

CLINICAL-STATISTICAL STUDY ON THE EFFECTIVENESS OF ULTRASOUND COMBINED WITH LASER IN OUTPATIENT TREATMENT

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Abstract

This paper summarizes the results of a study conducted in order to determine the benefit of combined laser and ultrasound treatment applied in patients undergoing ambulatory rehabilitation treatment within Fiziomed Recovery Practice in Botosani. There have been evaluated patients aged 20-80 years old, who received rehabilitation treatment within this private practice between April 2009-May 2012. A number of 386 patients with post-traumatic disorders and other myofascial tissue disorders have been taken into study. The objectives of the complex rehabilitation programme are: restoring and preserving the main myo-arthropod-kinetic parameters, reducing pain syndrome, in order to increase patients' quality of life.

Key words: pain, joint stiffness, laser, ultrasound, study

1. INTRODUCTION

The purpose of the study is to assess the benefit of ultrasound treatment combined with laser in post-traumatic disorders and other myofascial tissue disorders

1.1. The objectives of laser biostimulation

Laser biostimulation is a proven method for treating acute and chronic pain. There have been used laser radiations known as "low level laser therapy" (LLLT), with (600-1000) nm wavelength and power density of (0.05-5) W/cm². Laser treatment may:

- reduce the painful and inflammatory syndrome;
- decrease joint stiffness and increase range of motion;
- fight muscle contraction;
- increase oxidative processes;
- stimulate cell functions;
- increase or inhibit (according to dose) collagen synthesis.

1.1.2. Biological effects of laser radiation

1.1.2.1. Systemic stimulating effect: increased urinary acetylcholine secretion, corticosteroids can be noticed.

1.1.2.2. Local effects:

- increased oxidative processes;
- stimulation of some cell functions;
- increase the cell metabolism;
- increasing or inhibiting (according to dose) collagen synthesis;
- enhanced action potential of the nerve cell;
- stimulating DNA and RNA formation;
- local stimulation of the immune system;
- improve epithelialization and granulation;
- enabling local inflammatory systems.

1.2. The objectives of ultrasound therapy

Ultrasound therapy has proven its effectiveness in both articular pathology and soft tissue in the acute, subacute and chronic stages.

1.2.1. Biological effects of ultrasound therap.

After penetration into tissues, ultrasound produces thermal and mechanical heat, causing local tissue temperature increase, favouring blood circulation. Ultrasound can be with pulsatile or continuous emission. In this study, we used the continuous form, with a frequency of 1 MHz and intensity $I = 0.6 \text{ W / cm}^2$. In areas exposed to ultrasounds, there could be observed selective heating, decrease joint stiffness, increased pain threshold, moderate increase of blood flow.

1.3. The objectives of the complex rehabilitation programme are:

- fighting pain;
- maintaining joint mobility;
- maintaining or restoring muscle tone;
- improving local circulation;
- increasing quality of life.

To restore motion amplitude, the kinetic methods are different depending on the structure involved in limiting mobility. Thus, for the involvement of the soft tissue (muscle, connective periarticular tissue) muscle stretching has been recommended through which the soft tissue, pathologically shortened, can be elongated allowing increased flexibility, limiting pain and muscle tension and contributing to physical and mental relaxation, as well as to active inhibition, especially when the limit is determined by muscle contracture in a muscle normally innervated. In combination with stretching, the muscle is relaxed, facilitating its elongation during stretching.

For the case in which articular structures are involved, manipulations and mobilizations are recommended (allowing for joint movement correction, decreasing joint pain syndrome, retaining normal biological status).

When both soft tissue and joint structures are involved, stretching and active inhibition can be applied (hold-relax, hold-relax-contraction, agonist contraction), mobilizations and manipulations.

2. METHODS

2.1. The selection of the patients

We have studied four groups of patients with post-traumatic disorders (sprains and muscle contusions, sequelae post first degree sprains, post fracture sequelae or dislocation) and other myo-fascial tissue diseases (bursitis, cervicalgia, muscle stiffness, epicondylitis, fasciitis, painful shoulder syndrome), selected on the basis of diagnosis, age, gender.

Between 2009-2012, a number of 411 patients came *Fiziomed Recovery Practice*, of which 386 were selected to be included in this study.

The selection criteria were:

- patients had algic and functional symptoms;
- a painful episode between 2009-2012;
- no other conditions;
- opportunity to assess the patient at the beginning, at the end of the treatment and on the 30-day-check-up;
- the patient's consent to apply the specific recovery programme;
- data collection was done according to the principles of medical ethics.
- exclusion criteria were:

- age (under 20 and over 80 years old);
- debilitating conditions associated;
- neuro-psychiatric diseases.

The large majority of the patients presented to the consultation on their own initiative (76%), the rest on referral from a GP or specialist (24%). For the application of the recovery programme, the patient's consent was asked for.

Patients' evaluation was done in the Fizomed private practice, upon the onset of the algo -functional episode, 5 days after the onset of treatment and at end of the recovery programme.

There have been included in the study anamnestic parameters (pain, functional impotence), clinical and functional parameters according to condition (assessment of motion range and flexibility, prehension assessment, LDAs deployment).

Scales and questionnaires were used for evaluation, namely VAS scale for pain and the functional index – LEE, for the assessment of the clinical and functional status.

These scales allow the expression of the elements described by the patient in the form of quotes and recording a score used for comparison in evolution of the same patient data, as well as interpatients.

LEE functional index is a tool that allows the general functional assessment of the patient diagnosed with a musculoskeletal pain, which has implications for the quality of life. This index includes 17 questions that refer to different functional activities the patient conducts daily.

The final score of the scale ranges from 0 (corresponding to an optimal functional status) and 34 (corresponding to a minimum functional status, the patient not being able to perform activities due to his/her clinical condition).

2.2. Statistical analysis

Patients' data were processed by calculating the averages, proportions (%), standard deviation, while in order to compare the mean values of the quantitative variables, we used the „t-Student” test.

2.3. Recovery and treatment methodology used in the four study groups

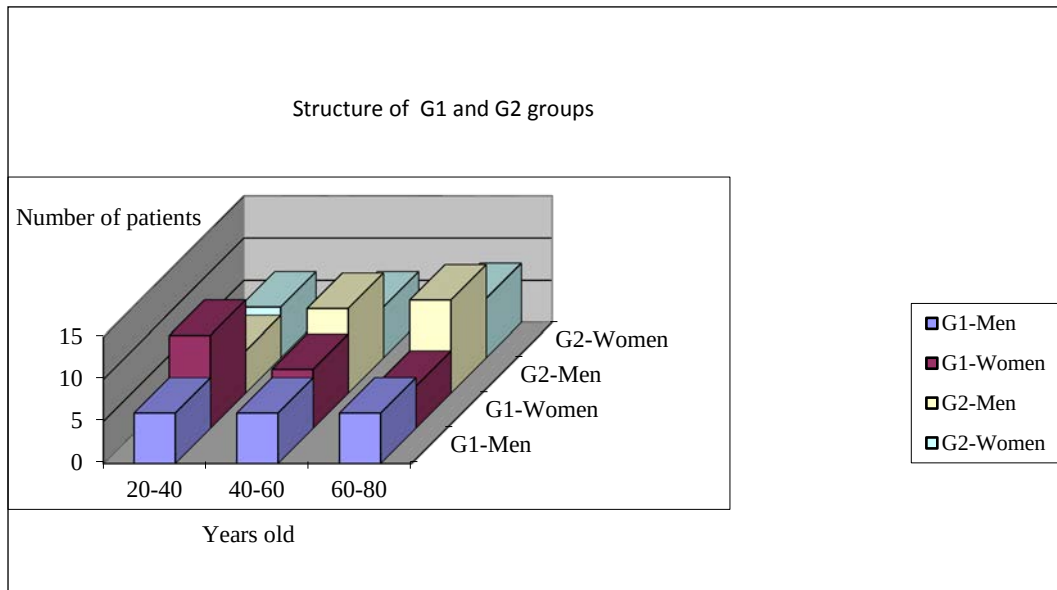
In terms of recovery treatment, laser, ultrasound and massage were applied. All groups received pharmacological treatment (depending on the condition), as well as a complex programme of physical therapy.

Groups G1 and G2 (post-traumatic disorders) included 81 patients, groups G3 and G4 (other myo-fascial tissue diseases) counted 80 patients.

G1 group followed a laser-ultrasound combination therapy and included 41 patients of which 18 females (43.90%) and 23 males (56.09%), and G2 followed ultrasonic treatment and was made up of 40 patients, of which 22 females (55%) and 18 males (45%). Structure of the groups according to gender and age groups is presented in Table 1 and Graphic no.1.

Groups		Post-traumatic disorders	Age group		
			20-40 years old	40-60 years old	> 60 years old
Group G1	Women	18	6	6	6
	Men	23	11	7	5
TOTAL		41	17	13	11
Group G2	Women	22	5	10	7
	Men	18	6	6	6
TOTAL		40	11	16	13

Table no.1. Structure of G1 and G2 groups according to gender and age groups

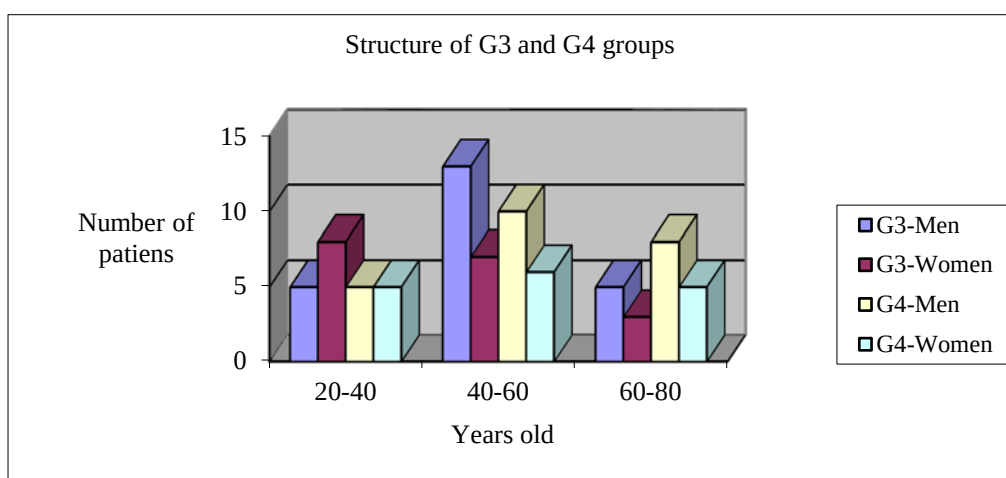


Graphic no. 1. Structure of G1 and G2 groups

Group G3 comprised 41 patients of which 23 females (56.09%) and 18 males (44.90%) and G4 group consisted of 39 patients, including 23 females (58.97%) and 16 males (41.02%). Structure of groups per age and gender is presented in Table 2.

Groups		Other conditions	Age group		
			20-40 years old	40-60 years old	> 60 years old
Group G3	Women	23	5	13	5
	Men	18	8	7	3
TOTAL		41	13	20	8
Group G4	Women	23	5	10	8
	Men	16	5	6	5
TOTAL		39	10	16	13

Table no. 2. Structure of groups G3 and G4 per age groups and gender



Graphic no. 2. Structure of G3 and G4 groups

3. RESULTS

3.1. The pain

Evolution of mean pain score assessed using the visual analogue scale VAS is shown in Table 3 for the post-traumatic conditions and in Table 4 for the other myo-fascial tissue diseases.

Groups	No. of cases	Mean scores			Score diff.	Score diff.	Score diff.	Stat. sig. (p value)
		initial	control	final	initial-control	control-final	final-initial	
G1	41	7,82	4,65	2,73	3,17 (40,53%)	1,92 (24,55%)	5,09 (65,08%)	p=0,002594 ES
G2	40	7,72	5,62	3,57	2,1 (27,20%)	2,05 (26,55%)	4,15 (53,75%)	p=0,0050034 S

Table no 3. Evolution of mean pain score in G1 and G2 groups

Groups	No. of cases	Mean scores			Score diff.	Score diff.	Score diff.	Stat. sig. (p value)
		initial	control	final	initial-control	control-final	final-initial	
G3	41	7,56	4,12	2,81	3,44 (45,50%)	1,31 (17,32%)	4,75 (62,83%)	p=0,000085 ES
G4	39	7,39	5,71	3,93	1,66 (22,73%)	1,78 (24,08%)	3,46 (46,82%)	p=0,00565 S

Table no. 4. Evolution of mean pain score in G3 and G4 groups

A comparative assessment of pain score showed an improvement of 65.08% in G1 (study), while G2 (witness group), the improvement was of 53.75% - a difference of 11.33%.

It has been found that the improvement was of 40.53% in G1 versus baseline and of 24.55% between the end of the treatment and check-up, compared with G2, which showed a pain relief of 27.20% at the time of check-up versus baseline and of 26.55% at end of the treatment.

The comparative evaluation of pain score indicates an improvement of 62.83% in group G3 (study) to 46.82% in G4 group (control group), a difference of 16.01%.

The improvement of pain score was of 45.50% in group G3 at check-up as against baseline and of 17.32% between the end of the treatment and check-up, while in group G4, it was a difference of 22.73% between check-up and baseline versus 24.08% between the end of the treatment and check-up.

3.2. Evolution of dysfunctions and quality of life

For groups G1 and G2, the functional clinical status and quality of life index was measured using the functional Index LEE with the evolution presented in Table no. 5.

Groups	No. of cases	Mean scores			Score diff. initial-control	Score diff. control-final	Score diff. final-initial	Stat. sig. (p value)
		initial	control	final				
G1	41	1074 (78,45%)	751 (54,85%)	320 (23,37%)	323 (23,6%)	431 (31,48%)	754 (55,08%)	p=0,0005187 ES
G2	40	1031 (75,80%)	692 (50,88%)	357 (26,25%)	339 (24,92%)	335 (49,55%)	674 (49,55%)	P=0,005262 83 S

Table no. 5. Evolution of dysfunctions and quality of life in G1 and G2 groups

The percent of improving the quality of life and dysfunctions scores (between the end of the treatment and baseline) recorded in G1 (the study) was of 55.08%, as compared with the group G2 (control), in which there was an improvement of 49.55 %. For G1, the improvement recorded at check-up as against baseline was of 23.6%, in comparison to G2, which was of 24.92%. The improvement recorded at the end of the treatment compared with check-up was of 31.48% in G1 as compared to G2, which was of 49.55%.

For G3 and G4 groups, physical dysfunctions score and the functional status assessed using the Functional Index LEE registered the evolution shown in table 6.

Groups	No. of cases	Mean scores			Score diff. initial-control	Score diff. control-final	Score diff. final-initial	Stat. sig. (p value)
		initial	control	final				
G3	41	956 (69,83%)	617 (45,06%)	340 (24,83%)	338 (24,77%)	278 (20,23%)	616 (45%)	P=0,000017 2 ES
G4	39	895 (67,49%)	676 (50,98%)	359 (27,07%)	265 (16,51%)	317 (23,91%)	583 (40,42%)	P=0,005045 S

Table 6 Evolution of physical dysfunctions score and assessment of functional status in G3 and G4 groups

4. DISCUSSIONS

The improvement of dysfunctions score and the assessment of the functional status score (between the end of the treatment and baseline) registered in G3 group (study group) were of 45%, compared to G4 group (control), in which the improvement was of 40.42%. For G3, the improvement recorded at check-up versus baseline was of 24.77%, compared to G4 group, which was of 16.51%. The improvement recorded at the end of the treatment compared with check-up was of 20.23% in G3, compared to 23,91% in G4.

5. CONCLUSIONS

Ultrasound therapy and laser biostimulation has proven its effectiveness in both articular pathology and soft tissue in the acute, subacute and chronic stages

The results of combined laser-ultrasound treatment recorded after two weeks of treatment indicate an improvement in all clinical and functional parameters evaluated, which is statistically significant and comparatively higher in the study group compared to the control group.

The complex evaluation of a number of clinical and functional parameters allowed us to provide conclusive evidence on the comparative effects of ultrasound, applied in combination within a recovery methodology, which also includes pharmacological therapy and physical therapy.

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