

Original Article

Effects of the Neurac[®] technique in patients with acute-phase subacromial impingement syndrome

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Abstract. [Purpose] This study investigated the effects of the Neurac technique on shoulder pain, function, and range of motion in patients with acute-phase subacromial impingement syndrome. [Subjects] Thirteen patients (seven females and six males) with acute-phase subacromial impingement syndrome participated in this study. [Methods] Shoulder pain, function, and range of motion were assessed before and after the application of the Neurac technique. [Results] Pain and function scores were significantly lower after than before the Neurac intervention. Shoulder range of motion was significantly greater after Neurac intervention than before it. [Conclusion] The Neurac technique is a useful intervention for patients with acute-phase subacromial impingement syndrome.

Key words: Acute-phase subacromial impingement syndrome, Neurac technique, Shoulder pain

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INTRODUCTION

Subacromial impingement syndrome (SIS) is the most commonly diagnosed cause of shoulder dysfunction; it is the causative factor in 74% of cases of shoulder pain¹⁾. The mechanisms of SIS include both intrinsic and extrinsic factors²⁾. Patients with SIS present with pain, dysfunction³⁾, and limited range of motion (ROM)⁴⁾.

Rehabilitation programs aiming to improve symptoms comprise four phases: acute, intermediate, and advanced strengthening, and return to activity⁵⁾. The acute phase of rehabilitation takes place within four weeks of pain onset⁶⁾ and involves manual therapy, injection, and strengthening exercises. Strengthening exercises in the acute phase are performed to restore muscle balance and prevent muscle atrophy⁵⁾. However, patients sometimes experience some pain following exercise⁷⁾; limiting the type and range of exercises that can be performed⁵⁾.

The Neurac[®] technique has recently been used as a pain-free exercise in patients with musculoskeletal problems. This technique has four major aspects. First, the Neurac technique is a weight-bearing exercise that encourages muscle co-activation, thus providing joint stability. Second, exercise intensity can be controlled, because the body weight is unloaded using an elastic cord. Third, the Neurac tech-

nique can be used as a strengthening exercise that gradually increases exercise intensity by decreasing the elastic cord support. Because the technique provides vibration using Redcord Stimula (Redcord AS; Staudbo, Norway), patients can exercise without pain⁸⁾. Kim et al.⁹⁾ demonstrated that Neurac sling exercise is an effective method for reducing pain, adjusting postural balance, and normalizing muscle response pattern in patients with chronic low back pain. However, few studies have investigated the effects of the Neurac technique in patients with acute-phase SIS.

Therefore, this study investigated the effects of the Neurac technique on pain, function, and ROM in patients with acute-phase SIS. We hypothesized the Neurac technique reduces pain and function scores and increases shoulder ROM.

SUBJECTS AND METHODS

This study involved 13 patients (seven women and six men) with shoulder impingement syndrome who visited the Pusan National Yang Hospital, Yangsan, Korea. Their mean \pm SD age, height, and weight were 44.53 ± 8.53 years, 164.86 ± 9.40 cm, 63.42 ± 10.30 kg, respectively. The inclusion criteria included onset of shoulder pain within the last three weeks and at least one positive finding among the following three items⁶⁾: positive Neer and Hawkins signs, painful arc of movement during flexion and/or abduction; and pain on resisted lateral rotation, abduction, or the Jobe test. Patients were excluded if they had a history of shoulder surgery, symptoms related to the cervical spine, degenerative arthritis of the glenohumeral joint, or shoulder instability. Prior to participation, all patients read and signed an informed consent form approved by the Inje University Ethics Committee for Human Investigations.

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The patients underwent four sessions of the Neurac technique using a Redcord trainer (Redcord AS; Staudbo, Norway). Before starting treatment, an investigator instructed each patient about the four main exercises of the Neurac technique. First, the patients performed kneeling shoulder extension. The patient kneeled directly under the Redcord trainer, the hand strap was placed on both elbows at shoulder height, and the elastic cord and wide strap were used to unload the body weight. The patient then leaned with a straight arm until 180° shoulder flexion. Second, the patients performed the kneeling push-up plus. The patient kneeled directly under the Redcord trainer, the hand strap was placed on both hands at the height of the anterior superior iliac spine, and the elastic cord and wide strap were used to unload the body weight. Then the patients leaned with a straight arm until 90° shoulder flexion, following by performing the push-up plus. Third, the patients performed supine shoulder abduction. The patient lay in a supine position with a neutral shoulder position and rolled their knees underneath. The hand strap was placed on both elbows above the shoulder height, the split sling was used to support the head, the wide sling was placed under the upper back, and the pelvis was used to unload the body weight. The patient extended their knee and hip, then pressed their arms into the straps to lift their body from the treatment table and abducted their straight arms to 180°. Finally, the patients performed supine external shoulder rotation. The patient lay in a supine position with the shoulder at 90° abduction, elbow at 90° flexion, and knees rolled underneath. The hand strap was placed on both forearms above the shoulder height, the split sling was used to support the head, the wide sling was placed under the upper back, and the pelvis was used to unload the body weight. All exercises were performed using the Redcord Stimuli at 50 Hz vibration¹⁰. The Neurac technique was performed for three sets of four repetitions each, three times per week for four weeks. The exercise load was gradually increased, and the exercises progressed as long as no pain occurred and no compensation movement occurred during exercise.

Pain level was evaluated by using a 100-mm visual analog scale in which 0 mm indicated no pain and 100 mm indicated the worst pain possible. Shoulder function was evaluated by using the Shoulder Pain and Disability Index (SPADI). The SPADI is 13-item self-administered questionnaire scored from 0–130, with 130 indicating the worst pain and disability levels.

Shoulder ROM was measured by a goniometer while the patient lay in a supine position. Shoulder flexion was measured with the arm at the patient's side with neutral shoulder rotation to obtain maximum flexion. Meanwhile, shoulder abduction was assessed with the arm at the patient's side with external shoulder rotation to obtain maximum abduction. Shoulder external and internal rotation were assessed with the arm abducted to 90°, elbow flexed to 90°, and neutral shoulder rotation to obtain maximum external and internal rotation.

SPSS version 20 (SPS, Inc., Chicago, IL, USA) was used for data analysis. Paired t-tests were used to compare the pre- and post-Neurac scores. The level of significant was set at $p < 0.05$. The data are presented as mean \pm standard

deviation.

RESULTS

Visual analog scale scores were significantly lower post-Neurac than pre-Neurac (27.63 ± 13.64 vs. 64.61 ± 10.52 mm, respectively; $p < 0.001$). SPADI scores were significantly lower post-Neurac than pre-Neurac (37.09 ± 17.32 vs. 59.76 ± 17.93 , respectively; $p = 0.001$). Flexion angle was significantly greater post-Neurac than pre-Neurac ($160.46^\circ \pm 6.43^\circ$ vs. $142.46^\circ \pm 9.27^\circ$, respectively; $p < 0.001$). Abduction angle was significantly greater post-Neurac than pre-Neurac ($159.23^\circ \pm 7.38^\circ$ vs. $142.76^\circ \pm 9.45^\circ$, respectively; $p = 0.001$). External rotation angle was significantly greater post-Neurac than pre-Neurac ($56.53^\circ \pm 10.50^\circ$ vs. $50.61^\circ \pm 11.69^\circ$, respectively; $p = 0.002$). Internal rotation angle was significantly greater post-Neurac than pre-Neurac ($48.38^\circ \pm 11.54^\circ$ vs. $39.23^\circ \pm 14.07^\circ$, respectively; $p < 0.001$).

DISCUSSION

In this study, patients' pain decreased significantly after application of the Neurac technique. This improvement in pain may have been more closely related to an increase in the scapulohumeral stability and subacromial space¹¹. The Neurac technique focused on the strength of the serratus anterior, lower trapezius, and rotator cuff. The serratus anterior and lower trapezius have the largest movement arm with which torque is generated for scapular upward rotation and posterior tilting to increase the subacromial space¹². In addition, the rotator cuff can maintain the humeral head in the glenoid fossa and produce inferior gliding of the humeral head during arm elevation¹³, which may influence shoulder pain. Therefore, we propose that the Neurac technique decreases pain in patients with acute-phase SIS.

Our results also show that SPADI function scores decreased significantly after Neurac treatment. The SPADI is based on pain experienced during functional tasks; thus, pain reduction decreases SPADI score¹. Hence, our results suggest the Neurac technique is useful for improving shoulder function.

Active shoulder flexion, abduction, and external and internal rotation increased after the Neurac technique. The reduction of ROM-related pain may have been associated with the increased ROM of the shoulder¹². Moreover, increased scapular and glenohumeral joint stability as well as increased subacromial space secondary to the Neurac technique are other factors that helped increase shoulder ROM. Therefore, the Neurac technique may be a useful intervention for increasing ROM.

This study had several limitations. First, intervention duration was short. Future studies should investigate the long-term effects of the Neurac technique in patients with acute-phase SIS.

In conclusion, the Neurac technique significantly reduced pain, improved function, and increased ROM. These findings suggest the Neurac technique is a useful intervention for patients with acute-phase SIS.

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