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Comparison of different electrotherapy methods and exercise therapy in shoulder impingement syndrome: A prospective randomized controlled trial

Sevtap Gunay Ucurum [a, *], Derya Ozer Kaya [a], Yasemin Kayali [b], Ayhan Askin [c], Mustafa Agah Tekindal [d]

[a] Izmir Katip Celebi University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Izmir, Turkey
[b] Izmir Katip Celebi University, Atatürk Training and Research Hospital, Department of Physical Therapy and Rehabilitation, Izmir, Turkey
[c] Izmir Katip Celebi University, Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Izmir, Turkey
[d] Izmir Medical Park Hospital, Izmir, Turkey

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ABSTRACT

Objective: The aim of this study was to assess and compare the effects of different electrotherapy methods and exercise therapy on pain, function and quality of life in shoulder impingement syndrome.
Methods: Eighty-three patients (66 females, 17 males; mean age: 48.2 ± 7.33 years) with shoulder impingement syndrome were selected and 79 of them were randomly allocated into four groups. Group 1 (n = 19, mean age: 47.89 ± 7.12 years) was given hot pack and exercises, Group 2 (n = 20, mean age: 47.70 ± 6.51 years) was given hot packs, exercises and interferential current, Group 3 (n = 20, mean age: 48.50 ± 8.34 years) was given hot packs, exercises and TENS and Group 4 (n = 20, mean age: 48.55 ± 7.89 years) was given hot packs, exercises and ultrasound three times a week for four weeks. Assessments were made before treatment, right after it and three months after that using the visual analog scale (VAS), Short Form-36 (SF-36) and the Disabilities of the Arm, Shoulder and Hand (DASH) outcome measures.
Results: At the fourth week and third month assessments, all groups showed significant improvements in terms of pain, DASH and SF-36 physical component scores ($p < 0.05$). In intragroup comparisons, a significant difference between pre- and post-treatment results was found only in SF-36 mental component scores of Group 2. No significant difference was observed between the groups in any stage of the study period ($p > 0.05$).
Conclusion: Application of ultrasound, interferential current and TENS in addition to exercise therapy in shoulder impingement syndrome treatment had similar improvements in terms of pain, function and physical component of quality of life. However, interferential current treatment showed significantly better outcomes for the mental component of quality of life.
Level of evidence: Level I, Therapeutic study.

Shoulder pain is one of the most frequent type of musculoskeletal complaints.[1,2] Subacromial impingement syndrome, also known as shoulder impingement syndrome (SIS) is the most common cause of shoulder pain, with a prevalence of %44–65 among all shoulder pains.[3,4] It is defined as the mechanical compression of the rotator cuff and subacromial bursa between the humerus and coracoacromial arch.[4–6] The condition is seen more frequently in women and with an increasing incidence by age. It causes painful movement limitation, functional deficit and restriction of daily living activities. As a result of overuse of the shoulder, especially in overhead positions, weakness of shoulder stability and various traumas occur.[2,5,6]

The treatment of SIS is mostly performed through conservative methods,[7] in which the aim is to reduce the pain and joint stiffness, improve muscle strength, prevent progression of the problems,

* Corresponding author. Izmir Katip Celebi University, Health Sciences Faculty, Department of Physiotherapy and Rehabilitation, Cigli, Izmir, Turkey. Tel: +90 232 329 35 13/4717; fax: +90 232 329 39 99.
E-mail address: sevtapgunay.tfd@gmail.com (S. Gunay Ucurum).
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bring shoulder function to the highest level and bring the person back to daily activities as early as possible.[5,8–11] These conservative methods include exercise programs for the rotator cuff and scapular muscles, a variety of medications, manual therapy techniques, modification of daily activities and a variety of physical therapy modalities.[10–12] In general practice, physical therapy and rehabilitation usually begins with heat application to relieve soft tissue pain and continues with different electrotherapy modalities. Transcutaneous electrical nerve stimulation (TENS), interferential current and ultrasound are the most popular applications to control pain, increase blood circulation and prepare the patient for exercise.[13] Yavuz et al. compared the ultrasound and the low-level laser therapy in treatment of SIS and showed improvement in terms of pain and disability with both treatments.[11] Van der Heijden et al.[14] compared the ultrasound and the exercise to placebo ultrasound and exercise, and then to exercise alone and found that the groups showed no difference in self-perceived recovery, pain or functional capacity. In addition, the authors compared bipolar interferential current in addition to exercise to placebo bipolar interferential current and exercise, and exercise alone and again observed no difference between groups in the short and long term. In a recent study, Page et al. reviewed 47 trials out of 3488 articles about electrotherapy modalities for rotator cuff disease and concluded that although these modalities were widely used as components of physical therapy interventions, the evidence levels of the studies were low and that high-quality placebo-controlled trials were needed to confirm the effects of electrotherapy.[15] To our knowledge, additional effects of the applications have not been established and the comparison of different methods has not been researched yet. Furthermore, long-term results of the patients after the program are unknown.

Therefore, the aims of our study were to evaluate and compare the effectiveness of a four-week physical therapy and rehabilitation program with different electrotherapy applications on pain, quality of life and function in treatment of SIS and to investigate the three-month results after the program was over. We hypothesized that there might be positive effects of additional different electrotherapy applications on the quality of life, pain and functionality in SIS. Different electrotherapy applications are not superior to each other. All of the applications may maintain their effect after the third month of follow-up.

Patients and methods

In this prospective randomized controlled study, 95 volunteers who had a shoulder pain complaint lasting at least for four weeks and were diagnosed with SIS with clinical examinations and MRIs were selected.

The selection criteria were as follows: 1) patients aged between 18 and 55, 2) have continuous unilateral shoulder symptoms, 3) have a restriction of less than 30% in passive range of motion compared to the unaffected side and 4) haven't undergone any type of treatment for the past year at least. Twelve patients who had adhesive capsulitis or major rotator cuff tears, permanent loss of shoulder function, advanced muscle atrophy and weakness, sensory and muscular deficits rooted from neurological, inflammatory joint diseases or previous shoulder injury, a history of shoulder dislocation or surgery, have had steroid injections during the past six months and were using any steroids or NSAIDs were later excluded.

The patients were informed about the study and their written informed consent was obtained. This study was conducted in accordance with the rules of the Declaration of Helsinki and was approved by the Ethics Committee of the University (approval number: 75/1.04.2015).

Eighty-three patients (66 females, 17 males; mean age: 48.2 ± 7.33 years) with shoulder impingement syndrome were selected. Four of them dropped out of the study due to personal reasons. The remaining 79 patients were randomly allocated into four groups using the SPSS software (SPSS Inc., Chicago, IL, USA). Group 1 (n = 19, mean age: 47.89 ± 7.12 years) was given hot pack + exercises, Group 2 (n = 20, mean age: 47.70 ± 6.51 years) was given hot pack + exercises + interferential current, Group 3 (n = 20, mean age: 48.50 ± 8.34 years) was given hot pack + exercises + TENS and Group 4 (n = 20, mean age: 48.55 ± 7.89 years) was given hot pack + exercises + ultrasound for three days per week for four weeks. The patients were told not to use any pain-killer during treatment and they were evaluated before treatment, right after that and at the postoperative third month.

Patients' demographic data, previous treatments, height and weight were asked. A visual analog scale (VAS) was used for pain, the Short Form-36 (SF-36) for the quality of life, and the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH) for shoulder function assessments.

In VAS assessment, the patients were asked to place a vertical mark along a horizontal line indicating their current degree of pain at rest and during activity, where 0 points indicated 'no pain' and 100 points indicated 'worst pain'.[16]

The SF-36 scale is an indicator of a patient's overall health status and it consists of eight sections: vitality, physical functioning, bodily pain, general health perceptions, physical role functioning, emotional role functioning, social role functioning and mental health.[17] The physical and mental component summaries were used for this study. Scores range from 0 to 100. Lower scores indicate more disability, higher scores indicate less disability.

The DASH questionnaire is designed to measure the physical function and symptoms of people with musculoskeletal disorders in the upper limb. It consists of 30 items; 6 items about symptoms and 24 items about function. Patients answer the questions using a 5-point Likert system and the cumulative score is scaled from 0 to 100, with higher scores indicating more disability.[18]

To reduce muscle spasm, all patients received hot pack application on the upper trapezius muscle for 15 min. After this warm-up and relaxation period, a standardized exercise program was applied. The exercise program included Wand exercises for shoulder abduction, flexion, hyperextension and internal and external rotation, Codman exercises and isometric and resistive exercises of the shoulder girdle.[5,10,19] The exercise program was performed under the supervision of an experienced physiotherapist and the patients were encouraged to exercise at home on daily basis. The exercises were adjusted according to the patient's tolerance. The isometric exercises were used during the painful period, and the resistance exercises were added after the pain began to relieve. In addition to the routine hot pack and exercise program, different electrotherapy modalities were used for the groups except the controls. Group 2 patients were given interferential current at 50–120 Hz frequency for 20 min around the effected shoulder. Group 3 patients were given TENS in conventional mode for 20 min. Group 4 patients had a 1 MHz ultrasound at an intensity of 1.5 W/cm^2 for 5 min.[14] All electrotherapy applications were performed using the Enraf-Nonius 492 Sonopuls (Enraf-Nonius BV, Rotterdam, the Netherlands) combined device.

The G × Power software v.3.0.10 (Franz Faul, Kiel University, Germany) was used to determine the necessary sample size of at least 76 subjects, including at least 19 individuals of each group. The power of the test in this series was estimated to be approximately 80.48%. The SPSS software v.20 (SPSS Inc., Chicago, IL, USA) was used for calculations. All values were presented in mean and standard deviation and in percentage. The repeated measures

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