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*Comparison of the effectiveness of the conservative treatment
of the periodontal pockets with or without the use of laser
biostimulation*

It is difficult today to imagine a modern dental surgery without at least one of several types of lasers. Lasers which are most common among dentists are biostimulative lasers of low or medium power. They may be a complementation of the traditional therapy of periodontal diseases and the diseases of the oral mucosa. Preservation of proper means of personal protection makes laser therapy the method which is safe both for the patient and for the doctor performing the surgery (8, 15). Contraindications concerning the use of laser therapy which are mentioned in references are scarce. Absolute contraindications are: neoplastic diseases, diabetes mellitus, generalized bacterial diseases, disturbances in hormonal balance, application in the area of endocrine glands.

The Department of Periodontology at the Medical University in Lublin has had the biostimulative PCM-018 laser for two years. The laser has been used as the adjunctive treatment of gingivitis, periodontitis, labial herpes, chronic recurrent aphtae, hypersensitivity of the teeth necks as well as after the surgical procedures performed on the periodontium.

The aim of this work was the comparison of soft tissues healing after the routine periodontological conservative treatment with and without the additional use of laser biostimulation for two groups of pockets: 2–5 mm and below 5 mm.

MATERIAL AND METHODS

Six patients treated in the Department of Periodontology for periodontitis were chosen for the study. In these people radiologically mixed, vertical and horizontal defects of the bones of alveolar processes were revealed as well as the periodontal pockets up to 9.5 mm. In all patients conventional conservative treatment was applied, simultaneously the right side of the periodontium (maxilla and mandible) was irradiated with biostimulative PCM-018 laser (wave length 830 nm, power 200 mW, time 20 sec.) using the dose of 4 J on the papilla every day or every two days for seven days. API (Approximal Plaque Index), acc. to Lange and associates, the SBI (modified Sulcus Bleeding Index), PPD (Periodontal Pocket Depth) indices were submitted to clinical analysis (10), for each side separately. The measurements of pockets' depths were performed with the use of electronic Paro Audio Probe in six points at each tooth. The use of this probe allows to control the pressure force on the tissues inside the pocket increasing the repeatability of the measurements (5). Additionally, during each appointment the patients were asked the same questions concerning the occurrence of pain or observed bleeding

during the hygienic procedures. The examinations were conducted four times: I. Before the beginning of the treatment. II. After the hygiene phase: hygiene training, supra- and subgingival scaling and the removal of topical irritating and traumatic agents. III. After the laser therapy. IV. 3 months after the end of the therapy.

Generally, 891 sites were examined out of which 278 pockets were excluded having the values of PPD up to 2 mm and thus not demanding the treatment (physiological gingival clefts). Two groups of pockets were submitted to statistic analysis; with the measure values of PPD 2–5 mm and above 5 mm – usually qualified for surgical treatment. Thus, on the right side of patients' dentition which was conservatively treated with laser therapy 323 pockets were found (297 with the depth of 2–5 mm and 26 above 5 mm) and on the left side treated solely conservatively there were 290 sites (including 251 with the depth 2–5 mm and 39 above 5 mm).

The statistic analysis of the PPD values was conducted using Anova Friedman, Wilcoxon and U Mann-Whitney tests. The influence of laser biostimulation was compared on the healing of shallow (2–5 mm) and deep (> 5 mm) periodontal pockets. The differences were considered statistically essential for the essentiality level $p < 0.05$.

RESULTS

Table 1 presents the mean values of API and SBI indices in the successive examinations for the right side where conservative treatment and laser therapy were used and also the values for the left side treated only conservatively. Distinct decrease of indices values was stated both on the side treated conservatively and the one treated with additional use of biostimulative laser.

Table 1. Mean values of the Sulcus Bleeding Index (SBI) and Approximal Plaque Index (API) in successive examinations

Examination	Right side – conservative treatment + laser		Left side – conservative treatment	
	API	SBI	API	SBI
I	76%	73%	80%	75%
II	41%	20%	43%	34%
III	15%	10%	23%	20%
IV	20%	13%	20%	19%

N – number of sites, Min – minimal value, Max – maximum value, M – arithmetic mean, SD – standard deviation, Me – median – median value, p – importance level, ns – statistically not important

Statistically essential drop of the PPD values was revealed in the four successive examinations both after the conservative treatment and after the conservative treatment and laser biostimulation (Table 2, 4, 7, 9). Changes among the successive examinations were statistically essentially higher in the therapy with the use of laser both for the pockets up to 5 mm and for the deep ones, above 5 mm (Table 3, 5, 6, 8). The statistic analysis conducted using U Mann-Whitney test (Table 10) revealed that with the pockets of 2–5 mm the influence of laser therapy was statistically essential only in examination II whereas the use of laser biostimulation as the treatment reinforcing the healing of deep pockets (> 5 mm) was essentially statistically profitable which was visible while comparing the results of examinations I, II and IV in both groups.

In the subjective evaluation of patients the use of biostimulative laser almost completely eradicates pain on the side submitted to its activity after the first procedure. The evaluation of bleeding was doubtful as the patients were not able to define clearly the site of bleeding.

Table 2. PPD values of the pockets 2–5 mm conservatively treated in the successive examinations

2 to 5	N	min	max	M	SD	Me	Anova Friedman	
I	251	2.00	5.00	3.12	0.75	3.00	443.19	P<0.0001
II	251	0.50	4.50	2.39	0.71	2.50		
III	251	0.50	5.00	1.82	0.86	2.00		
IV	251	0.50	3.50	1.69	0.74	1.50		

Table 3. The comparison of PPD pockets conservatively treated in particular treatment stages.

	P
I vs II	<0.01
II vs III	<0.0001
III vs IV	<0.0001

Table 4. The values of the PPD pockets above 5 mm conservatively treated in the successive studies

> 5	N	Min	max	M	SD	Me	Anova Friedman	
I	39	5.50	9.50	6.18	1.12	5.50	100.59	P<0.0001
II	39	2.50	6.50	4.21	0.83	4.00		
III	39	0.50	5.00	2.76	1.31	2.50		
IV	39	1.00	5.50	2.53	1.10	2.00		

Table 5. The comparison of the PPD values of the pockets above 5 mm conservatively treated in particular treatment stages (Wilcoxon test)

	P
I vs II	<0.0001
II vs III	<0.0001
III vs IV	ns

Table 6. The PPD values of the pockets 2–5 mm treated conservatively and with laser therapy in the successive studies

2 to 5	N	min	max	M	SD	Me	Anova Friedman	
I	297	2.00	5.00	2.97	0.76	3.00	630.76	P<0.0001
II	297	0.50	4.50	2.07	0.68	2.00		
III	297	0.50	3.50	1.70	0.67	1.50		
IV	297	0.50	3.00	1.47	0.53	1.50		

Table 7. Comparison of the PPD values 2–5 mm treated conservatively and with laser therapy in the successive studies (Wilcoxon test)

	P
I vs II	<0.001
II vs III	<0.0001
III vs IV	<0.0001

Table 8. Comparison of the PPD values above 5 mm treated conservatively and with laser therapy in the successive studies

> 5	N	Min	max	M	SD	Me	Anova Friedman	
I	26	5.50	7.50	6.02	0.71	5.50	70.888	P<0.001
II	26	1.50	5.50	3.37	0.87	3.50		
III	26	0.50	3.50	2.19	1.05	2.50		
IV	26	1.00	3.50	2.19	0.72	2.25		

Table 9. Comparison of the PPD values treated conservatively and with laser therapy in the successive studies (Wilcoxon test)

	P
I vs II	<0.0001
II vs III	<0.0001
III vs IV	ns

Table 10. Comparison of the influence of laser biostimulation on the decrease of PPD periodontal pockets depth

Conservative vs Conservative + laser	P
2 to 5 mm	
I vs II	ns
II vs III	<0.0001
III vs III	ns
IV vs IV	ns
>5 mm	
I vs I	<0.01
II vs II	<0.0001
III vs III	ns
IV vs IV	<0.05

DISCUSSION

Laser biostimulation was used in the treatment of numerous diseases of the oral cavity, for example impeded wisdom tooth eruption, after resections, in the illnesses of temporo-mandibular joint, trigeminal nerve neuralgias, postextraction aches, periodontal diseases etc. (4, 6, 9, 11, 12). The study revealed that reinforcing the conventional conservative treatment of the periodontitis using laser biostimulation substantially accelerates it. The decrease of the API, SBI and PPD indices values in the successive examinations is the evidence of the effectiveness of the conducted therapy. The comparison of changes on the side treated with the conservative method only as well as the conservative and biostimulative ones, shows faster and larger drop of the measured pockets depth on the side submitted to laser therapy especially in deeper pockets, i.e. above 5 mm. Low power laser radiation stimulates the regeneration process of the damaged tissues through the increase of collagen production and the DNA and RNA synthesis, the increase in the number of macrophages, fibroblasts and the decrease of the dystrophic cell changes (9, 11, 12). Laser light also reduces the number of bacteria in the treated area (11). The studies conducted in Szczecin Clinical Centre did not prove any essential differences in the healing of the periodontium soft tissues after the routine procedure of deposits removal (scaling) as well as root planing in comparison with the same procedures combined with laser stimulation. These studies were conducted in 28 patients who had 4 pockets in mandible analysed (2 with laser therapy and 2 without it). The authors obtained statistically essential drop of the SBI, SFR (Sulcus Fluid Rate) indices which

are the evidence of the decrease of clinical symptoms of the periodontium inflammation in both groups (6). It is compatible with the results obtained in self studies, in which both methods of treatment also led to the essential decrease of the evaluated indices.

Laser therapy is anti-inflammatory, antioedematous, accelerates the regeneration of the damaged tissues and decreases the risk of infection (3, 11). The analgesic action of laser light is related to the stimulation of the metabolic processes in the mitochondria. In the consequence of endorphins production or opiate-like substances the peripheral nerves excitability is decreased (11). Clinical studies conducted by Płocica et al. (7) reveal substantial differences in reducing the time of pain duration and the cease of inflammation in patients treated without the use of laser therapy, which corresponds to our observations. Similar results were obtained by other authors as well (1, 2, 3, 9). Bendowski (1) and Ciechowicz (3) claim that the use of laser biostimulation only is utterly sufficient for the elimination of pain after dental surgical procedures even 3 days after the procedure. The clinical studies of Piekarczyk (12), Grzesiak-Janias (9) reveal considerable reduction of pain duration and the cease of inflammation in patients treated with the use of laser therapy in comparison with the patients treated without laser therapy. In patients treated for anhydrous alveolus laser light together with pharmacotherapy eliminated pain as soon as after 24 hours, that is after the first cycle of irradiation (1). The authors quoted used low therapeutic doses i.e. 2–4 J/cm² once a day for 1.5–3.5 min. It was stated that higher doses; 6–12 J/cm² applied only once for 5–10 minutes are effective in obtaining the anti-inflammatory effect and the stimulation of tissue regeneration. In self studies patients when asked about the pain occurrence during the treatment of periodontitis, emphasized substantial reduction of pain duration on the side treated with the use of laser therapy in comparison with the opposite side and it was even after the first procedure. The final result of the treatment obtained in self studies with the use of laser stimulation confirmed by the statistic analysis of the examined indices recommends the use of this method in the complex treatment of periodontitis, especially in deeper periodontal pockets. Numerous authors' clinical investigations confirm positive stimulating influence of laser therapy in the process of reinforcing the healing of the periodontal tissues (1, 2, 3, 6, 9, 12, 15).

CONCLUSIONS

1. Reinforcing the conventional periodontological treatment with laser biostimulation considerably accelerates it, influencing the decrease of the investigated indices values in the successive examinations especially in the pockets deeper than 5 mm but also in 2–5 mm pockets.

2. Laser biostimulation leads to the eradication of pain in a shorter time than conservative treatment.

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SUMMARY

The use of laser therapy as the agent reinforcing conventional treatment of the periodontal diseases becomes more and more common. In the physiotherapy of the periodontal diseases the biostimulating laser is eagerly used because of its action which accelerates the healing of wounds and also because of its antioedematous, anti-inflammatory and analgesic action. The aim of work was the evaluation of the influence of laser biostimulation on the change of the periodontological pockets depth after the routine conservative periodontological treatment with additional use of laser biostimulation and without it for two groups of pockets: above and below 5 mm. In six patients having periodontitis 613 sites were submitted to the statistic analysis (290 treated conservatively only, including 251 with the depth 2–5 mm and 39 above 5 mm as well as 323 with the use of laser therapy including 297 shallow pockets and 26 deep ones). The initial values of API, SBI, PPD and their changes in the course of the treatment were registered. During each control appointment the patients subjectively estimated periodontal pain occurrence. In both studied groups statistically essential decrease of the evaluated parameters was obtained. Reinforcing the conventional treatment with laser biostimulation shortens its duration and leads to the elimination of pain faster than with the use of conservative treatment only. The changes of the PPD index among the successive examinations were statistically essentially higher in the therapy with the use of laser, especially in relation to deep pockets.

Porównanie skuteczności leczenia zachowawczego kieszeni przyzębnych z zastosowaniem lub bez biostymulacji laserowej

Zastosowanie terapii laserowej jako środka wspomagającego leczenie chorób przyzębia staje się coraz bardziej powszechne. W fizykoterapii chorób przyzębia laser biostymulacyjny jest chętnie używany z uwagi na swoje działanie przeciwobrzękowe, przeciwzapalne, przeciwbólowe, przyspieszające gojenie ran. Celem pracy była ocena wpływu biostymulacji laserowej na zmianę głębokości kieszonek przyzębnych po rutynowym zachowawczym leczeniu periodontologicznym z zastosowaniem dodatkowo biostymulacji laserowej i bez niej dla dwóch grup kieszonek: powyżej i poniżej 5 mm. U 6 pacjentów z zapaleniem przyzębia ocenie statystycznej poddano 613 miejsc (290 leczonych wyłącznie zachowawczo, w tym 251 o głębokości 2–5 mm i 39 powyżej 5 mm oraz 323 z użyciem laseroterapii, w tym 297 płytkich i 26 głębokich). Rejestrowano wstępne wartości wskaźników API, SBI, PPD oraz ich zmiany w przebiegu leczenia. W trakcie każdej z wizyt kontrolnych pacjenci subiektywnie oceniali dolegliwości bólowe ze strony przyzębia. W obydwu badanych grupach uzyskano statystycznie istotne obniżenie wartości ocenianych parametrów. Wspomaganie konwencjonalnego leczenia biostymulacją laserową skraca jego czas i prowadzi do likwidacji objawów bólowych szybciej niż przy zastosowaniu tylko leczenia zachowawczego. Zmiany wskaźnika PPD między kolejnymi badaniami były istotnie statystycznie wyższe w terapii z zastosowaniem lasera, szczególnie w odniesieniu do kieszonek głębokich.