér and Hode⁵ reported insufficient energy density as a cause of failed LLLT. Our hypothesis that application of 0.1 J/cm² has no analgesic effect was confirmed in another study,⁶ that compared the treatment effect in patients who were treated with 0.1 J/cm², 10 J/cm², and 15 J/cm², with who received basic conservative treatment (advice to avoid activities that cause repeated traumatization of the TMJ, such as maximal opening of the mouth and chewing gum and hard food) for 1 month. That study showed that the treatment effect in the placebo group and in patients with conservative treatment were significantly worse than in patients treated with 10 J/cm² or 15 J/cm². Moreover, there was no significant difference in treatment results comparing 0.1 J/cm² and conservative therapy.⁶

In our study we did not evaluate changes in pain after LLLT with assessment of changes in mobility of the affected joint, as has been studied by others.⁷⁻¹⁰ However, the results suggest that the effect of LLLT on the treatment of pain caused by TMD might improve mobility of the joint.

We found significantly better therapeutic results in patients who were treated with LLLT (improvement in 77% of patients) compared to those treated with sham laser (improvement in 37% of patients).

However, there is no general consensus in the literature on the effectiveness of laser therapy in treating TMD. Hanssen and Thorøe²² described no difference between active and placebo laser therapy. In a meta-analysis Gam et al.²³ did not find a better therapeutic effect for active laser therapy than for placebo. Similarly, significant differences between real and placebo laser treatment were not found in a study by Conti.²⁴

In support of our findings, better therapeutic results of LLLT compared to placebo laser treatment were also described in studies by Bradley et al.,⁴ Bertolucci and Grey,⁷ Kulekcioglu et al.,⁸ Cetiner et al.,⁹ Beckerman et al.,¹¹ Sanseverino et al.,¹² and Gray et al.¹³

Besides the influence of applied energy density on the effectiveness of LLLT, we also evaluated the influence of the duration of TMD on its therapeutic effect. In patients suffering from pain for less than 6 months, there was no significant difference in the final evaluation of the treatment results between sham laser and

both densities of LLLT. On the other hand, in the patients with chronic pain (more than 6 months), the treatment results were significantly different between active and placebo laser treatment. Improvement in TMD-related pain was reported by 76% of the patients with chronic pain in the group treated with LLLT, and by none of the patients treated with the sham laser. This suggests that LLLT may be effective for TMD, notwithstanding relief of pain that may occur with spontaneous remission.

Even though the efficacy of LLLT has been shown in many clinical studies, there has still not been any definite consensus about the appropriate energy density in TMD. Kulekcioglu et al.⁸ and Nunez et al.¹⁰ recommend an applied energy density of 3 J/cm², Gray et al.¹³ 4 J/cm², Tunér and Hode⁵ 4–10 J/cm², Navrátilová and Navrátil¹⁴ 6–8 J/cm², Kobayashi and Kubota¹⁵ 20–40 J/cm², Sanseverino et al.¹² 45 J/cm², and Bradley et al.⁴ 100 J/cm². The present study evaluated the treatment effect of the application of 10 J/cm² and 15 J/cm². These energy densities were chosen both to try to achieve sufficient energy density in the TMJ and masticatory muscles to achieve analgesia, and to avoid prolonged treatment sessions. Although better treatment results were obtained from patients treated with 10 J/cm² than those treated with 15 J/cm², this difference was not significant.

The percentage of the patients who reported decreased pain in this study is similar to the results reported by Bradley et al.⁴ and Gray et al.,¹³ who described reduced pain in 77% and 73% of patients, respectively. We found that pain was reduced in 82% of patients with myofascial pain, 77% of patients with TMJ arthralgia, and 73% of patients with both myofascial pain and TMJ arthralgia. There was no significant difference in patients with myofascial pain, TMJ arthralgia, or both, even though the latter received the highest energy density, LLLT being applied to both the TMJ and the masticatory muscles. Kulekcioglu et al.⁸ also reported the same therapeutic effect for LLLT for these diagnostic groups. However, Bezzur et al.¹⁶ described greater efficacy for TMJ arthralgia than for myofascial pain.

Pain decreased in 23% of the patients after the second application, and in 28% after the third application of LLLT. Gray et al.¹³ reported decreased pain after the fourth application. Since 81% of our patients reported reduced pain after the fifth application, this point could be appropriate for preliminary evaluation of the treatment and energy density chosen.

Although LLLT initially caused an increase in pain in some patients, 59% reported >70% pain reduction after treatment. Initial pain may not be a deleterious effect, as it appears related to individual sensitivity to treatment, leading to reduced pain after completion.^{4,5,14}

Our results suggest that LLLT can be recommended for the treatment of painful conditions related to TMD.

CONCLUSION

The results of this study found significantly better treatment results for TMD-related pain in patients treated by LLLT (10 J/cm² or 15 J/cm²) than in those treated by sham laser (0.1 J/cm²).

The application of energy density of 10 J/cm² or 15 J/cm² resulted in reduced TMD-related pain in 77% of patients, no change in pain in 20%, and increased pain in 3%. An improvement after laser therapy was reported by 82% of patients with myofascial pain, 77% with TMJ arthralgia, and 73% with both myofascial pain and TMJ arthralgia. The greater effectiveness of 10 J/cm² compared to 15 J/cm² was not statistically significant.

LLLT was effective, especially for those with chronic pain, and in those who did not respond to other previous conservative treatments.

ACKNOWLEDGEMENT

This study was done with financial support from the Research Project of the Ministry of Education, Youth, and Sports of the Czech Republic, grants no. FJ MSM 11100005 and IGA MZ CR 8112-3.

We would like to thank R.N.Dr. J. Hořejšová of BTL Beauty-line Technology Laser for lending us their GaAlAs laser.

REFERENCES

- Dworkin, S.F., and LeResche, L. (1992). Research diagnostic criteria for temporomandibular disorders: review, examinations and specifications criteria. *J. Craniomand. Disord. Facial Oral Pain.* 6, 301-355.
- McNeill, Ch. (1997). History and evolution of TMD concepts. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 83, 51-60.
- Goldstein, B. (1999). Temporomandibular disorders: A review of current understanding. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 88, 379-385.
- Bradley, P., Groth, E., and Gursoy, B. (2000). The maxillofacial region: recent research and clinical practice in low intensity level laser therapy, in: Simunovic Z. (ed.) *Lasers in Medicine and Dentistry*. Grangesberg, Sweden: Prima Books, pp. 385-400.
- Tunér, J., and Hode, L. (2002). *Laser Therapy. Clinical Practice and Scientific Background*. Tunér, J., Hode, L. (eds.). Grangesberg, Sweden: Prima Books, p. 570.
- Fikáčková H, Dostálová T, Navrátil L, and Klaschka J. (2006) Využití neinvazivní laseroterapie v léčbě TMP: placebem kontrolovaná studie. *Prakt. Zub. Lék.* (accepted for publication, 2006).
- Bertolucci, L.E., and Grey, T. (1995). Clinical analysis of mid-laser versus placebo treatment of arthralgic TMJ degenerative joints. *Craniomandibular Pract.* 13, 27-29.
- Kulekcioglu, S., Sivrioglu, K., Ozcan, O., and Parlak, M. (2003). Effectiveness of low level laser therapy in temporomandibular disorders. *Scandinavian J Rheumatol.* 32, 114-118.
- Cetiner S., Kahraman S.A., and Yücesas S. (2006). Evaluation of low-level laser therapy in the treatment of temporomandibular disorders. *Photomed. Laser Surg.* 24, 637-641.
- Nunez, S.C., Garcer, A.S., Suzuki, S.S., and Riberio, M.S. (2006). Management of mouth opening in patients with temporomandibular disorders through low-level laser therapy and transcutaneous electrical neural stimulation. *Photomed. Laser Surg.* 24, 45-49.
- Beckerman, H., de Bie, R.A., Bouter, L.M., De Cuyper, H.J., and Oostendorp, R.A.B. (1992). The efficacy of laser for musculoskeletal and skin disorders: a criteria-based meta-analysis of randomized clinical trials. *Phys. Ther.* 72, 13-21.
- Sanseverino, N.T.M., Sanseverino, C.A.M., and Ribeiro, M.S. (2002). Clinical evaluation of low intensity laser antialgic action of GaAlAs (wavelength = 785 nm) in the treatment of temporomandibular disorders. *Laser Med. Surg. Abstract issue*, 18.
- Gray, R.J.M., Davies, S.J., and Quayle, A.A. (1994). A clinical approach to temporomandibular disorders: A clinical approach to treatment. *Br. Dent. J.* 6, 101-106.
- Navrátilová, B., and Navrátil, L. (2000). Fototerapie a terapeutický laser ve stomatologických indikacích, in: *Moderní Fototerapie a Laseroterapie*. Navrátil, L. (ed). Prague: Manus Praha, pp. 104-117.
- Kobayashi, M., and Kubota, J. (1999). Treatment of TMJ pain with diode laser therapy. *Laser Therapy.* 1, 11-18.
- Bezzur, N.J., Habets, L.L.M., and Hansson, T.L. (1988). The effect of therapeutic laser in patients with craniomandibular disorders. *J Craniomand. Disorders.* 2, 83-86.
- Hansson, T. (1989). Infrared laser in the treatment of craniomandibular disorders, arthrogenous pain. *J Prosthet. Dent.* 61, 614-617.
- Fikáčková, H., Dostálová, T., Vošicka, R., Peterová, V., Navrátil, L., and Lesák, J. (2006). Arthralgia of the temporomandibular joint: Low level laser therapy. *Photomed. Laser Surg.* 24, 522-527.
- Medlicott, M.S., and Harris, S.R. (2006). A systematic review of the effectiveness of exercise, manual therapy, electrotherapy, relaxation training, and biofeedback in the management of temporomandibular disorder. *Phys. Ther.* 86, 955-973.
- Opatovský J., Raudenská, J., and Rokyta, R. (2000) Vyšetřování osob s algickými syndromy a hodnocení bolesti. *Bolest. Suppl.* 1, 33-37.
- De Bont, L.G.M., Dijkgraaf, L.C., and Stegenge, B. (1997). Epidemiology and natural progression of articular temporomandibular disorders. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 83, 72-76.
- Hanssen, H.J., and Thorøe, U. (1990). Low power laser bistimulation of chronic oro- facial pain. A double blind placebo controlled cross over study in 40 patients. *Pain.* 43, 169-179.
- Gam, A.N., Thosen, J., and Lonnberg, F. (1993). The effect of low level laser therapy on musculoskeletal pain: a meta-analysis. *Pain.* 52, 63-66.
- Conti, P.C.R. (1997). Low level laser in the treatment of TMD: A double-blind pilot study. *Cranio.* 15, 144-149.

Address reprint requests to:

Dr. Tatjana Dostalova
Department of Paediatric Stomatology
The 2nd Medical Faculty
Charles University
V Uvalu 84,150 06,
Prague, Czech Republic

E-mail: tatjana.dostalova@fnmotol.cz