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THE USAGE OF LOW POWER LASER IN THE THERAPY OF PAIN IN THE PATIENTS WITH ACUTE LOW BACK PAIN SYNDROME

SUMMARY

The aim of the paper was to compare the results of pain reduction by usage of low power laser therapy (LPL) and by therapy of other physical procedures in the patients with acute lumbal pain syndrome (ALPS). The investigation involved 70 patients divided into three groups, aged 25-64 years, from the city of Nis. The first group involved 20 patients treated with the LPL with frequency of 73 Hz. The second group included 20 patients treated with the LPL with frequency of 5000 Hz. The patients from the third group were treated with electrotherapy, termotherapy and exercise. All the patients were examined before the application of laser therapy, and than they had two control examinations. The Mantel-Haensezel X^2 test, t-test and the Fischer's exact probability test were used for the statistical analysis. Each patient had 10 treatments, and the intensity of pain was assessed after each third treatment, according to the four-degree scale. In the patients who were treated with the LPL with frequency of 73 Hz, the analgesic effect was obtained in 7 patients already after the fifth treatment. In the patients treated with the LPL with the frequency of 5000Hz, the analgesic effect was obtained in 4 patients. After 8 treatments, the analgesic effect was obtained in 9 patients of the first group and also in 5 patients of the second group. After 10 treatments, the analgesic effect was obtained in 18 patients (90%) of the first group and in 15 patients (75%) of the second group. In 18 patients, the analgesic effects was obtained after 7,05 treatments (SD=2,1) on average. In 15 patients of the second group, the analgesic effect was obtained after 8,04 treatments (SD=1,17) on average. The difference was statistically significant ($t=2,245>t=2,03$ and $p<0,05$, S.S=32). In the third group, the analgesic effect was obtained in 6 patients (20%) and for 17,5 average treatments. It can be concluded that the analgesic effect was obtained in a larger number of patients and for the shorter time period after the application of LPL than in patients who were not treated with the LPL. By the application of LPL with frequency of 73 Hz, the analgesic effect was obtained faster and in a larger number of patients compared with the usage of LPL with frequency of 5000 Hz. Further studies involving a larger number of patients are necessary so as to investigate the duration of the obtained analgesic effect of laser therapy.

Key words: **laser therapy, low power laser, acute lumbal pain syndrome, analgesia**

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INTRODUCTION

Low power lasers (LPL) have been promoted as an effective way to produce analgesia and accelerate healing of a variety of clinical conditions (1). An appropriate dose of light can improve speed and quality of acute and chronic wound healing, soft tissue healing, pain relief, and improve the immune system and nerve regeneration (1).

The acute low back pain syndrome (ALBPS) encompasses the symptoms and physical signs which may appear because of the irritation of free nerve ends of the spinal nerves in the soft tissues of vertebral segment or because of the radix compression of the spinal nerve in the region of intervertebral canal or inervertebral hole (2-4).

In the majority of cases, ALBPS is the result of degenerative changes of vertebral discuses (3,4). This occurs in almost 90% of cases (2,3). In addition, some other diseases or injuries of lumbar spine might give the clinical manifestation of ALBPS (2). Some of degenerative changes of the intervertebral discus are simply the result of the ageing process, but there is a large number of different environmental factors which also may cause the injuries and disorders of intervertebral discuses (3).

There are many authors who have pointed out that the main causes of prolapses of intervertebral discus (prolapsus nuclei pulposi) are the degenerative processes of joints of the lumbar and sacral segments of the spine. In the majority of cases, these degenerative processes occur at the level of the fourth and fifth lumbar vertebrae, and at the level of the fifth and first sacral vertebrae. These vertebrae are exposed to the greatest loads and injuries (2,3).

Many nonpharmacologic therapies are available for the treatment of acute low back pain (4); LPL is one of them.

Laser therapy is the application of red and near infrared light over injuries or lesions to improve wound / soft tissue healing and give relief for both acute and chronic pain. By definition, LPL therapy uses irradiation intensities that induce minimal temperature elevation (not more than 0.1-0.5°C). LPL are also known as "cold lasers" and non-thermal lasers. Their biological effects are not thermal (5). Laser therapy is used to: increase the speed, quality and tensile strength of tissue repair; give pain relief; resolve inflammation; as an alternative to needles for acupuncture. The advantages of the laser therapy are the following: it is noninvasive, nontoxic, it is not painful and very fast (5).

AIMS

The aim of the paper was to compare the results of the usage of laser therapy with the results of other procedures of physical medicine in pain reduction.

MATERIAL AND METHODS

The investigation involved 70 patients, aged 25-64 years, of different professions, from the city of Nis. The diagnosis of the ALBPS was based on the detailed history, physical examinations, X-ray of lumbar and sacral (LS) spine segments, electromyelographical (EMG) findings. The patients were divided into three groups. There were 20 patients in the first group who were treated with the LPL with the frequency of 73 Hz. The second group included 20 patients treated with the LPL with the frequency of 5000 Hz. The third group involved 30 patients who were treated with different physical procedures such as electrotherapy, thermotherapy and exercise. All the patients were examined before the application of therapy, and then they had two control examinations. Each patient had 10 treatments, and the intensity of the pain was assessed after each third treatment in all examined groups. The intensity of pain was assessed according to the four-degree scale as it follows: 0-without pain; 1-pain after palpation; 2-pain during movements; 3-pain when body is at rest.

The patients were treated with the low power laser-Gallium Arsenide (GalAs), with sonde that consisted of 4 laser diodes, each powered of 15 mW, wavelength 904nm and with frequency from 73 to 5000 Hz. The total period of time for each treatment was 10 minutes and the total dose per treatment was 36J.

As for statistical parameters, average values, standard deviation (SD), coefficient of variation (CV) were calculated. The Mantel-Haensezl X^2 test, t-test and Fisher's test of exact probability were used for statistical analysis. The statistical analysis was performed by Microsoft Excel programme.

RESULTS

Table 1 presents the data related to gender and the mean age of patients having been treated with the laser therapy.

Table 1: Distribution of examined groups of patients by age and applied therapy

Age group	Laser therapy				Other physical procedures	
	73Hz		5000 Hz			
	n	%	n	%	n	%
25-34	3	15	2	10	3	10
35-44	2	10	4	20	7	23
45-54	10	50	7	35	10	34
55-64	5	25	7	25	10	23
Total	20	100	20	100	30	100

According to these data, a large number of patients was from the age group 45-54 years. More than one third of all the patients (38,6%) belonged to this age group. The mean age of patients treated with the laser therapy was 49,45 years, and the mean age of patients treated with other procedures of physical medicine was 48,87 years. The difference found was not statistically significant (p>0,05).

Different clinical manifestations of ALBPS were described Table 2.

Table 2: Distribution of clinical manifestation of ALBPS

Clinical manifestation	I group (73Hz) number	%	II group (5000 Hz) number	%	Total number	%
Lumboishialgia	8	40	9	45	17	43
Ishialgia	6	30	5	25	11	27
Lumbago acuta	3	15	5	25	8	20
Radiculopathia compresiva	1	5	0	0	1	2.5
Insuficientio dorsi	2	10	1	5	3	7.5
Total	20	100	20	100	40	100

According to the data in Table 2, the most frequent were lumboischialgia, ishialgia, lumbago acuta, while less frequent was insuficientio dorsi. The difference was not statistically significant (p>0,05).

Table 3 presents the number of treatments with the low power laser and the number of patients without acute low back pain.

Table 3: The number of treatments and the number of patients treated with the LPL producing analgesic effect

Pain reduction	I group (73Hz) number	%	II group (5000 Hz) number	%
1. After 5 treatments	7	35	4	20
2. After 8 treatments	9	45	5	25
3. After 10 treatments	2	10	6	30
Total	18	90	15	75
Persistent pain	2	10	5	25
Total	20	100.0	20	100.0

In the patients who were treated with the LPL with frequency of 73Hz, an analgesic effect was obtained in 7 patients (35%) even after the fifth treatment. In the patients of the second group who were treated with the low power laser with frequency of 5000 Hz, the analgesic effect was obtained in 4 patients (20%) after the same number of treatments.

After 8 treatments, the analgesic effect was obtained in 9 patients (45%) of the first group and also in 5 patients (25%) of the second group.

After 10 treatments, the analgesic effect was obtained in 2 patients (10%) of the first group and in 6 patients (30%) of the second group.

After 10 treatments, the analgesic effect was obtained in 18 patients (90%) of the first group and in 15 patients (75%) of the second group (Table 3). There were 2 patients (10%) of the first group and 5 patients (25%) of the second group who felt pain after 10 treatments. The difference was not statistically significant (p>0,05).

Table 4 presents the final results after 10 treatments with the LPL. After 10 treatments with LPL, the analgesic effect was obtained in 33 patients (82,5%) of 40 treated patients. The analgesic effect was obtained in 18 patients (90%) of the first group and in 15 patients (75%) of the second group (Table 4).

Table 4: The presence of the acute low pain back after 10 treatments in the patients treated with LPL

Examined group	Without pain number	%	With pain Number	%	Total number	%
I group (73Hz)	18	90	2	10	20	100
II group (5000 Hz)	15	75	5	25	20	100
Total	33	82.5	7	17.7	40	100

In 18 patients of the first group, the analgesic effect was obtained after 7,05 treatments (SD=2,1) on average. In 15 patients of the second group the analgesic effect was obtained after 8,04 treatments (SD=1.7) on average. The difference was statistically significant ($t=2.245 > t=2.03$ and $p<0.05$, S.S=32).

According to the results of t-test and Fischer's test of exact probability (p=0,15), it was determined that the analgesic effect with the usage of the LPL with frequency of 73 Hz was obtained faster and for the shorter time period compared with the usage of LPL with the frequency of 5000 Hz.

After 10 treatments, the analgesic effect was achieved in 6 patients (20%) of the third group. The analgesic effect was obtained in the third group after 17.5 treatments on average.

DISCUSSION

Low power laser therapy has been proposed

as a treatment of carpal tunnel syndrome, painful musculoskeletal disorders such as temporomandibular joint dysfunction and acute and chronic low back pain, and other conditions such as wound healing (6). Low power lasers are also known as "cold lasers" and non-thermal lasers. Low power lasers refer to the use of red-beam or near-infrared lasers with a wavelength between 600 and 1000 nm and Watts from 5-500 milliwatts (7).

When applied to the skin, these lasers produce no sensation and do not burn the skin. Because of low absorption by human skin, it is hypothesized that the laser light can penetrate deeply into the tissues where it has a photobiostimulative effect (6,7).

The analgesic effects of low-energy lasers have been most intensely studied in rheumatoid arthritis. Recent well-designed, controlled studies have found no benefit from low energy lasers in relieving pain in rheumatoid arthritis or other musculoskeletal conditions (8).

There is still debate on the analgesic effect of laser, and its mechanism of action is not clear. One explanation has focused on the systemic effect of laser, which may alter the sensorial input to the central nervous system and decrease the perception of localized pain in the treated area (9). Other researchers have suggested a mechanism starting with secretion of endogenous opioids, as in acupuncture and transcutaneous electrical nerve stimulation, and leading to clearance of the analgesic substances via stimulation of the microcirculatory system (9).

There are contradicting results in the medical literature about the relationship between the clinical effect of the laser and its frequency. Some results have shown that there are no differences between the applied laser frequencies and wound regeneration process (8).

The use of frequencies between 80 Hz and 120 Hz would help to calm the pain afferents. Higher Hz frequencies are necessary to penetrate into tissues overlying the area, along with a low duty cycle (5).

The dependence of the neural response was shown in the mice (9); impulses of low frequency produced an increased release of acetylcholine from the isolated Aeurbach's plexus (9).

The basic effects of the low power laser (biochemical, bioenergetical and bioelectrical) are the result of the absorption and they also may cause two indirect effects, as the following: the stimulation of microcirculation and stimulation of cell's metabolism (10). These indirect effects of low power laser cause the general positive therapy effects and one of them is the analgesic effect (10).

It is confirmed in many experiments that the low power laser may cause two effects on the neuron cell's membrane: stimulative effect and stabilizing effect. Many authors have pointed out the importance of these effects of the LPL for the pain reduction (11).

Miriutova et al. (12) followed 73 patients with compression-ischemic myeloradiculopathy who received treatment including infrared laser radiation on the paravertebral fields, motor points of the affected nerves and biologically active points Y63, Y67, YB34, YB42, YB43, E34, E42 (1.0-5.0 mW/cm2; 5 and 5000 Hz), electrostimulation of motor nerve points and innervated by them muscles by double square impulses with a fixed gap 5 ms. Impulse infrared laser therapy relieves pain syndrome, stimulates repair processes in the affected nerve structures. Further modified electric stimulation activates a regenerative growth of the nerve fibers, reinnervation of the limb muscles (12).

The results of our examination showed that the laser therapy had statistically significant better results related to the pain reduction in the patients with ALBPS. The analgesic effect which was obtained in patients with the usage of LPL with the frequency of 73 Hz was achieved faster than by the usage of LPL with the frequency of 5000Hz.

Although all the patients who were treated with the LPL were in better clinical condition than before the therapy, some of the differences were determined.

CONCLUSION

The analgesic effect was obtained in 90% of patients from the first group, in 75% of patients from the second group and in 20% of the patients from the third group. The analgesic effect which was achieved with the application of LPL was obtained faster and in the larger number of patients than with the application of other procedures of physical medicine. Further studies are necessary to investigate the effect of laser therapy in this syndrome.

REFERENCES

1. Yousefi-Nooraie R, Schonstein E, Heideri K. et al. Low level laser therapy for nonspecific low-back pain. Cochrane Database Syst Rev 2007.

2. Mandic M. Primena lasera male snage u terapiji akutnog bolnog sindroma. Magistarska teza. Medicinski fakultet u Nisu. Univerzitet u Nisu, 2001.

3. Jajic I i saradnici. Lumbalni bolni sindrom. Skolska knjiga, Zagreb, 1984: 56-65.

4. Konecni J. Klinicka reumatologija. Medicinska knjiga, Beograd-Zagreb, 1984.

5. Fitz-Ritson Don. Lasers and their therapeutic applications in chiropractic. J Can Chiropr Assoc 2001; 45(1):1-13.

6. Brosseau L, Robinson V, Wells G, et al. Low level laser therapy (Classes I, II and III) for treating rheumatoid arthritis. Cochrane Database Syst Rev. 2005;4

7. Brosseau L, Robinson V, Wells G, et al. Low level laser therapy (Classes III) for treating osteoarthritis. Cochrane Database Syst Rev. 2007;1.

8. Lale A, Umit B, Hehtap M.A: Investigation of the effect of GaAs laser therapy on cervical myofascial pain syndrome. Rheumatol Int 2005;25:23-7.

9. Vizi ES, Master, Tizza S, Mester A: Acetylcholine realizing effect of laser irradiation of Aerbach plexus in guinea ping ileum. J Neurolo Transm 1977; 40(4):305-8.

10. Lazovic M. Laseroterapija. ECPD, Beograd, 1997: 137-8.

11. Sato T, Kawatani M, Takeshige C, Matsumoto I: GaAlAs laser irradiation inhibic neuronal activity associated with inflammation. Acpunct. Electrother Res 1994;19(2-3):141-151.

12. Miriutova NF, Abdulkina NG, Luksha LV, Levitskii EF. Laser therapy and electric stimulation in rehabilitation treatment of peripheral neuropathy. Vopr Kurortol Fizioter Lech Fiz Kult. 2002;(4):25-7.

PRIMENA LASERA MALE SNAGE U TERAPIJI BOLA KOD BOLESNIKA SA SINDROMOM AKUTNOG LUMBALNOG BOLA

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SAŽETAK

Cilj rada bio je da uporedi rezultate laseroterapije sa rezultatima klasičnih fizikalnih procedura u terapiji bola kod bolesnika sa sindromom akutnog lumbalnog bola (ALBS). Ispitivanjem je obuhvaćeno 70 bolesnika, životne dobi 25-64 godine, sa teritorije grada Niša. Formirane su tri grupe. U prve dve grupe bilo je po 20 bolesnika i oni su bili tretirani laserom male snage (LPL), a treća grupa bila je kontrolna i u njoj je bilo 30 bolesnika. Kod bolesnika iz treće grupe primenjivane su elektroterapija, termoterapija i kineziterapija. Bolesnici iz prve grupe tretirani su LPL, frekvencije 73 Hz, bolesnici iz druge grupe tretirani su LPL, frekvencije 5000 Hz. Svi bolesnici bili su pregledani pre primene terapijskih procedura, a zatim su imali dva kontrolna pregleda. Svaki bolesnik imao je 10 tretmana. Intenzitet bola određivan je posle svakog trećeg tretmana, prema četvorostepenoj skali. Za statističku analizu primenjeni su Mantel-Haensezel X2 test, t-test i Fisherov test egzaktne verovatnoće. Analgetski efekat postignut je kod 18 (90%) bolesnika iz prve grupe i kod 15 (75%) iz druge grupe. Kod bolesnika iz prve grupe, analgetski efekat postignut je u proseku posle 7.05 tretmana (SD=2.1), a kod 15 iz druge grupe, analgetski efekat postignut je u proseku posle 8.04 tretmana (SD=1.71). Razlika od 1.01 tretmana statistički je značajna ($t=2.245 > t=2.03$; $p<0.05$ i S.S=32). Kod treće grupe, analgetski efekat postignut je kod 6 bolesnika (20%) i to u proseku posle 17.5 tretmana. Može se zaključiti da je analgetski efekat postignut kod većeg broja bolesnika i za kraće vreme posle primene laseroterapije, nego kod onih kod kojih nije bila primenjena laseroterapija. Razlika između grupa tretiranih laserom male snage, različitih frekvencija u brzini postizanja analgetskog efekta, statistički je značajna ($p<0.01$). Primenom lasera niže frekvencije (73Hz) analgetski efekat postignut je brže i kod većeg broja bolesnika nego posle primene lasera sa višom frekvencijom (5000Hz). Potrebna su dalja ispitivanja i kod većeg broja bolesnika, kako bi se utvrdilo trajanje postignutog analgetskog efekta.

Ključne reči: **laseroterapija, laseri male snage, akutni lumbalni bolni sindrom, analgezija**