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Research Paper:
Evaluation of the Effects of Tecar Therapy on Acute Symptoms of Athletes Following Lateral Ankle Ligament Sprain

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Conflict of interest

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ABSTRACT

Background and Objectives: Tecar therapy as a modality has been considered due to its reported effects on reducing pain and swelling and finally increasing range of motion and improving function. The aim of this study was to evaluate the effects of tecar therapy on acute symptoms of athletes following lateral ankle ligament sprain in the treatment and control groups between pre-treatment periods, after 6 sessions, and after 12 sessions of treatment.

Methods: In this study, 23 patients in each group including athletes with an acute lateral ankle ligament sprain in the acute stage in Tehran. The participant of this study were divided into 2 groups of control with normal treatment and the second group with normal treatment + tecar treatment. Participants were homogenized in terms of age, height, weight, and level of exercise. To evaluate the pain intensity of patients in the two groups and to measure the swelling of the ankle joint, a tape measure (mm) was used. A goniometer was used to measure the degree of ankle motions. The Foot and Ankle Ability Measure (FAAM) questionnaire was also used to collect data.

Results: Statistical analyzes showed that the mean numerical visual criterion of pain in both groups was significantly lower after 6 and 12 sessions of treatment ($P<0.001$). The results of the analysis of variance showed that the mean swelling in the treatment group and in the control group after 6 and 12 sessions of treatment ($P<0.001$) was significantly lower than the mean swelling before treatment. Also, the mean swelling after 12 sessions of treatment was significantly lower than after 6 sessions of treatment ($P<0.001$). Regarding daily life activities and the percentage of athlete satisfaction in performing the activity, the test results showed that the athlete's scores after 6 and 12 sessions of treatment ($P<0.001$) were significantly higher than before treatment. Also, their scores after 12 sessions of treatment were significantly higher than 6 sessions ($P<0.001$). The performance scores in both groups after 6 and 12 sessions of treatment ($P<0.001$) were significantly higher than performance scores before treatment. Also, the performance scores after 12 sessions of treatment were significantly higher than 6 sessions of treatment ($P<0.001$).

Conclusion: The results of the present study showed that tecar therapy in patients with lateral ligament sprain of the ankle joint improves the condition of symptoms after an injury, including swelling, pain, daily life activities, percentage of athlete satisfaction with daily activities, and finally his performance and it can be used as a complementary treatment along with common therapies.

Keywords: TECAR, Lateral ankle sprain, Athlete

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Function & Disability Journal

What is "already known" in this topic:

The goal of treatment after a sprain is to reduce pain, swelling, and accelerate the healing of swelling and ankle performance. The effects of Tecar therapy in musculoskeletal tissues can include the increased microcirculation within intracellular and tissue tissues (blood circulation), increased oxygen delivery, and increased intracranial heat.

What this article adds:

Tecar therapy in patients with lateral ligament sprain of the ankle joint improves symptoms including swelling, pain, daily life activities, percentage of athlete satisfaction with daily activities, and hip performance.

1. Introduction

The ankle joint is prone to serious injury due to its importance in bearing weight and maintaining balance while performing jumping, leaping, and sudden diversion exercises; these injuries account for 25% of all injuries in sports. An ankle sprain is one of the most common injuries among ankle joint injuries [1, 2]; 22% of sports injuries are related to the sprain of this joint [3-5]. An external ankle sprain is a common injury in sports and daily activities [6], such that external ligament sprain accounts for 85% of all ankle sprains [7]. The reason for this high prevalence is that the joint surfaces outside the ankle are higher than inside it, and the ligaments outside the ankle have a smaller diameter and are weaker than the internal ligaments of the ankle [8, 9].

The main mechanism of the lesion occurs due to bending and rotation of the ankle in or out [10]. Local inflammation and tenderness occur a few hours after injury [11, 12]. The pain is exacerbated by ankle joint motions and, is seen with joint instability in severe cases [13, 14]. In ankle sprains, RICE steps, including rest, ice, compression, and elevation are performed to reduce inflammation, pain, and the inability of motion [2, 15]. To reduce the forces applied to the damaged ligament, a cane is used to repair and walk with low weight-bearing. Also, physiotherapy treatments, such as ultrasound, infrared radiation, friction massage, tens, deep sensation stimulation exercises, and strengthening the muscles around the ankle motions are used [2, 16, 17].

After most sprains, the person feels pain in the affected ligament, and the swelling starts and gradually increases often immediately after the ankle injury. There is also the possibility of bruising on the ankle. The ankle is usually sensitive to touch and pain is felt with each motion. In most severe sprains, the person may hear the sound of a rupture or feel that the tissue has been torn in the ankle.

Treatment is required in the acute phase of ankle sprain, and joint pain, swelling, and hardening will continue if left untreated. Eventually, problems arise in daily life. For this purpose, different medical and physical treatments for the ankle sprain, such as medication, braces, and physiotherapy have been proposed [9, 10], which seem to be the most effective physiotherapy treatments [14, 15]. Among physiotherapy treatments, the emerging and expanding modality of tecar therapy has been considered due to its reported effects on reducing pain and swelling and thus increasing range of motion and improving function [18-22]. However, few studies have been done considering the treatment of ankle sprain

In the treatment of ankle sprains, it is very important that the injured area is not subjected to weight during the recovery period. The doctor may be able to diagnose the extent of the foot injury by examining the foot, ankle, and leg, as well as the skin around the affected area, and moving the foot to check the range of motion of the foot. X-ray, CT scan, Magnetic Resonance Imaging (MRI), and ultrasound may be recommended to check for bone fractures and make more detailed assessments in the case of severe injuries. Treatment also varies depending on the severity of the ankle injury. In general, the goal of treatment is to reduce pain, swelling, and accelerate the healing of swelling and ankle performance. You could see an orthopedic surgeon or physical therapist for severe injuries. In general, the following approaches are used for the treatment of ankle sprains:

1. Home treatment: RICE steps [23].

2. Medical treatments: The doctor may advise not to use the injured ankle until the pain subsides. But the use of

canes or casts, physiotherapy [24-28], and surgery can be done in two ways: arthroscopy and surgery [29]. Finally, tecar therapy is prescribed, which affects various parts of the musculoskeletal system, including bones, muscles, ligaments, tendons, and nerves, and includes chronic or acute pain. There are three types of tecar therapy: ultrasound, - short wave diathermy, and microwave diathermy. The effects of tecar therapy in musculoskeletal tissues can include the increased microcirculation within intracellular and tissue tissues (blood circulation), increased oxygen delivery, and increased intracranial heat [29].

In athletes who have been unable to continue exercising due to injury, the ultimate goal is to return to balance and speed in performing sports activities. At this stage, the physiotherapist provides speed and balance to return exercise through the programs designed to achieve this goal and using balance plate exercises and Swiss ball and trampoline as well as plyometric exercises that include jumping and running exercises [28].

This is largely provided in the protocols, such as tecar therapy and physiotherapy using specialized ankle exercises. However, the risk of re-injury is higher if you have once experienced ankle sprain, and your ligament healing and repair period has not been completed and you return to activity sooner than the recommended time and the pain has remained in your ankle [26-28].

2. Materials and Methods

This research is a single-blind clinical trial and was registered with the IRCT code of IRCT20200909048667N1. The study population consisted of 23 athletes from Tehran hospitals who suffered from a sprain in the external ligament of the ankle joint in the acute stage. Inclusion criteria included severity of elongation with pain and swelling in the area outside the ankle on the outer surface of the ankle joint, limited motion of the ankle, and no dead blood around the ankle joint [29]. The FAAM questionnaire was prepared and the results include the scores assigned according to the protocol performed after referring the doctor in the physiotherapy clinic of Iran School of Rehabilitation Sciences, Iran University of Medical Sciences.

Exclusion criteria included Achilles tendon injuries, ankle fractures, such as talus bone fracture, tibia fracture, ankle dislocation [1-5, 15], unwillingness to continue treatment, and problems to use tecar therapy and ultrasound devices, such as pregnancy, the presence of malignant tissue, tumors, in the ankle and electrical devices implanted in the body. Therapeutic effects were assessed by measuring the severity of pain, inflammation around the joint, and motions of the ankle joint. To evaluate the pain severity of patients, a Visual Analogue Scale (VAS) was used with the help of a 100 mm horizontal line without a number, the left end of which showed the point without pain and the right end indicated the point of pain with very high severity. For this purpose, the patient will be asked to mark the severity of his pain before and after the treatment on the mentioned line. The validity and reliability of this tool have been confirmed in various studies [4, 10]. To measure the swelling of the ankle joint, it was measured and recorded with a tape measure in the ankle area and its unit was in millimeters. A goniometer was used to measure the range of ankle motion [1, 16].

The Foot and Ankle Ability Measure (FAAM) questionnaire was also used to measure the pain score and injury. This questionnaire includes 29 questions each of which with 4 scores that the sum of the scores of each section is presented in percent. A score of 4 indicates problems or pain during the activity, the score of 3 shows the pain at a low extent, the score of 2 represents the pain at a moderate level, the score of 1 indicates the pain at a very high level and, and the score of zero indicates inability. This questionnaire has been organized into 2 parts. The first part has 21 questions measuring daily life activities and if the person scores less than 90%, he will enter the test. The second part has 8 questions measuring sports activities with difficult tasks necessary for sports and if the person scores less than 80%, he will enter the study. Also, the validity and reliability of this questionnaire have been confirmed in the study by Allen et al. [21].

Methodology: The patient selection criteria were assessed on the basis of the diagnosis of an orthopedic specialist. That is, after the sprain of the external ligament of the ankle was determined and the initial RICE treatment (was performed, patients were referred to a physiotherapy clinic for research. After checking the inclusion criteria, written consent was obtained from them. Patients were evaluated for pain, inflammation, and range of motion before starting treatment. Then, the patients were randomly divided into two groups. The control group received conventional physiotherapy treatments, including infrared freezing, ultrasound, and tens [1-3, 9]. In addition to the conventional physiotherapy treatments, the treatment group also received tecar therapy with 10%-30% intensity. In the first session and after 6 and 12 sessions of treatment, the patients were evaluated again for pain, inflammation, and range of motion (Figure1).

Data before and after the intervention were entered into SPSS statistical software and analyzed. The research ethics code was IR.IUMS.REC.1398.1374.

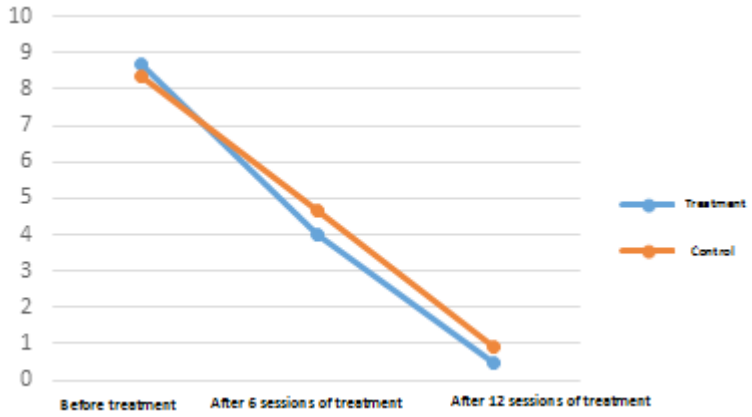

Figure 1. Numerical index of Visual Analogue Scale of pain

3. Results

Regarding the VAS score of pain, as can be seen in Table 1, there was no statistically significant difference for the mean value of this criterion between the control and treatment groups before treatment (P=0.393), after 6 sessions of treatment (P=0.058), and after 12 sessions of treatment (P=0.103).

Figure 2 displays the difference between the two groups of control and treatment regarding VAS score. Regarding mean swelling, the results of Table 2 show that there was no statistically significant difference in terms of mean swelling between the control and treatment groups before treatment (P=0.941), after 6 sessions of treatment (P=0.761), and after 12 sessions of treatment (P=0.874).

Figure 3 indicates the mean swelling trend between the two control and treatment groups during 12 sessions of treatment. The most important indicator studied in this study was the numerical index of daily life activities in athletes with sprained external ligaments of the ankle joint. According to Table 3, the results of repeated measures analysis of variance showed the average daily activities of life (P<0.001) and the percentage of athlete satisfaction in performing daily activities (P<0.001) in both groups in at least one of the time points had a statistically significant difference. The results of the Bonferroni test showed that in both the treatment and control groups, the scores of daily life activities and the percentage of athlete satisfaction in performing daily activities after 6 (P<0.001) and 12 sessions (P<0.001) of treatment were significantly higher than pre-treatment scores. Also, the scores obtained after 12 sessions of treatment were significantly higher than 6 sessions (P<0.001), which means an improvement in the condition of athletes in daily activities.

Figure 4 displays the trend of daily life activities between the control and treatment groups during the treatment process.

According to Table 5, the performance status before the treatment was extremely abnormal in most athletes in the treatment group (58.3%) and the control group (50%), whereas after 6 sessions of treatment, their performance in the treatment (66.7%) and control (83.3%) groups was abnormal. The results showed that the performance status of the athletes after 12 sessions was normal in the treatment (75%) and control (66.7%) groups. The results of the Friedman test showed that in both the treatment (P<0.001) and control (P<0.001) groups, the current performance of athletes significantly improved.

Table 1. Mean pain scores using the Visual Analogue Scale

Time	Mean±SD		Independent t-test Result
	Treatment	Control	
Before treatment (0-10)	8.66±0.98	8.33±0.88	t = 0.871, df=22 P = 0.393
After 6 sessions of treatment (0-10)	4.00±0.85	4.66±0.77	t = 2.000, df = 22 P = 0.058
After 12 sessions of treatment (0-10)	0.52±0.50	0.91±0.66	t = 1.701, df = 22 P = 0.103

(A)

(B)

Figure 2. A. Tecar therap; B. Winback tecar

Figure 5 shows the trend of improving athletes' performance during the treatment process between the treatment and control groups.

According to Table 5, the mean daily life activities and also the percentage of athlete satisfaction with performing daily life activities increased after 6 and 12 sessions of treatment compared with pre-treatment in the treatment group than the control group; however, this increase was not statistically significant (P>0.05). The increase in scores of daily life activities and the percentage of athlete satisfaction with performing daily life activities after 12 sessions of treatment was more than after 6 sessions of treatment in the control group; however, it was not statistically significant (P>0.05).

Figure 6 displays the differences between the control and treatment groups regarding the mean daily activities of life and athlete satisfaction with performing daily activities of life.

4. Discussion

The mean pain scores of the VAS in both groups showed that tecar therapy significantly reduced pain compared with before treatment. Al-Mandeel and Watson in a detailed review of the records of patients who used pulsed short-wave diathermy found that this modality can be used in pain management, fracture healing, accelerated healing, and absorption of edema, and muscle hematoma plays a key role in that case [30]. Their results were also consistent with the results obtained by Notarnicola et al. in 2017 [17] after the assessment of 60 patients with low back pain. In this study, patients were randomly divided into two groups of 30 cases and each group received the therapeutic intervention for two weeks (10 sessions in total). One group received tecar therapy and the other laser therapy. Pain Severity (VAS) and disability were assessed at 4 intervals (initially, at the end of 2 weeks, one month after treatment, and two months after treatment). Both criteria improved at the end of two weeks. Laser therapy showed a significant difference in pain severity by the end of two weeks and tecar up to two months after treatment. According to the findings of this study, it seems that tecar therapy caused a significant improvement in patients with low back pain and was more effective than laser therapy after one- and two-month follow-ups [19]. This part of the mechanism of action in tecar therapy goes back to diathermy functions to produce a deep heat in the body tissue because heat therapy can be used for chronic skeletal muscle pain.

Table 2. Mean scores of swelling

Time	Mean±SD		Independent t-test Result
	Treatment	Control	
Before treatment (0-10)	56.08±5.36	56.25±5.56	t = 0.075, df = 22 P = 0.941
After 6 sessions of treatment (0-10)	53.00±5.09	53.66±5.48	t = 0.309, df = 22 P=0.761
After 12 sessions of treatment (0-10)	51.00±5.06	51.33±5.10	t = 0.161, df = 22 P = 0.874

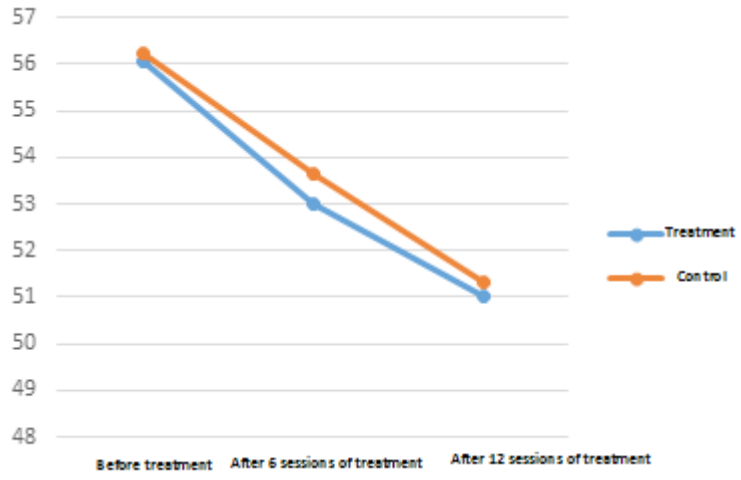

Figure 3. Mean swelling index

The results also showed that the mean swelling decreased in both groups; however, this decrease was significantly different after 12 sessions of treatment compared with 6 sessions. It can be said that this treatment improved pain and reduced the VAS of pain score and inflammation after 12 synergistic sessions. Consistent with our findings, Stregioulas in 2004 examined the effects of low-power lasers and RICE. He concluded that the low-power laser combined with RICE could reduce the inflammation caused by ankle sprain [1]. In line with our findings, Bjordal et al. in a systematic review showed that low-power lasers can reduce the inflammatory process and acute pain of ankle sprains [7]. It can be concluded that tecar therapy can reduce inflammation and edema caused by injury due to increased blood circulation in the tissue because of giving deep heat to the tissue and elasticity that it causes it creates in the muscle.

Regarding the mean daily life activities and the percentage of athlete satisfaction with performing daily activities, the results showed that 12 sessions of treatment can cause a significant difference in the daily life of athletes compared with 6 sessions of treatment. Consistent with the results of our research, Guimaraes et al. in 2018 [18]conducted their research on 60 female volleyball players with a mean age of 16.4 years. These 60 subjects were randomly divided into two 30-subject groups of test and control. To conduct the study, patients in both groups performed fatigue protocol and were evaluated as follows: control group: before and after fatigue protocol and treatment group: before fatigue and before

Table 3. Mean scores of daily life activities

Variable	Time	Mean±SD	
		Treatment	Control
Daily life activities (0-100)	Before treatment	15.15±10.01	9.77±9.42
	After 6 sessions of treatment	58.33±15.83	50.89±14.36
	After 12 sessions of treatment	94.34±10.52	94.34±4.97
	Results of repeated measures analysis of variance	F=88.57, P<0.001	F=488.85, P<0.001
Percentage of athlete satisfaction in performing daily activities (0-100)	Before treatment	18.33±8.07	17.92±9.16
	After 6 sessions of treatment	58.33±17.49	50.83±7.93
	After 12 sessions of treatment	92.50±11.96	90.42±7.52
	Results of repeated measures analysis of variance	F=98.028, P<0.001	F=891.391, P<0.001

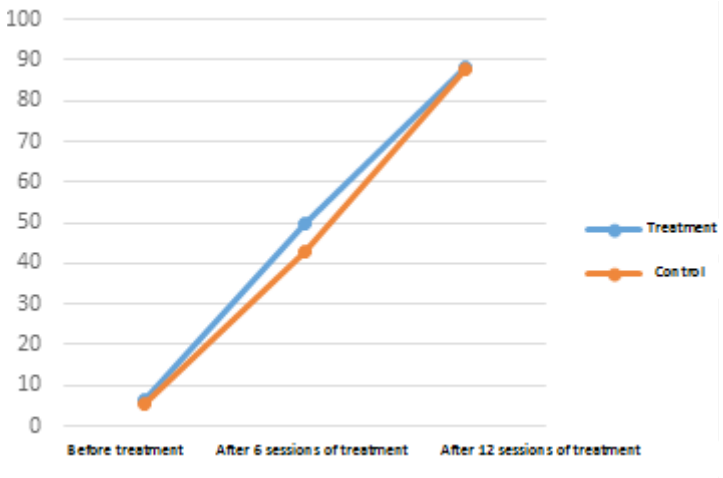

Figure 4. The trend of daily life activities

and 24 hours after tecar therapy. Also, the members of both groups were re-evaluated 72 hours after the fatigue protocol. The variables evaluated included compressive pain threshold, muscle irritation (VAS), performance (Single Hop Test), and muscle strength (isotonic maximum torque evaluation). The results showed that tecar therapy was effective in reducing pain and muscle irritation after 24 hours. The treatment group also showed faster recovery, more muscle strength, and better performance after 72 hours [20]. They concluded that the positive or negative effect of ultrasound on ankle sprain cannot be well demonstrated because few studies have been done on this subject [3], which is not consistent with the results of our study.

Table 4. The performance status in both groups

Time	Current Performance Status	No. (%)	
		Treatment	Control
Before treatment	Normal	0 (0)	0 (0)
	Almost natural	0 (0)	1 (8.3)
	Abnormal	5 (41.7)	5 (41.7)
	Extremely abnormal	7 (58.3)	6 (50)
After 6 sessions of treatment	Normal	1 (8.3)	0 (0)
	Almost natural	3 (25)	2 (16.7)
	Abnormal	8 (66.7)	10 (83.3)
	Extremely abnormal	0 (0)	0 (0)
After 12 sessions of treatment	Normal	9 (75)	8 (66.7)
	Almost natural	2 (16.7)	4 (33.3)
	Abnormal	1 (8.3)	0 (0)
	Extremely abnormal	0 (0)	0 (0)
Results of Friedman test		$X^2 = 21.043$, P<0.001	$X^2 = 22.372$, P<0.001

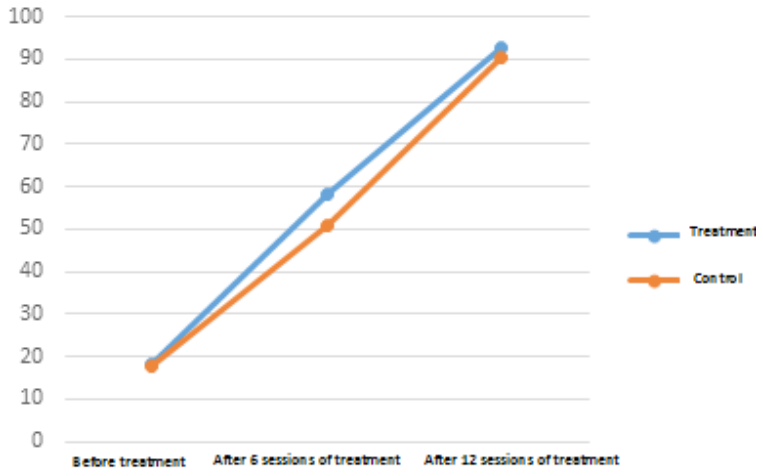

Figure 5. Performance index

Therefore, it can be said that reducing pain, swelling, returning to daily activities, and performing normal daily routine are important effects of tecar therapy and it is recommended for athletes. Inducing deep heat into the tissue with high elasticity to the muscles and tendons with more blood supply can be mentioned as its mechanisms.

The results of the subject's performance showed that tecar therapy after 12 sessions has a significant effect compared with before the start of treatment and 6 sessions of treatment. In line with the results of our study, Alvisi et al. [31] in 2015 conducted a study on 66 patients with chronic back pain with/without leg pain. In this study, the patients were treated daily for three weeks (10 sessions in total). In each session, patients first received a high-power laser with a dose of 500 joules and then 20 minutes of tecar therapy. Before starting treatment, all patients took painkillers or nonsteroidal anti-inflammatory drugs. The findings of this study showed that the combination of laser and tecar therapy can be used in the treatment of back pain of disc origin, and significantly reduced pain and improved quality of life also reduced the number of drugs used. It is worth noting that in this study, it was hypothesized that the anti-inflammatory effects of combining these two devices together, probably due to the effect on mechanical and thermal analgesic receptors that are deep in the tissue [16], which can be attributed to the increase in blood flow to the tissue due to the reduction in pain and the mean swelling caused by the heat entering the tissue because similar to our result, both of these factors caused a faster return to daily life and the athlete's health was achieved faster.

Table 5. An increase in the mean scores of daily activities of life and also the percentage of athlete satisfaction with performing daily activities of life

Variable	Time	Mean±SD		Result of Independent t-test
		Treatment	Control	
Daily life activities	Before treatment - after 6 sessions of treatment	48.31±24.01	41.46±10.46	t =0.905, df=22 P=0.375
	Before treatment - after 12 sessions of treatment	84.32±18.26	84.92±7.85	t = -0.104, df=22 P=0.918
	After 6 sessions of treatment - After 12 sessions of treatment	36.01±23.34	43.45±9.71	t = -1.019, df=22 P=0.319
Percentage of athlete satisfaction in performing daily activities	Before treatment - after 6 sessions of treatment	40.00±17.70	32.91±6.55	t = 1.299, df=22 P=0.207
	Before treatment - after 12 sessions of treatment	74.16±10.18	72.50±7.22	t = 0.462, df=22 P=0.649
	After 6 sessions of treatment - After 12 sessions of treatment	34.16±24.38	39.58±3.34	t = 0.762, df=22 P=0.454

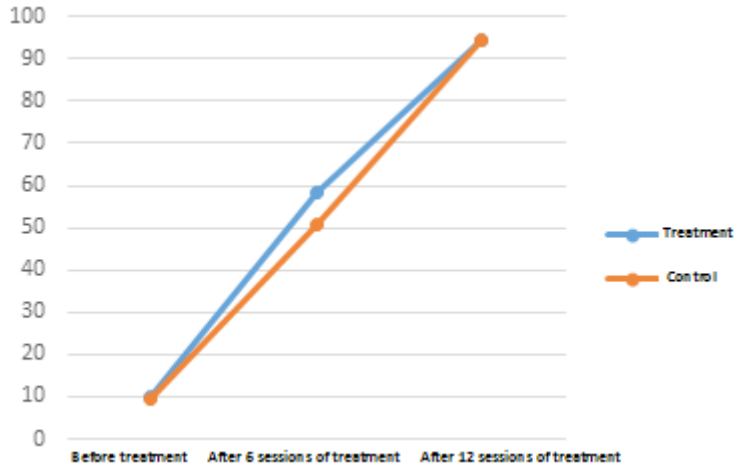

Figure 6. An increase in the mean daily activities of life and also the percentage of athlete satisfaction with performing daily activities of life.

The results of our study showed that the difference in the mean pain between the control and treatment groups at all three time points, including before treatment, after 6 sessions, and after 12 sessions of treatment was not statistically significant. Consistent with our results, Ganzit in a study on 629 subjects (including 122 women and 229 men) aged 11 to 32 years showed that athletes with chronic and acute pain were treated with tecar therapy. Most patients expressed pain relief and improvement in function at the end of treatment [28]. Also, in a study conducted by Mondardini on 62 patients, it was shown that rehabilitation time was much faster when tecar therapy was performed [29].

This shows that this type of treatment alone cannot help to return to professional sports activities because the mechanism of action in tecar therapy is based on blood supply, and oxygen supply is more than that of the needed energy that this process needs to rest the affected area; however, it was a great help for daily activities and the differences were significant after treatment between the groups. Therefore, we may need adjuvant therapies and a variety of treatments during the recovery period to return to professional exercise.

5. Conclusion

The results of the present study showed that tecar therapy is an emerging non-surgical treatment used for the treatment of bone, joint, and soft tissue diseases and improve musculoskeletal problems. It is also a safe and non-invasive method, which was initially used only for sports injuries and, gradually was used for the treatment of other injuries of the musculoskeletal system, in which physiotherapy is involved. According to our results, this type of treatment can accelerate the healing process and also improve lymph and blood flow, reduce edema and swelling, increase oxygen delivery, stimulate the release of pain-relieving hormones, stimulate soft muscle tissues, lymph, and veins, and increase range of motion of the joints, etc.

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بررسی اثرات تکارتراپی بر علائم حاد ورزشکاران به دنبال کشیدگی رباط خارجی مچ پا

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چکیده

مقدمه هدف از این مطالعه بررسی اثرات تکارتراپی بر علائم حاد ورزشکاران به دنبال کشیدگی رباط خارجی مچ پا بود که در گروه‌های کنترل و درمان در بین زمان‌های پیش از درمان، پس از ۶ جلسه درمان و پس از ۱۲ جلسه درمان بود.

مواد و روش‌ها در این مطالعه، ۲۳ بیمار در هر گروه ورزشکاران دارای پیچ‌خوردگی رباط خارجی مفصل مچ پا در مرحله حاد در شهر تهران بودند. متغیرها در شرکت‌کنندگان همگن‌سازی شدند. اثرات ارزیابی شدت درد بیماران از مقیاس عددی دیداری به کمک یک خط ۱۰۰ میلیمتری افقی بدون شماره استفاده شد. سنجش تورم مفصل مچ پا با متر نواری در ناحیه قوزک‌ها اندازه‌گیری و ثبت گردید. برای اندازه‌گیری درجه حرکات مچ پا از گونیامتر استفاده شد. همچنین برای اندازه‌گیری نمره پرسشنامه توانایی حرکت زانو استفاده شد.

یافته‌ها آنالیز آماری نشان دادند میانگین معیار عددی دیداری درد و میانگین تورم در هر دو گروه پس از ۶ جلسه و پس از ۱۲ جلسه درمان به صورت معنی داری کمتر بود ($P<0/001$). در آیتم فعالیت‌های روزمره زندگی و درصد رضایت ورزشکار در انجام فعالیت نتایج نشان داد که نمرات ورزشکار در زمان ۶ جلسه پس از درمان و ۱۲ جلسه پس از درمان به صورت معنی داری بیشتر از پیش از درمان بود ($P<0/001$). همچنین نمرات ۱۲ جلسه پس از درمان نسبت به ۶ جلسه پس از آن به صورت معنی داری بیشتر بود ($P<0/001$). داده‌ها نشان دادند که در هر دو گروه نمرات عملکرد و دامنه حرکتی پس از ۶ جلسه و پس از ۱۲ جلسه درمان ($P<0/001$) به صورت معنی‌داری از نمرات عملکرد پیش از درمان بیشتر بوده و همچنین پس از ۱۲ جلسه درمان نسبت به ۶ جلسه درمان نیز به صورت معنی داری بیشتر بود ($P<0/001$).

نتیجه‌گیری با توجه به اینکه عملکرد تکار تراپی ایجاد یک گرمای عمیق در بافت بدن است و می‌تواند با این گرما درمانی برای دردهای مزمن ماهیچه ای اسکلتی انجام بدهد و علاوه بر این اکسیژن رسانی و خون‌رسانی بیشتر بافت را نیز افزایش می‌دهد. همین کارایی می‌تواند التهاب و ادم ناشی از آسیب وارده را کاهش دهد. از اینرو می‌توان بیان کرد که کاهش درد، تورم، بازگشت به فعالیت‌های روزمره و انجام روال عادی روزانه از تاثیرات مهم درمان با این روش است، که برای ورزشکاران بازگشت سریعتر به فعالیت‌های ورزشی درکنار درمان‌های دیگر پیشنهاد کرد.

کلیدواژه‌ها:
تکارتراپی، ورزشکار، رباط خارجی مچ پا، مرحله حاد

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