# EFFECT OF KINESIOLOGY TAPING AFTER ROTATOR CUFF TEAR

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**Annotation**

*The purpose of this study was to compare clinical results utilizing two distinct physiotherapy protocols for pain, range of motion and muscle strength. The use of kinesiology tape has become an increasingly popular treatment aimed at reducing musculoskeletal pain and improving function. The novelty of this study is determined by the fact that the effect of physical exercises and kinesiology taping technique on individuals with rotator cuff injuries will be analyzed. Therefore, it was chosen as an intervention applied in conjunction with physiotherapy without kinesiology taping.*

**Keywords:** *rotator cuff, kinesiology taping, rupture.*

**Presentation of the problem:** A rotator cuff tear is a common injury to the shoulder musculature. Although kinesiology taping is most commonly used in sports medicine, there is increasing of research proving the benefits of this method in the rehabilitation of orthopedic-traumatological injuries. There is still a lack of literature on the effects of including kinesiology taping in a physiotherapy program on shoulder joint function after rupture of a rotator cuff. [6;8]

**The aim of the research:** To determine the effect of kinesiology taping on shoulder joint function after rotator cuff tear.

**Research objectives:**

1. To assess pain, evaluate the active range of motion performed in the shoulder joint, evaluate manual and isometric muscle strength before and after physiotherapy, including kinesiology taping in the physiotherapy program, for individuals after tear of the rotator cuff.

**Methodology**

*Organization of the study:* An empirical study was conducted to compare the effect of different methods of physiotherapy on patients in the second rehabilitation period at 8 weeks after rotator cuff tear. Before the research, the purpose of the research and its benefits for the participants were explained to the respondents. In order to maintain a balance between the researcher's desire for objective information and the safety of the subject, the researcher undertakes to assess the information provided, the competence, volunteering and understanding of the participants. The investigator undertakes to strike a balance between ethical issues such as dignity, privacy and confidentiality at the end of the investigation. *Subjects*: 30 individuals (men and women) between the ages of 38 and 55 with primary rehabilitation after tear of the rotator cuff. The characteristics of the subjects are presented in Table 1. Patients were randomly divided into two groups. Control (N1) subjects (n = 15) underwent a 14-day physiotherapy program were performed active exercises to increase the range of motion and additional 3 times a week of water physiotherapy. For the study group (N2) respondents (n = 15), together with the physiotherapy program, kinesiology taping tapes are glued before each physiotherapy session in water, which are instructed to be kept until the next session. Applied functional correction technique to increase proprioreceptor stimulation, stimulate movement and muscle taping to regulate muscle tone and thus facilitate healing or recovery.

Table 1

Characteristics of the subjects

| Research groups | N1 (n=15) | N2 (n=15) |
|---|---|---|
| Age (x ± SD) | 48 ± 6.19 | 50 ± 3.16 |
| Weight, *kg* (x ± SD) | 78 ± 10.74 | 80 ± 11.89 |
| Sex, *m/f* | 7/8 | 10/5 |

*Research methods*: Subjective results of the assessment of the shoulder pain perception recorded twice, i.y. before and after the 14 – day physiotherapy program. A visual analog pain scale (VAS) was used to subjectively assess pain perception. Subjects were asked to rate perceived pain in the shoulder joint area on a VAS pain scale from 0 to 10 points [6]. During the study, the mobility of the shoulder joint was assessed with a standard goniometer. Goniometry is identified and widely used as a method of estimating the range of motion (ROM) of the "gold standard ". The estimation of active range of motion consist of: flexion, extension, abduction, internal rotation, external rotation [4]. The muscle strength of the injured arm was assessed by Manual Muscle Testing on a 5 – point scale according to the R. Lovett [2]. Isometric evaluation of muscle strength was performed using a manual dynamometer (*Lafayette Manual Muscle Tester, Model 01165, Lafayette Instrument Company, USA*) Tests were performed in standing and siting positions according to the muscle groups tested [7]. Statistical analysis was performed using SPSS 19.0 (Statistical Package for Social Sciences) and Microsoft Office Excel 2018 computer programs. Quantitative variables are presented as arithmetic mean (x) and standard deviation (± SD). The Stjudent t criteria was used to compare the means of the two dependent results. The level of significance was chosen to evaluate the reliability of statistical hypotheses when $p < 0.05$.

**Analysis of results**

*Visual analog scale evaluation results*

A visual analog scale was used to subjectively assess the effect of the applied physiotherapy on the perceived pain in the shoulder joint area before and after physiotherapy. It was found that in the group of subjects N1 the pain decreased significantly ($p < 0.05$) from 6.4 ± 1.07 to 5 ± 1.05 points. In the study group, N2 pain decreased significantly ($p < 0.05$) from 5.3 ± 1.56 to 2.9 ± 1.19 points. Assessing the results between the groups, it was found that the alteration in perceived pain was significantly ($p < 0.05$) higher in the N2 group treated with kinesiology taping compared to the N1 group treated with the physiotherapy program. Alteration in group N1 1.4 ± 0.84 points, in group N2 2.4 ± 1.26 points (Figure 1).

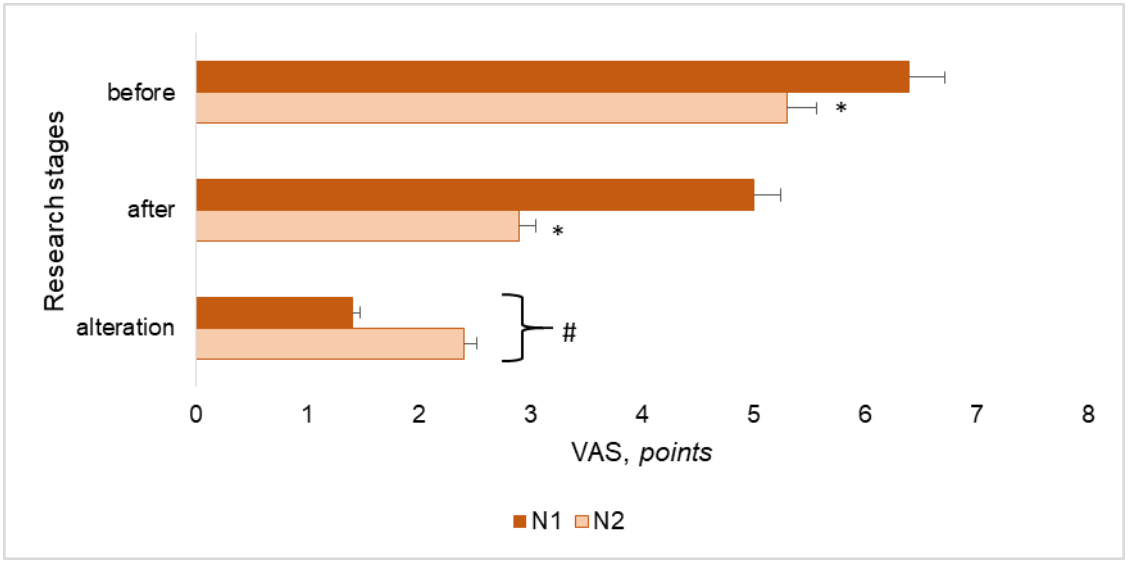


Fig. 1. Results of visual analog scale evaluation before and after the applied physiotherapy program.

*Note: * - significant difference between results ($p < 0.05$). # - significant difference between groups.*

*Range of motion evaluation results*

Table 2 presents data on the alteration of active ROM in the shoulder joint before and after the applied physiotherapy program. The amplitude of flexion increased significantly ($p < 0.05$) in both study groups: N1 alteration 25.5 ° ± 8.32, N2 alteration 34.5 ° ± 10.91. When evaluating the results between the groups, it was found that the increase in the flexion ROM was significantly ($p <0.05$) higher in the study group N2 compared to the study group N1.

ROM on arm extension increased significantly ($p < 0.05$) in both study groups: N1 increased by 13.5 ° ± 6.68, N2 increased by 15.5 ° ± 4.38. No significant differences ($p > 0.05$) were found between the groups when evaluating the results of the alteration in the extension ROM. The abduction ROM increased significantly ($p < 0.05$) in both study groups: N1 increased by 22.5 ° ± 9.51, N2 increased by 26.5 ° ± 7.83. No significant differences ($p > 0.05$) were found between the groups.

The ROM on internal rotation increased significantly ($p <0.05$) in both study groups: N1 increased by 10.5 ° ± 4.97, N2 increased by 12.5 ° ± 6.34. When evaluating the results of the change in the ROM of the internal rotation of the arm, no significant differences were found between the groups ($p > 0.05$).

The ROM on external rotation of the arm increased significantly ($p < 0.05$) in the N2 study group: 9.5 ° ± 2.83. There were no significant differences in the N1 study group 1.6 ° ± 2.36. When evaluating the results between the groups, it was found that the increase in the ROM of the external rotation of the arm was significantly ($p < 0.05$) higher in the study group N2 compared to the study group N1.

Table 2

Active range of motion in the shoulder joint results after physiotherapy

| **Movement** | **N1** | **N2** |
|---|---|---|
| ***Flexion*** | | |
| Before physiotherapy (x±SD) *(active movement with gravity eliminated)* | 85.5° ± 18.32 | 97.5° ± 20.17 |
| After physiotherapy (x±SD) | 111.0° ± 17.91 | 132.0° ± 21.37 |
| Alteration (x±SD) | 25.5° ± 8.32*# | 34.5° ± 10.91*# |
| ***Extension*** | | |
| Before physiotherapy (x±SD) *(active movement with gravity eliminated)* | 27.0° ± 8.88 | 28.5° ± 7.47 |
| After physiotherapy (x±SD) | 40.5° ± 7.97 | 44.0° ± 8.76 |
| Alteration (x±SD) | 13.5°± 6.68* | 15.5° ± 4.38* |
| ***Abduction*** | | |
| Before physiotherapy (x±SD) *(active movement with gravity eliminated)* | 70.5° ± 17.86 | 73.5° ± 23.92 |
| After physiotherapy (x±SD) | 93.0° ± 24.51 | 100.0° ± 23.02 |
| Alteration (x±SD) | 22.5°± 9.51* | 26.5° ± 7.83* |
| ***Internal rotation*** | | |
| Before physiotherapy (x±SD) *(active movement with gravity eliminated)* | 30.5° ± 5.98 | 38.5° ± 6.68 |
| After physiotherapy (x±SD) | 43.0° ± 8.56 | 49.0° ± 4.35 |
| Alteration (x±SD) | 10.5° ± 4.97* | 12.5°± 6.34* |
| ***External rotation*** | | |
| Before physiotherapy (x±SD) *(active movement with gravity eliminated)* | 17.5° ± 2.63 | 18.0° ± 4.83 |
| After physiotherapy (x±SD) | 19.1° ± 3.84 | 27.5° ± 4.24 |
| Alteration (x±SD) | 1.6° ± 2.36# | 9.5° ± 2.83*# |

*Note: * - significant difference between results ($p < 0.05$). # - significant difference between groups.*

*Results of manual muscle strength testing according to the R. Lovett scale*

Manual muscle testing according to the R. Lovett scale was chosen to determine the muscle strength of arm flexors, extensors, abductors, and those involved in internal and external rotation. The results of the study group N1 are presented in Figure 2. After the analysis of the data, it was found that in the group of subjects N1, when applying the usual physiotherapy program, there was a significant ($p < 0.05$) increase in arm flexors (from 2.2 ± 0.42 points to 3.1 ± 0.73 points), extensors (from 2.2 ± 0.41 points to 3.1 ± 0.73 points), abductors (from 2.2 ± 0.42 points to 3.2 ± 0.63 points) and internal arm rotation (from 2.1 ± 0.31 points to 2.6 ± 0.52 points) of the participating muscles, but there are no significant ($p > 0.05$) differences in the alteration in the strength of the muscles involved in the external rotation of the arm (from 2.1 ± 0.32 points to 2, 3 ± 0.48 points).


Fig. 2. Manual muscle strength according to the R. Lovett scale N1 group results

*Note: * - significant difference between results.*

The results of the study group N2 are presented in Figure 3. Analysis of the data showed that in the N2 study group, when physiotherapy combined with kinesiology taping, there was a significant ($p < 0.05$) increase in the strength of all muscles involved in shoulder joint movements: flexors (from 2.1 ± 0.32 points to 3.8 ± 0.42 points), extensors (from 2.1 ± 0.32 points to 3.9 ± 0.32 points), abductors (from 2.1 ± 0.32 points to 3.9 ± 0.32 points), muscles involved in the internal rotation (from 2.1 ± 0.32 points to 3.7 ± 0.48 points), muscles involved in the external rotation (from 2.1 ± 0.32 points to 3.3 ± 0, 48 points).

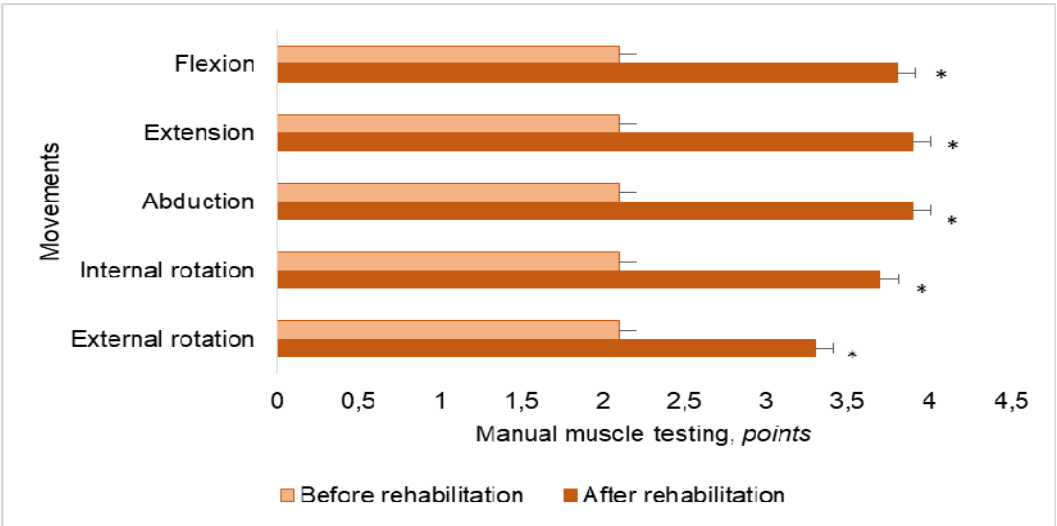


Fig. 3. Manual muscle strength according to the R. Lovett scale N2 group results

*Note: * - significant difference between results.*

Comparing the alteration of muscle strength between the groups, using manual muscle testing according to R. Lovett 's scale, it was found that the alteration of muscle strength was significantly ($p < 0.05$) higher in the N2 respondents compared to the N1 respondents (Fig. 4). The largest difference was found by analyzing the results of muscle strength of internal and external rotation. In the group of subjects N1, the strength of the muscles participating in the internal rotation increased on average by 0.5 ± 0.53 points, the change in muscle strength in the group of subjects N2 increased significantly ($p < 0.05$) by 1.6 ± 0.52 points. In the group of subjects N1, the strength of the muscles participating in the external rotation increased on average by 0.2 ± 0.42 points, the change in muscle strength in the group of subjects N2 increased significantly ($p < 0.05$) by 1.2 ± 0.63 points.

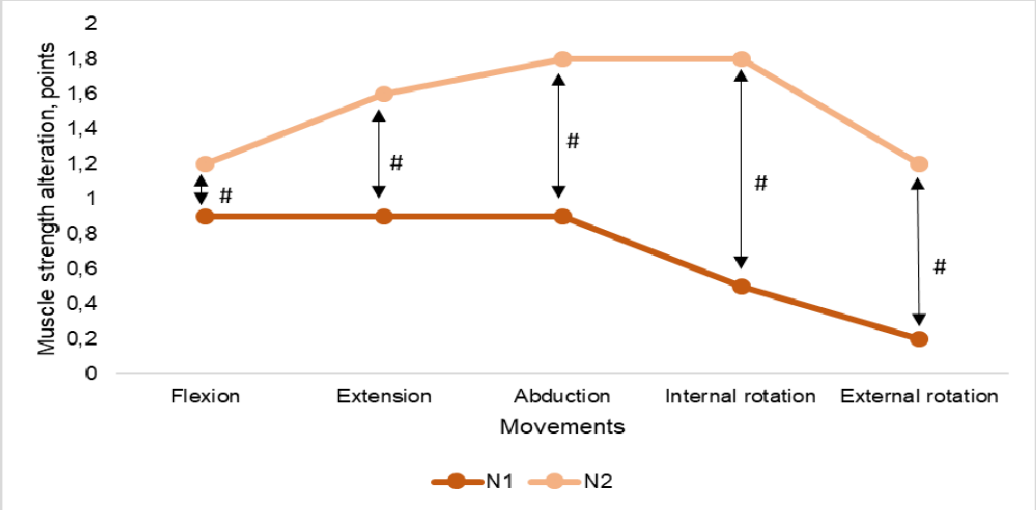


Fig. 4. Alteration differences between groups using manual muscle testing on the R. Lovett scale

*Note: # - significant difference between groups.*

*Results of isometric muscle strength assessment*

No significant ($p > 0.05$) differences were found in the evaluation of isometric muscle strength in the study group N1, but the analysis of the data shows that the isometric force has a tendency to increase. The results of isometric muscle strength before and after physiotherapy are presented in Table 3. The analysis of the data showed that in the study group N1 the largest alteration in isometric muscle strength during arm abduction: from 2.19 ± 0.42 kg to 3.53 ± 0.47 kg. The least changed in isometric muscle strength of the muscles involved in the external rotation of the arm, from 1.73 ± 0.32 kg to 2.36 ± 0.36 kg.

Table 3

Results of isometric muscle strength

| | Before physiotherapy | After physiotherapy | Alteration |
|---|---|---|---|
| **N1** | | | |
| Flexion (x±SD), *kg* | 2,79 ± 0,61 | 3,47 ± 0,52 | 0,68 ± 0,38 |
| Extension (x±SD), *kg* | 1,05 ± 0,57 | 1,72 ± 0,58 | 0,67 ± 0,25 |
| Abduction (x±SD), *kg* | 2,19 ± 0,42 | 3,53 ± 0,47 | 1,34 ± 0,44 |
| Internal rotation (x±SD), *kg* | 2,77 ± 0,52 | 3,61 ± 0,54 | 0,84 ± 0,32 |
| External rotation (x±SD), *kg* | 1,73 ± 0,32 | 2,36 ± 0,36 | 0,63 ± 0,25 |
| **N2** | | | |
| Flexion (x±SD), *kg* | 2,60 ± 0,31 | 5,21 ± 0,43 | 2,61 ± 0,61* |
| Extension (x±SD), *kg* | 1,33 ± 0,59 | 2,34 ± 0,35 | 1,01 ± 0,39 |
| Abduction (x±SD), *kg* | 1,81 ± 0,11 | 5,44 ± 0,20 | 3,63 ± 0,31* |
| Internal rotation (x±SD), *kg* | 2,78 ± 0,46 | 4,05 ± 0,55 | 1,27 ± 0,31 |
| External rotation (x±SD), *kg* | 1,78 ± 0,26 | 3,12 ± 0,22 | 1,34 ± 0,33 |

*Note: * - significant difference between results.*

Analyzing the results of the N2 study group, a significant increase in isometric muscle strength ($p < 0.05$) was found in the arm flexor and abductors muscle groups. The largest

change was found in the isometric force of the muscles involved in arm abduction from 1.81 ± 0.11 kg to 5.44 ± 0.2 kg, the least changed was found in the isometric force of the muscles involved in arm extension from 1.33 ± 0.59 kg to 2.34 ± 0.35 kg.

Comparing the results between the study groups, a significant ($p < 0.05$) difference in the isometric muscle strength alteration was found when assessing the isometric muscle strength of arm abductors (Figure 5). Alteration in the study group N1 1.34 ± 0.44 kg (from 2.19 ± 0.42 kg to 3.53 ± 0.47 kg). The alteration in the study group N2 was 3.63 ± 0.31 kg (from 1.81 ± 0.11 kg to 5.44 ± 0.20 kg).

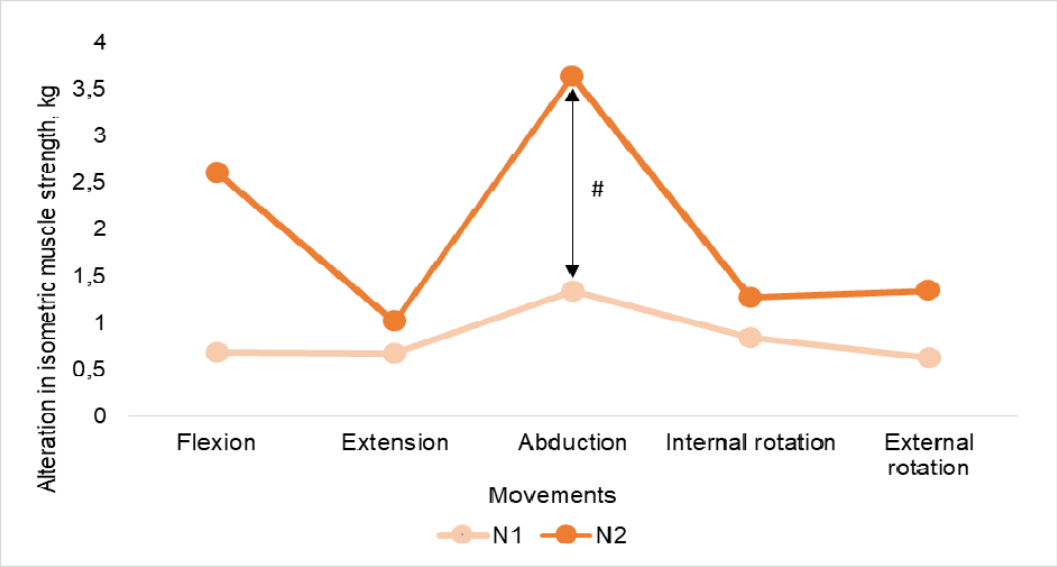


Fig. 5. Alteration differences between groups in isometric muscle strength.
*Note: # - significant difference between groups.*

**Discussion**

Kinesiology taping is most often used in sports medicine, but with the increasing number of studies proving the benefits of this method, it is increasingly used in the physiotherapy of orthopedic - traumatological injuries. physiotherapy protocols often recommend the application of kinesiology taping (KT) to decrease pain and enhance motion control. KT is an elastic acrylic adhesive tape, that supports and stabilizes muscles and joints without restricting the range of motion (ROM). The aim of the study was to determine the advantage of kinesiology taping in reducing pain by increasing the range of motion performed in the shoulder joint, restoring lost functionality compared to physiotherapy program in patients after rupture of the rotator cuff.

Injuries of rotator cuff muscles: supraspinatus, infraspinatus, subscapularis, teres minor are one of the many causes of pain in the shoulder arch region [1]. The study found that the inclusion of kinesiology taping in a physiotherapy procedure significantly reduced the pain. Bolach (2019) and co-authors compared perceived pain on the VAS scale to women who underwent physiotherapy procedures after a rotator cuff injury and were allowed to engage in active physical activity with women who restricted their activity to physiotherapy procedures only. The researchers found a significant reduction in subjective pain only in the group of active women. Compared to the results of our study, a greater reduction in pain is recorded in the traditional rehabilitation program by including kinesiology taping, so it can be argued that complex treatment when more methods are included in the rehabilitation program may have better results. The results of our study confirm the results presented by Coskun and co-authors (2018) that the application of kinesiology taping significantly reduces the perceived pain on the VAS scale compared to the traditional rehabilitation procedure.

Muscle damages also causes changes in biomechanics [1]. When assessing individuals after rupture of the rotator cuff, one of the main complaints during the survey was stiffness and decreased range of motion. The reduced range of motion performed in the shoulder joint impairs functional movements when the injured dominant arm is difficult to service. We evaluated the effect of traditional rehabilitation, and when rehabilitation treatment includes kinesiology tapings on the change in the range of motion of active movements in the shoulder joint. We found that concomitant application of kinesiology taping significantly increases the amplitude of arm flexion and external rotation compared to traditional rehabilitation, which does not significantly affect the change in amplitude of external arm rotation.

During the study, patients performed only active movements, no manual interventions were applied. Recent studies have shown that manual rehabilitation is included in the rehabilitation program 6 weeks after surgery and post isometric relaxation significantly increases the range of motion of passive movements within 2 weeks, and full amplitude can be recovered from 4 to 5 weeks by passive movements [6]. The findings of the analyzed research show that kinesiology taping increases the range of motion performed in the shoulder joint, and helps to restore functionality compared to normal rehabilitation. This may be related to the mechanisms of sensomotoric and proprioreceptive effects provided by the kinesiology band [3].

One of the reasons why it is difficult to assess the strength of the muscles surrounding the joint itself is the pain felt, which also limits the amplitudes of the movements performed. Decreased muscle strength and atrophy of the deltoid and supraspinatus muscles are secondary symptoms resulting from upper limb immobilization after injury [1]. Other authors hypothesize that the isometric force of the muscles that rotate the arm is lower due to patients 'fear of movement [5]. The results of our study confirm this hypothesis. Subjects in both groups showed lower than usual isometric external rotational muscle strength, but subjects in the first group who underwent a routine rehabilitation procedure were more likely to report fear of rotational movements due to possible instability and pain. Respondents subjected to kinesiology taping showed greater strength, but the difference is not significant. The subjects also indicated that they did not feel fear of instability, but there was muscle weakness. It can be stated that the study did not show a significant change in muscle strength due to the duration of rehabilitation, as the focus was on reducing pain and increasing the range of movements.

An analysis of the study data and scientific literature suggests that kinesiology taping can be integrated into a physiotherapy procedure for individuals experiencing rotator cuff rupture for faster function recovery and pain reduction.

**Conclusions**

The inclusion of kinesiology taping in a physiotherapy program significantly reduces subjectively perceived pain in the shoulder joint area, helps to significantly increase the range of motion of arm flexion and external rotation, exhibit significantly greater muscle strength on the Lovett scale show significantly higher isometric arm abductor muscle strength in individuals after tear of the rotator cuff compared to conventional physiotherapy.

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