

Multiple Impulse Therapy and Saunders Lumbar Traction Methods in the Treatment of Low Back Pain: A Randomized Controlled Trial

Mariusz Pingot^{1*}, Julia Pingot¹, Robert Haładaj² and Mirosław Topol²

¹Jan Kochanowski University in Kielce, branch in Piotrków Trybunalski, Słowackiego, 114/118 Poland

²Department of Normal and Clinical Anatomy, Medical University of Lodz, Narutowicza 60, 90-136 Łódź, Poland

*Corresponding Authors: Mariusz Pingot, Jan Kochanowski University in Kielce, branch in Piotrków Trybunalski, Słowackiego, 114/118 Poland, Tel: +48 780 220262; E-mail: rehabilitacja@paintherapy.pl

Received date: November 10, 2017; Accepted date: November 20, 2017; Published date: November 22, 2017

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Abstract

Background: Low back pain is a serious medical and social problem. Despite many different research studies, no explicit standard therapy has been found so far.

Material and Methods: The study included 193 adult patients of both genders (86 females, 107 males) with low back pain and pain-induced limited spinal mobility without lumbar spinal stenosis. The controlled, randomized clinical trials were used. Patients were randomly assigned to one of the two groups. Group A (Study group, n=95) was subjected to multiple impulse therapy (MIT) and in group B (Control group, n=98) – Saunders traction device was used. The Oswestry Low Back Pain Disability Questionnaire, Oswestry Disability Index - ODI were used to observe analgesic efficacy and to the analysis of functional progress. The collected results of the trial groups were presented statistically with the Student t-test for independent samples. In turn, comparing the patients' efficiency (disability index - ODI), analysis of variance of repeated measurements immediately and 1, 3, and 6 months after the therapy, was used. The study assumed the coefficient of significance $\alpha=0.05$. The calculations were performed using IBM SPSS Statistics 22.0.

Results: Multiple impulse therapy (MIT) produces beneficial analgesic effects in significantly shorter time and improves the functional ability and performance of activities of daily living in the treated patients than in the group of patients treated by Saunders axial traction method.

Conclusions: This randomized clinical trial proves that both applied therapies are useful in the treatment of low back pain. However, MIT therapy produces beneficial analgesic effects in significantly shorter time.

Keywords: Low back pain; Multiple impulse therapy (MIT); Saunders lumbar traction

Introduction

Back pain, mainly of the lumbar region, is one of the most common complaints being a big medical and social problem. Medical literature defines this phenomenon as the rapidly growing epidemic, calling it a civilization disease [1,2]. Many activities of daily living lead to overload of the spine, particularly of the lumbar region, resulting in irreversible structural changes. Often occurring hypokinesia and stress become an additional reason for these symptoms. Evoked in this way overload of muscles, ligaments and paraspinal structures leads to the development of degenerative changes within the intervertebral disc, facet joints and to vertebral canal stenosis. These changes cause spinal pain in many people of different age [3]. Musculoligamentous disorders destabilize the spine, usually leading to degenerative and proliferative changes [4]. Deformation of the bony protection of the nervous system results in neurological complications. Increased tone in paraspinal muscles causes pain, limits spine mobility and most often results in the whole locomotor system dysfunction. The occurrence of back pain syndromes increases in an alarming rate worldwide. Undoubtedly, adversely changing lifestyle, abnormal movement patterns and the negative impact of modern achievements of civilization are the reason.

Pain is the major complaint concerning the spine and induced by noxious stimuli at the site of injury indicates tissue damage [5,6].

Various methods of treatment recommended and currently used require in many cases long-term application and they are often ineffective. Thus, the search for new methods of conservative treatment of back pain syndromes is fully justified. Therapeutic effectiveness of the methods for back pain treatment depends on their effect on the cause that triggered the pain. Therefore, the decompression of the intervertebral disc, nerve root or very delicate paraspinal soft tissue structures may result in the reduction of excessive tension of adjacent muscles of the spine and in pain relief [7,8].

Back pain is a complex problem which requires individual and comprehensive management. In case of failure of the conservative therapy, there may appear neurological deficits and the need for surgical treatment. However, most patients are treated conservatively using pharmacotherapy and physical procedures [7-9].

The spinal axial traction with Saunders device is one of the therapies recommended in the conservative treatment in the field of physical medicine used in the present study. Many methods exist for the traction of the spine which have been used for a long time also in the treatment of low back pain [10]. All tractions are based on similar

principles. Their main task is to decompress the nerve roots, widen the intervertebral foramina lumen, stretch the intervertebral spaces, facilitate relaxation of the tensed paraspinal muscles and to lead to protruded disc repositioning by reduction of pressure inside the disc and to help suck back in the migrating nucleus material. All this is considered to be the analgesic effect. The Saunders Lumbar Traction has a pneumatic stretching mechanism owing to which traction load of 200 kg (90.6 F) can be applied [10-14].

Multiple Impulse Therapy (MIT), which recently has gained many supporters, is another and new method of conservative treatment of back pain syndromes based on completely different principles. MIT is a modern therapeutic method, worked out in the USA, used successfully in the treatment of back pain syndromes. The results of numerous studies conducted for many years in Poland confirmed unequivocally that in all patients suffering from back pain, there is observed increased paraspinal muscle tension in the pain area [15].

Therefore, a method was proposed to reduce this pathological condition, using a repeated mechanical stimulus which may be compared to impulses or vibrations, as in the therapy with the use of a shockwave with an additional acoustic effect. The reactions of an organism to exactly that kind of a mechanical impulse is called by the creators of the method mobilization (activation) of the facet joints. PulStarFRAS device consists of an interactive head which allows registering the actual value of paraspinal muscle tension at the level of each spinal motion segment, both during the analysis and the treatment itself. The obtained objective values displayed on the screen superimpose myographs of physiological muscle tension constituting an integral part of the PulStarFRAS and they result from a computer program of that device [14].

Aim

The aim of the study was to evaluate the difference in analgesic efficacy and improvement of daily functioning in patients with chronic low back pain after application of two methods: multiple impulse therapy (MIT) provided by PulStarFRAS and axial traction of the spine with Saunders device in randomized trials.

Material and Methods

The investigated group characteristics

Initially a population of 207 individuals was enrolled into the study on the basis of confirmed diagnosis and the patient's written consent to participate in research and the therapy.

All patients had chronic low back pain resulting from disc-radicular conflict and radiation of pain to the left or right lower limb. All patients underwent MRI or CT which confirmed the pain cause. All of them were also pre-treated with standard non-steroidal analgesic and anti-inflammatory pharmacological agents (NSAIDs). As the patients complained of pain lasting more than 1 month and of motor deficits (gait impairment, diminished lower limb muscle strength and slight but already visible muscular atrophy at the area of pain), as well as a major limitation in performing activities of daily living.

All patients were referred to rehabilitation by a specialist and none of them developed disorders as a result of trauma (bone fractures, musculoligamentous injury) or neoplastic disease, which constituted criteria for exclusion from the study. Patients who had earlier undergone neurosurgery due to discopathy, those who had been

diagnosed with multilevel discopathy as well as patients with spondylolisthesis, osteoporotic fractures, congenital lumbar spinal stenosis, with a history of stroke and those over 65 years of age, burdened with numerous somatic, systemic or rheumatic diseases were, in compliance with the study assumptions, excluded from the investigated group. Moreover, patients were also excluded if they were underage or due to pain were unable to come unassisted to the treatment sessions.

Finally, 12 patients were excluded from the trial as a result of inclusion criteria, and 2 patients as a result of the lack of their appropriate cooperation.

Eventually, 193 patients were included in the trial, 86 females and 107 males, aged 36 - 65 years, (mean age 50.5 years) and in order to eliminate the impact of uncontrolled variables on the results of the experiment, the patients were randomly divided into two groups (Table 1).

Number of patients	WOMEN		MEAN WOMEN	MEN		MEAN MEN	MEAN AGE TOTAL
	group A	group B		group A	group B		
193	42	44	43	53	54	53.5	50.5
age 36-41 years	12	11	11.5	15	14	14.5	52
age 42-47 years	10	10	10	10	12	11	44.5
age 48-53 years	9	8	8.5	13	11	12	50.5
age 54-59 years	8	10	9	11	12	11.5	56.5
age 60-65 years	3	5	4	4	5	4.5	62.5
place of Residence	WOMEN		MEAN	MEN		MEAN	MEAN TOTAL
town	25	26	25.5	25	24	24.5	25
village	17	18	17.5	28	30	29	23.2
professional activity							
worker	physical	20	22	21	24	29	26.5
	office	12	11	11.5	10	11	10.5
disability allowance/pension	living	10	11	10.5	19	14	16.5
Source: Own Calculations							

Table 1: Demographic characteristics of the investigated patients.

The nature of the study (experimental but not screening) was the decisive factor in determining arbitrarily the size of both samples. Taking into account the planned use of multifactorial models of analysis of variance, attempts were made to eliminate the possible effects of any deviations from normal distribution of the examined variables, therefore a balanced study design was adopted (similar size of groups) and as large as possible size of each sample was provided [16].

Due to the fact that variables such as age and gender, according to current knowledge, have no any significant impact on the treatment of back pain, the structure of the sample was not controlled as regards these features. All patients received basic number of procedures recommended for each type of the applied therapy. Two groups were distinguished randomly.

Random assignment of patients into the groups and therapeutic sessions

All patients who met the criteria were contacted by phone. The purpose and procedures were explained to them, an interview was arranged and assessment of their physical condition was made. The medical history was taken and the patients were examined to confirm the fulfillment of all the established criteria. The selected participants signed their written consent to participate in the research. The patients were randomly assigned to treatment groups A - the Study group (95 patients) and B-the Control group (98 patients). Random assignment was made by using pre-defined schedule of treatment with random numbers generated by the function of data analysis of Microsoft Excel. The procedure for assignment to groups was kept secret in such a way that it was carried out by a person not involved in the recruitment process, the course of treatment and evaluation. The results of this procedure were stored in labeled, sealed envelopes.

Group A patients (n=95) were subjected to 5 multiple impulse therapy (MIT) sessions (MIT) with the use of PulStarFRAS device (2-3 procedures per week). At the time of the analysis single impulse force was each time 15 F, whereas during the procedure - 20 F, the impulse frequency was at the level of 2-60 Hz. The session duration depended on the outcome of the analysis of MIT system computer program and ranged from 8 to 10 minutes for procedure.

Group B patients (n=98) underwent 15 axial lumbar traction procedures with Saunders device. These sessions were performed Monday to Saturday, one procedure a day in supine position. Traction force was established individually and it was 1/2 of the patient's weight, mean weight of the tested patients was 88.5 kg (40.0 F). Thus, mean stretching force was 44.25 kg (20.04 F). Traction time ranged from 5 to 12 minutes, which during 15 sessions was established according to the following rules: first session -5 minutes, second -6 minutes, the 3 and 4-8 minutes each, 5 and 6-10 minutes each, 7-9-11 minutes each, the remaining procedures -12 minutes each.

The Oswestry Low Back Pain Disability Questionnaire, Oswestry Disability Index - ODI, which allows to evaluate the efficiency of patients suffering from back pain, showing their functional capabilities (restrictions), was used to observe analgesic efficacy and to the analysis of functional progress of the carried out therapy [16-19].

The evaluation of the results with the use of ODI was performed immediately prior to the sessions and at four time points after completion of the therapy (on completion of the sessions, 1 month, 3 months and 6 months afterwards). ODI serves not only for the evaluation of the intensity of a very complex phenomenon of pain sensation, but above all, it shows the patient's level of efficiency. Much better than the other scales, it allows for self-assessment of physical activity the results of which are consistent with the so-called pain behaviors. These patients personally described the state of perceptible pain and its effect on their ability to manage in everyday life. This scale consists of 10 questions concerning the activities of daily living. Each question has 6 possible answers to choose from, scored from 0-5. The subject chooses only one answer which most clearly describes his/her

problem. When describing the condition, it is stated explicitly, that the present state must be described. The results of ODI are converted to (%), which allows distinguishing 5 groups of determining the efficiency of each patient. I-0-20%, no or minimal disability; II-21-40% moderate disability (the patient has problems with lifting, standing, sitting, the patient may be disabled from work); III-41-60%, severe disability, (pain restricts basic activities of daily living and patient requires detailed investigations); IV-61-80%, crippled (pain impinges on all aspects of the patient's life). V-81-100%, total disability (pain prevents self-reliance, patient is bed-bound). All patients made the same assessment five times.

The collected results of the trial for Group A (n=95), and for Group B (n=98) are presented statistically using first the basic descriptive statistics (mean - M, median - Me, standard deviation - SD, skewness coefficient, kurtosis) and then assessing the significance of differences between the groups, taking into account ODI, with the Student t-test for independent samples. In turn, comparing the patients' efficiency (disability index - ODI) prior to the therapy and at four time points after completion of the sessions (immediately, 1 month, 3 months and six months after the therapy), analysis of variance of repeated measurements was used. In addition, taking into account the time of the measurements and also the tested group of patients, assessment of the disability (ODI) was performed using two-way analysis of variance. The study assumed the coefficient of significance $\alpha=0.05$. The calculations were performed using IBM SPSS Statistics 22.0.

The study was conducted in the Fiort Clinic Rehabilitation Center-Pain and Spinal Dysfunction Treatment in Piotrkow Trybunalski, Folwarczna 38, Poland, in the period from January 2011 to December 2015.

The study protocol was approved by the Bioethics Committee of the Medical University in Lodz on 14.12.2010, NO: RNN/712/10/KB. The chairperson of the Ethics Committee is prof. Przedzislaw Polakowski.

Results

Group A consisted of patients (n=95) who underwent multiple impulse therapy with PulStarFras device. Group B patients enrolled in the study (n=98) were subjected to the treatment using lumbar axial traction with Saunders device.

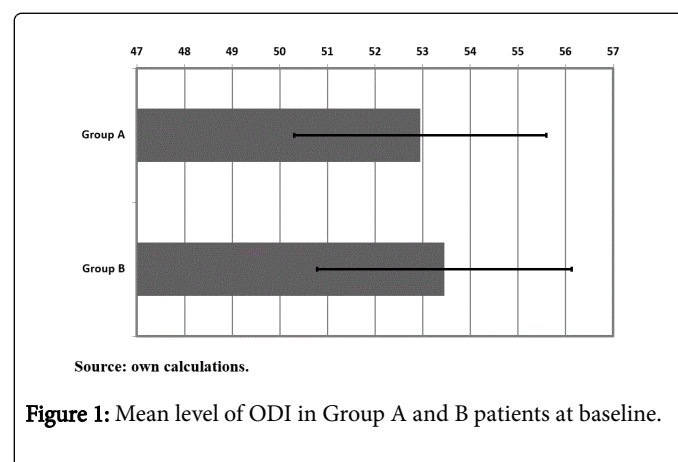


Figure 1: Mean level of ODI in Group A and B patients at baseline.

Patients selected for the trial did not differ significantly with regard to parameters of key importance for the assessment of the therapy efficacy, i.e. own assessment of the performance according to ODI (the differences were not statistically significant; in t-test $p>0.05$) Figure 1.

Before the therapy, the patients' performance assessed by ODI questionnaire was on the average approximately 53% (and thus, on the average, they were defined as patients with severe disability - pain limited their basic activities of daily living and required detailed investigation).

Both applied therapies brought significant improvement-comparing the assessment of the performance of patients before and after the therapy. We noted that each of the obtained results after completion of the therapy significantly differed, as indicated by $p < 0.001$ in F test of the repeated measures analysis of variance. In comparison with the baseline results, the mean level of the ODI is significantly lower in all

subsequent measurements; this applies to both investigated groups. Statistically significant differences were also observed between successive measurements.

After the treatment, the assessment of the performance with the use of ODI decreased to approximately 20% (this is confirmed by both the value of the arithmetic mean and median), while this decrease occurred already immediately after the treatment sessions and in subsequent periods - after 1 month, 3 months and after 6 months and it persisted. The results obtained in consecutive measurements are statistically significantly lower in both A and B groups compared to the previous measurement (Table 2).

	MIT method-5 procedures (Group A)					Saunders method - 15 procedures (Group B)				
	Baseline	0 (after therapy)	1 (1 month later)	3 (3 months later)	6 (6 months later)	Baseline	0 (after therapy)	1 (1 month later)	3 (3 months later)	6 (6 months later)
No of observations	98	98	98	98	98	95	95	95	95	95
Min	41	15	15	15	9	43	19	17	16	16
Max	63	28	27	27	22	64	33	30	30	28
Mean	52.95	21.84	20.61	20.05	18.88	53.45	23.63	22.71	21.81	20.76
Median	55	21	20	20	20	55	23	23	21	20
SD	5.485	2.551	2.218	2.212	2.022	5.546	3.142	2.637	2.655	2.513
Skewness	-0.27	0.338	0.36	0.675	-1.678	-0.323	0.719	0.406	0.574	0.581
Kurtosis	-1.291	0.537	1.189	1.312	5.035	-1.181	0.36	-0.184	0.104	0.049
Analysis of variance repeated measures ^a	F=3326.261; df=1.456; p< 0.0001***					F=3189.045; df=1.637; p<0.0001***				

^aDue to non-sphericity of variance-covariance matrix, the test of within-subject effect in Greenhouse-Geisser version was used.

Table 2: ODI in the groups of patients before and after the therapy.

Thus, both therapies produced beneficial effects. First, immediately after their completion, the pain was relieved considerably (contributing to the greater efficiency of patients) and - which is important - it persisted in subsequent periods within six months after the end of the therapy. Figure 2 allows for another interesting statement - MIT method (group A) results in more measurable effects (greater decrease in the ODI scale) than the Saunders method.

The therapy with the MIT method resulted, basically already after 1 month, in restoration of physical efficiency whereas after Saunders traction it lasted longer. This is a particularly important conclusion in the context of much shorter - in the case of MIT-treatment period-5 treatment sessions are enough to restore the patient's efficiency and not, as in the case of Saunders method-15 sessions. In the case of patients treated with Saunders method, initially (0-3 months) an average patient was characterized by a moderate disability, i.e. had trouble with lifting, standing, sitting and was temporarily disabled from work. The restoration of physical efficiency occurred - on the average-six months after the therapy. However, the effect of interaction is statistically significant but at slightly higher level of significance than a standard $\alpha=0.05$ ($p=0.057$).

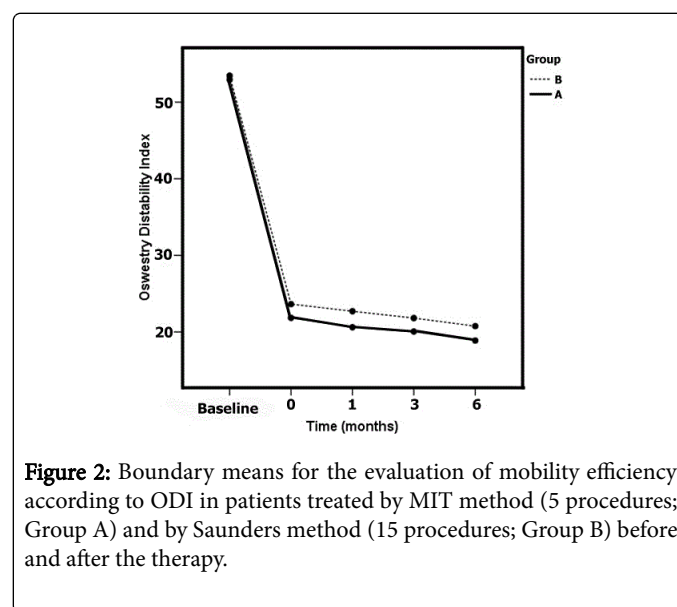


Figure 2: Boundary means for the evaluation of mobility efficiency according to ODI in patients treated by MIT method (5 procedures; Group A) and by Saunders method (15 procedures; Group B) before and after the therapy.

The standard deviation reaches about 5.5%, at weak left-sided skewness. Slightly stronger is also flattening of the distribution in relation to normal distribution; the convergence of variable distribution in relation to normal distribution is confirmed by the results of the Shapiro-Wilk test-Figure 2.

Assessing the performance of patients, in the subsequent measurements after the therapy there are observed statistically significant differences between the groups treated by MIT and by Saunders method (Table 3).

Time of measurement	Group A,M (SD)	Group B,M (SD)	Difference, M (95% CI)	p
Immediately after therapy	21.84 (2.55)	23.63 (3.14)	-0.80 (-2.21;0.98)	<0.001
1 month after therapy	20.61 (2.22)	22.71 (2.64)	-2.09 (-2.78;-1.40)	<0.001
3 month after therapy	20.05 (2.20)	21.81 (2.66)	-1.76 (-2.45;-1.07)	<0.001
6 month after therapy	18.88 (2.02)	20.76 (2.51)	-1.88 (-2.53;-1.23)	<0.001

M- mean, SD - standard deviation; 95% CI-95% confidence interval
Source: own calculations

Table 3: Comparison of ODI results in the group of patients treated by MIT method (5 procedures; Group A) and by Saunders method (15 procedures; Group B) at four time points (measurements) after completion of the therapy.

In the group of patients treated by MIT method, the results immediately after the end of the therapy, that is already after five sessions, indicate that the obtained efficiency was statistically significantly better ODI was significantly lower (M=21.84, SD=2.55) than in patients treated by Saunders method (M=23.63, SD=3.14). Importantly, the results obtained by the patients treated by MIT method were also more homogeneous than in the case of the treatment by Saunders method (although in this respect the differences are not significant). A month after the therapy, the difference between the results of ODI for both groups was more pronounced (reached 2.1 per cent points, p<0.001). At 3 and 6 months after treatment, the differences in favor of MIT treatment MIT was still maintained. Therefore, MIT is more economical and effective therapeutic method. It requires only 5 treatment sessions. In comparison with more common, better known and more widely used Saunders method, the effects of MIT therapy are also better in long-term follow-up (Table 3).

Discussion

The treatment of spinal pain, or - back pain has been one of the widely discussed medical problems for years. The issue is so serious that the ailments of the spine, especially of the lumbar region are the disease of our civilization and a real social problem. Nearly 80% of adults experience this pain, which is the most common cause of visits to a primary care physician. It is widely believed that nearly 50% of all patients coming for physical therapy is affected by just this disease [1,2,7,9,20].

In the case of back pain syndromes, it is essential to take into account biomechanical factors in their correct diagnosis and treatment. Unusual and complex biomechanical system of the spine

with spinal cord and spinal nerve roots works properly only when all the components function without errors. Therefore, the injury to any construction elements of the spine causes multi-causal dysfunction manifested by pain, limitation of movement and discomfort [4]. The anatomical conditioning of the sciatic neuralgia, i.e. the piriformis syndrome, should be also considered as one of the causes inducing low back pain [21].

The opinions on the effectiveness of tractions, including Saunders device used in this study, are diverse. In the case of clinical improvement it has not been defined clearly to what extent Saunders lumbar itself traction contributed to this improvement and to what extent the applied pharmacological treatment, restrictions on lumbar spine loading or beneficial lapse of time [13]. However, Hood and Chrisman [22] demonstrated that only 52.5% of patients treated with the traction obtained good and very good results. Eie and Kristiansen [23] reported that no significant improvement was observed in 33% of patients using traction.

Komori et al. [5] using MRI to identify morphological changes in the form of lumbar disc prolapse subjected 77 patients to Saunders lumbar traction sessions. All patients were diagnosed with disc herniation with symptoms of unilateral pain radiating to the lower limb and muscle weakness on the side of pain. Relief of radicular pain and also significant improvement of neurological deficits were observed in all patients. MRI reexamination revealed a reduction of disc protrusions in 64 patients. In 13 patients there were no significant changes on MRI despite noted clinical improvement. Out of 77 patients 62 achieved very good results.

It should be remembered that in the case of very large forces during the traction procedure, there may come to the damage of bone, spinal cord or nerve roots. Saunders described lumbar traction as an effective treatment for lumbar herniated discs and radicular symptoms. He suggested 15 - 30 treatment sessions and a traction force of ½ body weight of the patient. Saunders proposed traction force of 60 pounds (27 kg) as most optimal. Numerous studies conducted by many researchers, among others by Komori, Shinomiya and Nakai [5], Gupta [12], also pointed to good results of the treatment of patients with symptoms of sciatica and furthermore they supported the use of high forces, even of 60-80 pounds.

The effectiveness of the treatment of cervical pain with Sanders device has been also described by many researchers and their results demonstrate the improvement of mobility of this part of the spine. When the X-ray findings were compared before and after traction, they revealed the increase of intervertebral disc space. There was also observed the improvement of functional ability of the examined patients on the basis of the NDI Questionnaire (Neck Disability Index Questionnaire) [24,25].

For the needs of this study, the therapy with Saunders axial traction device gave positive results in Group B (n=98), but it should be remembered that there were performed 15 treatment sessions in each patient.

However, a limitation of this study is that the assessor-blind design could not be used because patients knew in which way they were treated.

Describing in detail the procedure itself using Saunders axial traction device, the technical side of this kind of therapy cannot be ignored [26,27]. Many patients reported malaise during a few minutes' session. These were usually patients with obesity or those with

gastrointestinal symptoms [1,8,25]. It seems that the need to fasten the patient with stabilization belts can further contribute to the development of these particular problems. The patients often report discomfort that results from the need to adopt a supine position which was established at the beginning and is necessary when using this kind of therapy. Sometimes persisting chronic spinal pain, often obesity, may induce malaise, which was reported during the procedure by many patients.

Unknown and not yet very popular in Poland therapeutic method for the treatment of back pain syndromes – Multiple Impulse Therapy (MIT) -was proposed to Group A patients (n=95). This therapy requires a device called PullStarFras and the creators of this method pointed to the need for the use of a tilting table for the patient to assume prone passive position. From a technical point of view in the case of the occurring back pain it makes the procedure easy to perform. This technique was fully accepted by the patients already before the procedure. The procedure itself is quick, painless, and not every day performed, which results from the recommendations of the method creators. The treatment cycle ends on five procedures [27,28]. Since this method requires carrying out a diagnostic investigation (analysis), both before and immediately after each procedure, the patient in a simple and clear way can see the differences before and after each session. The presented on the monitor of the device colored, horizontal graphs indicate the progress of the therapy. Such a graphical way to address the problem of pain has a positive influence on the cooperation with the patient and at the same time builds his confidence in the therapy. As the main goal of the Multiple Impulse Therapy is normalization of increased paraspinal muscle tension, this graphic presentation of the change coincides with the intensity of pain in many patients [28,29]. Furthermore, the investigation preceding and ending the therapy recognizes all segments of movement of the spine, showing the need for changing the intensified, pathological values of muscle tension, not only in the lumbar spine. The obtained results of the study confirm the efficacy of the multiple impulse therapy, do not produce any additional anxiety that the patient should wait patiently for the results of the therapy, as it happens in other methods of treatment. In many cases of this study group, the patients reported a significant improvement after only two or three sessions. Reduction of the intensity of pain usually translated into significantly improved lumbar spine mobility, which clearly improved the efficiency of the treated patients in everyday life, particularly in relation to household activities, which the patients themselves noticed before the end of the therapy. All participants in this study group assessed Multiple Impulse Therapy very positively. They highly appreciated the sessions and the feelings associated with this therapy. Taking into account the obtained results translating into very good opinions of the patients, their view should be shared of the wider introduction of multiple impulse therapy in the treatment program for all those who suffer from chronic back pain syndromes.

Thus, Multiple Impulse Therapy (MIT) is adapted to the expectations of many patients and it is a new method based on reliable, objective diagnostic test [29,31]. It does not require, as other conventional methods of treatment, a long time, numerous sacrifices and limitations. It is a completely safe method, significantly shortening the treatment time and of high analgesic efficacy. Definitely shorter period of treatment compared to that of patients treated with the Saunders axial traction device and thereby significantly faster return to activities of daily living and to professional work, is of great economic and social importance [28-32].

Comparing pain assessment in subsequent measurements after completion of the therapy, there were observed statistically significant differences between the group treated by MIT in relation to the Saunders group (Table 3). This applies to all measurement points-both immediately after the therapy as well as in the subsequent periods (including half a year after the end of the treatment). Lower mean levels of ODI were noted for patients treated with MIT as compared to Saunders method. This means that the MIT method gives better results than the treatment by Saunders method. The long-term follow-up demonstrated substantial persistence of the beneficial results of the MIT therapy in relation to Saunders therapy. This is even more important if we take into account the time spent on both therapies and thus - their cost. MIT treatment method is significantly shorter, more efficient and thus faster and with better effect it contributes to the improvement of the quality of life of patients with chronic lumbar pain than the applied Saunders method.

At the same time, some authors suggest that the combination of many therapeutic methods (multimodal treatment) gives the most favorable therapeutic results [33].

Conclusions

- Both physiokinetic methods: Multiple Impulse Therapy (MIT) and Saunders traction device are useful in the treatment of patients with chronic lumbar pain.
- Multiple Impulse Therapy (MIT) results in beneficial analgesic effects and functional improvement in everyday life activities in significantly shorter time compared to Saunders traction method.
- Multiple Impulse Therapy compared to Saunders traction therapy demonstrates higher effectiveness also in long-term follow-up.
- MIT therapy analgesic effect remains longer compared to Saunders traction analgesic effect, thus MIT is suggested to be more frequently in patients with low back pain when considering the application of physiokinetic methods.
- Totally pain-free and effective Multiple Impulse Therapy (MIT) enjoys popularity and approval of the treated patients.

Author Contributions

Mariusz Pingot - study conception, study realization, literature search, article preparation
Julia Pingot - study realization, literature search

Robert Haładaj - study realization

Mirosław Topol - study layout, study realization, article preparation

Competing Interests

The Authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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