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COMPARISON OF TWO PHYSIOTHERAPY METHODS IN PATIENTS WITH SHOULDER IMPINGEMENT

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ABSTRACT
Introduction: Shoulder impingement syndrome is the most common diagnosis of shoulder dysfunction. Physical therapy has been found to be effective in reducing pain and disability in these patients. Methodology: The purpose of this study was to compare the effectiveness of two physical therapy interventions in the treatment of primary shoulder impingement syndrome: 1) supervised exercise only, and 2) supervised exercise with manual therapy techniques. Thirty-six subjects diagnosed with primary shoulder impingement were randomly assigned to one of these two groups. Physiotherapy protocol involved twelve treatment sessions over a 6-weeks period. Participants in the exercise-only group performed exercises focusing on strengthening the rotator cuff and scapular stabilizing musculature, stretching to decrease capsular tightness, and patient education on proper posture. Participants in the exercise with the manual therapy group received the standard exercise protocol with the addition of joint mobilization and manual muscle techniques. Main outcome measures included 24-hour pain (Visual Analogue Scale – VAS), shoulder active range of motion (AROM), and shoulder function (Shoulder Pain and Disability Index – SPADI). Results: The statistical analyses were carried out using an SPSS package. Repeated-measures analyses indicated significant decreases in pain, improved function, and increases in AROM. Univariate analyses on the change from pre- to post-treatment for each dependent variable found statistically significant differences ($\alpha \leq .05$) between the two groups. The Manual therapy group had a higher level of change from pre- to post-treatment on pain measures (VAS), SPADI, and AROM, in comparison with the Exercise therapy group. Conclusions: This study suggests that performing manual therapy techniques in combination with a supervised exercise program may result in a greater decrease in pain and improved function although studies with larger samples are needed.

Keywords: *shoulder impingement syndrome, physiotherapy.*

INTRODUCTION

Shoulder impingement syndrome (SIS) is the most common diagnosis of shoulder dysfunction (Millar et al., 2006). It is often described as shoulder pain exacerbated by overhead activities (Hawkins, Kennedy, 1980; Neer, 1983). It appears as the mechanical block, repeated compressive of the rotator cuff tendons as they pass through the subacromial space; these can result in problems with shoulder functions. Physical therapy has been found to be effective in reducing pain and disability in patients with shoulder impingement. Effective interventions include therapeutic exercises focusing on strengthening the rotator cuff and scapular stabilizing musculature (Bang, Deyle, 2000; Ludewig, Borstad, 2003; Desmeules et al., 2003; Ganchev et al., 2007; Sazdova, 2017) stretching to decrease capsular tightness (D'Hespeel, 2004), scapular taping techniques, and patient education of proper posture (Borstad, 2006). Although therapeutic exercise has been shown to be effective in treating shoulder impingement symptoms (McClure et al., 2004), very few studies, have evaluated the effectiveness of incorporating glenohumeral joint mobilizations (Bang, Deyle, 2000; Conroy, Hayes, 1998; Sole, 2003) and other manual therapy techniques.

METHODOLOGY

The purpose of this study was to compare the effectiveness of two physiotherapy interventions within the treatment of primary shoulder impingement syndrome: 1) supervised exercise only, and 2) supervised exercise with manual therapy techniques.

Thirty-six subjects diagnosed with primary shoulder impingement were randomly assigned to 1 of those two groups: control group (CG) – supervised exercise only (18 patients) and experimental group (EG) – supervised exercise with manual therapy techniques (18 patients).

Inclusion criteria, additionally to age 18-65, included superiolateral shoulder pain and two out of 4 specified objective signs and symptoms (Michener et al., 2004):

- a positive (painful) Neer impingement test
- a positive (painful) Hawkins-Kennedy impingement test
- painful limitation of active shoulder elevation (flexion, abduction, scaption)
- pain or limitation with the functional movement patterns of hand-behind-back or hand-behind-head.

Exclusion criteria included:

- adhesive capsulitis
- grade III rotator cuff tear
- calcific tendonitis confirmed by radiology
- systemic or neurological disorder
- cervical radiculopathy
- a history of shoulder surgery
- corticosteroid injection within the past month
- subjects who had received physiotherapy treatment for their shoulder within the past three months.

A recent systematic review reveals that these inclusion and exclusion criteria have been used in many clinical trials (Michener et al., 2004).
All subjects signed consent forms approved by the Department of Theory and Methods of Physiotherapy, NSA, Sofia, Bulgaria.

Physiotherapy protocol involved 12 treatment sessions over a 6-weeks period.

Participants in *CG* (the exercise-only group) performed exercises under the direct one-on-one supervision of the physiotherapist. Physiotherapy interventions include:

- pendulum exercises.
- active-assisted ROM exercises in a non-painful range, with a gentle and gradual increase of motion to tolerance.
- strengthening program for the weaken muscles (rotator cuff and scapular stabilizing musculature).
- stretching to decrease capsular and muscle tightness
- patient education on proper posture, activities of daily living (ADL), and work.

Participants in EG (the exercise + manual therapy group) received the standard exercise protocol as per CG with the addition of:

- joint mobilization techniques (glenohumeral joint anterior, posterior, and inferior glides, and long-axis distraction passive accessory motions)
- glenohumeral joint mobilization with movement (Mulligan, 1999)
- manual muscle relaxation and stretching techniques for the tighten and shorten muscles.

The grade of joint mobility and reactivity were used to determine the direction and intensity of the joint mobilization (e.g., caudal glide for full elevation, anterior glide for full external rotation with abduction, posterior glide if flexion and internal rotation were limited, lateral glide and traction, for all glenohumeral movements). Grades I and II oscillations were used for pain; grades III and IV were for stiffness. Each mobilization was applied for a total of 3 sets of 30-second mobilizations.

The treatment technique under investigation in this study was a *Mulligan MWM* for shoulder elevation through abduction. The technique involved the manual application of a sustained posterior glide of the head of the humerus while the subject actively abducted the arm to the end of the pain-free range. The therapist then applied passive overpressure. The MWM was repeated three sets of 10 repetitions during treatment.

Manual muscle relaxation and stretching techniques (Post Isometric Relaxation, Reciprocal Inhibition, Post Facilitation Stretching) were designed to increase the flexibility of the glenohumeral capsule and other soft tissues, as well as the pectoral muscles, the lower trapezius, and other tight muscles, and thoracic spine. Immediately after the manual therapy, subjects were asked to perform *four stretching exercises* in the following fixed sequence: stretching in external rotation, in flexion, followed by stretching in hand-behind the-back, and cross-body adduction. They were asked to repeat the stretches four times (30 sec stretch, with 10-sec rest between each stretch).

Participants in both groups were instructed to perform *a home exercise program* once a day, mimicking the exercises performed in the clinic. If any prescribed exercise produced lasting or significant symptoms, it was avoided or modified.

Main outcome measures included maximum pain over the preceding 24-hour period graded by a 10-point visual analog scale (VAS) scale; pain intensity with the Neer test assessed by the same 10-point VAS scale; pain intensity with the Hawkins-Kennedy test via the 10-point VAS; pain-free active ROM measured with a standard goniometer for flexion and scaption; and measurement of shoulder function assessed with the Shoulder Pain and Disability Index (SPADI). One physical therapist with ten years of clinical experience performed pre- and post-treatment assessment measurements.

RESULTS AND DISCUSSION

The statistical analyses were carried out using an SPSS package. Differences were considered statistically significant when the $p \leq .05$.

Patients' characteristics

The demographic characteristics of the patients at baseline are presented in Table 1. Chi-square analyses and univariate analyses (ANOVA) were conducted to determine whether both groups differed in their demographic characteristics and pre-treatment measures.

Table 1. *Baseline demographic characteristics*

Characteristic	EG (n=18)	CG (n=18)	Sig.
Gender, n (%)			
Male	10 (55.6)	7 (38.9)	
Female	8 (44.5)	11(61.1)	.36*
Age (years)			
Mean (SD)	47.6 (14.4)	46.1 (14.8)	
Median (min., max.)	47.6 (33, 62)	46.1 (31, 66)	.45**
Involved Shoulder, n (%) Left Right	 6 (33.3) 12 (66.7)	 4 (22.3) 14 (77.8)	 .55**
Hand Dominance	**16R, 2L**	**18R**	**.57****

*Abbreviations: R = right; L = left; * One-way ANOVA; ** Chi-square tests.*

The mean age of patients was 47.6 (14.4) for EG and 46.1 (14.8) for CG. The treatment groups appeared balanced for these characteristics, including gender, age, involved shoulder, and hand dominance.

Table 2. *Baseline pre-treatment means (sd) for the dependent variable for each group*

	EG (n=18)	CG (n=18)	Sig.
VAS pre-test	5.6 (1.3)	5.7 (1.2)	.39*
NEER pre-test	5.3 (1.1)	5.4 (1.2)	.15*
HK pre-test	4.9 (0.9)	5.3 (0.9)	1.22*
Flexion pre-test	143.3 (22.9)	145.6 (18.5)	.33*
Scaption pre-test	147.8 (14.2)	151.1 (14.9)	.63*
SPADI pre-test	65.6 (34.1)	58.7 (26.7)	.02*

*Abbreviations: VAS = visual analog scale; NEER = Neer impingement test; HK = Hawkins-Kennedy impingement test; SPADI = Shoulder Pain and Disability Index; * One-way ANOVA.*

One-way ANOVA analysis indicated no statistically significant differences between the groups on baseline pre-treatment scores. The total SPADI score at baseline was similar to the scores found in other studies investigating shoulder complaints. However, the pain sub-score was markedly higher than the value for functional restriction.

Repeated-measures ANOVAs were conducted for each dependent variable with the pre-treatment and post-treatment scores. The analyses indicated that subjects in both groups had significant decreases in pain, significant improvement in function, and significant increases in active ROM. The change from pre- to post-treatment means revealed statistically significant patterns of improvement for both groups. Hence, time, exercise, and joint mobilization appeared to influence recovery from shoulder impingement. Significant differences were found between both groups on the dependent variables (Table 3).

Table 3. *Post-treatment means (SD) for the dependent variable for each group*

	EG (n=18)	CG (n=18)	Sig. t (α)
VAS	1.3 (0.89)	2.1 (1.2)	2.19 (α ≤ .05)*
NEER	1.1 (0.68)	1.9 (1.2)	2.63 (α ≤ .05)*
HK	0.9 (0.64)	1.8 (0.9)	3.52 (α ≤ .01)*
Flexion	166.4 (9.67)	161.7 (12)	2.19 (α ≤ .05)*
Scaption	171.9 (8.25)	165.3 (8.48)	2.39 (α ≤ .05)*
SPADI	11.1 (8.49)	21.7 (17.48)	2.30 (α ≤ .05)*

*Abbreviations: VAS = visual analog scale; NEER = Neer impingement test; HK = Hawkins-Kennedy impingement test; SPADI = Shoulder Pain and Disability Index; *Repeated-measures ANOVA.*

Results suggest that the group receiving manual therapy in combination with supervised exercise had a higher level of change on all three of the pain intensity measures (VAS, Neer, and Hawkins-Kennedy) compared to the supervised exercise group. Conroy and Hayes (1998) and Bang and Deyle (2000) found statistically significant reductions in pain measures with subjects who received joint mobilizations in combination with supervised exercise compared to those receiving exercise alone; however, no control group was used in either study. Results also revealed appreciable change differences between groups in scaption and flexion AROM measurements. The group receiving manual therapy in combination with supervised exercise had a higher level of change than the exercise-only group on the SPADI function test (Table 3.). An overview of the activities chosen by the participants that are most difficult indicates that activities involving upward-directed movements are clearly the most disabled, followed by dressing. The final functional results at six weeks of follow-up were statistically verified better in patients treated by exercise and manual therapy ($\alpha \leq .05$) – excellent in 12/18 cases (66.7%), good in 4/18 cases (22.2%), acceptable in 2/18 cases (11.1%), compared to those in exercise-only group – excellent in 7/18 cases (38.9%), good in 5/18 cases (27.8%), acceptable in 5/18 cases (27.8%), and poor in 1/18 case (3.6%). The analysis of the results confirms the positive effect of the physiotherapy to decreases in pain, improved function, and increases in shoulder active range of motion.

These results confirm that therapeutic exercise can play a key role in the improvement of shoulder function in SIS patients. In addition, combining supervised exercise with manual therapy techniques is more effective than a therapeutic exercise alone for improving shoulder function. In this study, shoulder joint mobilization was applied to improve hypomobility in noncontractile tissues. Of the shoulder mobilization techniques performed in this study, anteroposterior (A-P) and inferior mobilization could increase the flexion, scaption, and abduction of the shoulder joint on which manual force was applied. Furthermore, muscle techniques and therapeutic exercise reduce the upper trapezius muscle activity and increases the lower trapezius activity. The muscle techniques can increase the lower trapezius strength by decreasing the upper trapezius muscle tone. Thus, supervised exercise and manual therapy can alter scapular kinematics, improving the upper trapezius and pectoralis major tone, shoulder ROM, and SPADI. The therapeutic exercise was used for contractile tissue flexibility (pectorals, latissimus dorsi, levator scapulae, and lower trapezius) and facilitation (dorsal extension muscles) in this study. Therefore, the mechanism by which combining supervised exercise with manual therapy improves shoulder function appears to be multifactorial. Following passive joint mobilization and active exercise, shoulder joint mobility, pectorals, latissimus dorsi, levator scapulae, lower trapezius muscle stretching, and back muscle strength may have collectively played a role in correcting the thoracic posture and scapular kinetic changes. Such results correspond to study results indicating that joint mobilization and extension exercise is more effective for shoulder function than extension exercise alone (Haider et al., 2018). Additionally, joint capsule and shoulder joint hypomobility is presented, along with muscle imbalances in SIS. Thus, this study has demonstrated the need for the correctional scapular kinematics change to improve shoulder functions in patients with SIS, as well as joint mobilization, manual muscle relaxation/stretching, and therapeutic exercises to improve the noncontractile and contractile tissues.

CONCLUSION

This study aimed to examine the effects of supervised exercise only and a combination intervention of supervised exercise with manual therapy techniques on improving shoulder function in patients with subacromial impingement. Supervised exercise is effective in reducing pain and improving shoulder function. The manual therapy, in combination with a supervised exercise program, resulted in a higher level of change from pre- to post-treatment in all functional measures compared to the supervised exercise only. Manual therapy techniques like joint mobilizations, MWM, and muscle techniques can be an important adjunct to supervised exercise in the treatment of individuals with shoulder impingement syndrome.

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