DOI: https://doi.org/10.53350/pjmhs2115112859

ORIGINAL ARTICLE

Comparison of the Effectiveness of Isometric, Isotonic Eccentric And Isotonic Concentric Exercises in Pain and Strength Management of patients with Subacromial Impingement Syndrome - A Randomized Clinical Trial

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ABSTRACT

Aim: To compare the effect of isometrics, isotonic concentric and isotonic eccentric strengthening techniques on patients diagnosed with subacromial impingement syndrome.
Methods: The study design used is randomized clinical trial. 36 patients are allocated in 3 groups with 12 patients in each group with age limit from 30-50 years treated for 6 weeks on alternate days with isometrics, isotonic concentric and isotonic eccentric with baseline exercise plan respectively. Each patient received 18 sessions of exercise plan. Intervention plan is divided into 2 phases, with each phase of 3 weeks. Outcome measuring tools used are Numeric Pain Rating Scale(NPRS) to measure pain, Manual Muscle Testing (MMT) to measure muscle strength was assessed at Day 0, Week3, and Week 6.
Result: Results are generated by using SPSS 21. Post treatment ONE WAY ANOVA showed no significant difference in reduction of pain assessed by NPRS in GROUP1 treated with isometric exercise plan and GROUP2 & GROUP3 treated with isotonic eccentric and isotonic concentric exercise plan respectively. Post treatment One way anova showed p value .117 which is greater than 0.05. Post treatment ONE WAY ANOVA showed significant difference for strength of all the rotator cuff muscles.
Conclusion: Isometric exercise plan conclusively proved to be better as compared to isotonic eccentric and isotonic concentric program in strengthening of patients with subacromial impingement syndrome.
Keywords: Subacromial Impingement Syndrome, Isometric, Isotonic Eccentric, Isotonic Concentric.

INTRODUCTION

One of the most common causes of shoulder pain is Subacromial Impingement Syndrome. Subacromial bursitis and rotator cuff tendinopathy, partial- and full-thickness rotator cuff tears are considered to be the possible cause of shoulder pain associated with Subacromial Impingement Syndrome[1], Subacromial spur formation or coracoacromial ligament hypertrophy narrows the subacromial space which is considered to be the proposed mechanical mechanism of subacromial Impingement Syndrome[2]. Recurrence of subacromial impingement syndrome is common and symptoms are often persistent, with 40–50% of patients reporting ongoing morbidity after 6–12 months and 14% after 2 years[3].

Subacromial Impingement Syndrome results in decreasing range of motion and affecting the functional capabilities and quality of life of the patient[4]. The pain specifically in the anterolateral acromial area is the most typical sign of subacromial impingement syndrome, which radiations maybe felt up to the lateral side of mid portion of humerus bone[5]. The common consequences of SIS are pain and disability, loss of quality of life and sleep disturbances[6]. There is a higher prevalence of musculoskeletal disorders among women based on self-reports and women seem to seek health care providers and use medication more frequently than men. They are more affected with shoulder girdle problems[7].

Shoulder pain is now believed to be the most significant symptom of Subacromial impingement syndrome, the tendinitis and bursitis of the rotator cuff and the adjacent tissue as manifested on the set of clinical and the radiological findings[8].

A wide range of active population is affected by subacromial impingement syndrome with different type of pathologies and presentations. Pain, weakness, and loss of motion are common presenting complaints. Acomioclavicular joint arthritis, calcified coracoacromial ligament, structural abnormalities of the acromion, and weakness of the rotator cuff muscles are the major causes of impingement. Conservative treatment which includes rest, ice packs, non-steroidal anti-inflammatory drugs and physical therapy is often sufficient[9].

The risk factors for subacromial impingement syndrome are Diabetes, Cardiovascular disease, Osteoarthritis, Heavy manual work, Repetitive work, High frequency of work, High force exposure of work, Age-related degenerative changes[10]. Exercise is prescribed to relieve pain, decrease muscle spasm, provoke healing of tendon, reciprocate the abnormal force-couple imbalances, regain pain-free joint range of motion, and consequently improving the functional ability[11]. Conservative methods are mostly applied in the treatment of subacromial impingement syndrome, in which the major objective is to lessen the pain and stiffness in the joint, improve muscle strength, prevent progression of the problems, bring shoulder function to the best level and make the person capable to perform daily life activities as soon as possible[12]. The improvement in the functional capability and decreasing pain are the common aims of rehabilitation plan for patients with shoulder pain[13].

We are unfamiliar with such particular components of the heterogeneous exercise interventions which conclude in a better response and, the patient adherence to the planned exercise program probably results to moderate the effects of such intervention goals[14]. A small pilot study showed that low-load isometric exercises for rotator cuff tendinopathy can reduce pain and tendon thickness but regarding rotator cuff tendon responses to different isometric loads has been established very little in the literature[15].

The aim behind this study is to evaluate the difference between isometrics, isotonic concentric and isotonic eccentric exercise plan and which plan is more effective in patients with subacromial impingement syndrome. The hypothesis generated for this study is that isometric training is more effective as compared to the isotonic eccentric and isotonic concentric in patients with subacromial impingement syndrome.As very little literature is present to prove the effect of isometric exercise training as compared to isotonic concentric and eccentric exercise program.

Received on 14-05-2021
Accepted on 27-10-2021

MATERIALS AND METHODS

The study design set for this study was Randomized clinical trial. This study was conducted in OPD Physiotherapy Department Mayo Hospital Lahore. The duration of this study was 6 months from October 2019 to March 2020.A sample size of 36 Patients, 12 patients in each group by using G Power 3.1 with values of Effective size f: 0.48, α err prob: 0.5,Power (1-β err prob): 0.95. The study contained number of groups: 3 number of measurements: 3, 0.5 by adding attriation rate value 3 which is 10% of 33.The sampling technique was Purposive Non-probability technique.

The inclusion criteria for this study includes 30-50 years of age, Pain localized to the proximal anterolateral shoulder region, Positive for pain on at least one of the following three impingement tests: Hawkins-Kennedy, Neers, Jobes and Positive for pain on at least one of the following four tests: Painful arc, drop arm test, lift-off test, and resisted external rotation**.** The exclusion criteria for this study includes Large, full-thickness rotator cuff tear, Moderate-severe glenohumeral or acromioclavicular joint osteoarthritis, Glenohumeral joint instability including previous shoulder dislocation/subluxation, Previous shoulder fracture, Current neck pain/dysfunction with a somatic or radicular referral pattern indicative of cervical spine rather than shoulder as primary source of symptoms and/or pathology, Neurological deficits of the upper limb, Systemic inflammatory arthritic conditions.

Patients were recruited to the Physiotherapy Department Mayo Hospital by their general practitioner or orthopaedic OPD. Potentially eligible patients were given information about the study. While the treating physiotherapist was not blinded to treatment allocation, in order to minimize bias, the assessing physiotherapist was blinded to group allocation, and patients were not told in which intervention group they had been randomized to. The intervention was carried out by designated, experienced physiotherapists at each site, with the treatment sessions delivered by a physiotherapist who was not involved in any stage of the assessment process. This research study was conducted according to inclusion and exclusion criteria for treatment of subacromial impingement syndrome. Consent was taken through the consent form before starting the treatment of patients. The examination included data which had subjective and objective examination. The data included demographic information including age, gender, past medical history, socioeconomic status, marital status, and educational status, duration of onset nature and location of symptoms. 1st group involved 12 patients with subacromial impingement syndrome and were given isometrics training alongwith regular exercise plan which includes Passive Range of Motion of shoulder joint, Active-Assisted Range of Motion of shoulder joint, Active Range Of motion of shoulder joint, Pendulum Exercise, Wall climbing Exercise. The 2nd group again constituted 12 members and was treated with isotonic eccentric training with baseline exercise plan. The 3rd group of 12 members were given isotonic concentric plan with regular exercise plan. The intervention involved two phases: during Phase 1 (weeks 1–3) participants undertook the active group-specific physiotherapy treatment with 3 sessions in a week, each exercise included 5 repetitions with hold of 10 seconds; in Phase 2 (weeks 3–6), they undertook a progressive treatment plan with increase in number of repetitions and time duration..

Using SPSS 21, data were managed and analyzed. Quantitative data such as age was in the form of mean ±SD. And the Quantitative data such as gender was shown in the form of percentage, frequency table when applicable. Shapiro Wilk was used to assess the normality of the data. Repeated Measure ANOVA was used to determine the difference with-in all clinical parameters (NPRS, MMT). One way ANOVA was used to assess the difference between the three groups. If the value of $p<0.05$ than it showed that the results were significant. And if it was greater than 0.05 the results would not be significant.

RESULTS

Table 1: Anova test of NPRS pre and post treatment between groups

	Sum of Squares	df	Mean Square	F	Sig.
Pretreatment NPRS score					
Between Groups	.389	2	.194	.345	.711
Within Groups	18.583	33	.563		
Total	18.972	35			
Post treatment NPRS score					
Between Groups	2.722	2	1.361	2.294	.117
Within Groups	19.583	33	.593		
Total	22.306	35			

Table 2: Descriptive statistics of supraspinatus, infraspinatus, teres minor and subscapularis strength pre and post treatment between groups

		Pre treatment			Post treatment		
		N	Mean	Std. deviation	N	Mean	Std. deviation
Supraspinatus	Group 1	12	3.1667	.32567	12	4.7083	.33428
	Group 2	12	3.3750	.31079	12	4.7083	.25746
	Group 3	12	3.1250	.32611	12	4.3750	.37689
Infraspinatus	Group 1	12	2.9583	.14434	12	4.5833	.41742
	Group 2	12	3.0000	.36927	12	4.50000	.42640
	Group 3	12	3.0833	.28868	12	4.1667	.32567
Teres minor	Group 1	12	2.9583	.14434	12	4.5833	.35887
	Group 2	12	3.0417	.39684	12	4.5417	.39648
	Group 3	12	3.1250	.37689	12	3.9583	.33428
Subscapularis	Group 1	12	3.1250	.37689	12	4.7083	.33428
	Group 2	12	3.2917	.45017	12	4.7083	.25746
	Group 3	12	3.2083	.25746	12	4.2500	.26112

Table 3: Anova test of supraspinatus, infraspinatus, teres minor and subscapularis strength pre and post treatment between groups

	Pre treatment				Post treatment			
	Sum of squares	Mean square	F	p- value	Sum of squares	Mean square	F	p- value
Supraspinatus	.431	.215	2.158	.132	.889	.444	4.166	.024
Infraspinatus	.097	.049	.606	.551	1.167	.583	3.787	.033
Teres minor	.167	.083	.781	.466	2.931	1.465	11.052	.000
Subscapularis	.167	.083	.608	.550	1.681	.840	10.238	.000

DISCUSSION

Isometric exercise was not proved better than isotonic exercise in reducing pain in the pathologies of tendon. The findings are according to very short evidences and these arose from the patients of patellar tendinopathies who were treated with similar intervention plan. The quick beneficial results of both isometric exercise and isotonic exercise for pain in tendinopathies of patella were found. Isometrics exercises eventually resulted in outstanding decrease in pain as compared to isotonic exercise which showed no significant reduction in pain. As compared to this study, the results analyzed by our study, isometric exercise was more effective as compared to isotonic eccentric and concentric[16].

A retrospective study was performed on patients who had subacromial impingement syndrome to analyze the results of non-surgical and conservative management treatment. . Anti-inflammatory medication and a specific physical-therapy exercise plan of isotonic exercises for strengthening of the rotator cuff muscles were used for the management of these patients. Some of them had no improvement and went referred for arthroscopic subacromial decompression. Some patients who had a positive result had a recurrence of the symptoms during the follow-up period; and the symptoms were resolved with rest and post exercise program[17].

It is evident that exercise plan including heat therapy, passive to active assisted and active range of motion, muscle energy techniques, strengthening exercises and stretching exercises are generally believed to be the most beneficial in the management of patients with subacromial impingement syndrome. . It is pertinent to believe whether maximum clinical responses can be achieved with rotator cuff rehabilitation plan including Isometric training alongwith isotonic eccentric training and isometrics with isotonic concentric training[18].

Pathology of the rotator cuff and subacromial bursa is now believed to be the major reason behind pain and symptoms arising from the shoulder. Generally the diagnostic labels relate more to the underlying cause of the complaints treated with the physical therapy intervention. The exercise plan given to these patients was generalized for strengthening and mobility. The patients in group given strengthening plan were proved to be more effective as compared to the group with mobility exercises[19].

Six RCTs were performed from the previous systemic reviews. All of the studies executed a specific resistive exercise therapy in the form of different combinations like proprioceptive, rotator cuff, scapular and stretching. This review suggested no outstanding evidence in the favor of specific exercises over general exercises in rehabilitation programs for the effective treatment for reduction in pain, improving function, ROM and increasing strength in patients with SIS. Unclear description about the analysis of different exercises was seen as a result of this study. The study above showed significant differences among different exercise programs drawing isometrics as more effective treatment plan[20].

CONCLUSION

All of three exercise groups with isometrics, isotonic eccentric and isotonic concentric resulted in improved strength and reduction in pain and disability. Among all the groups, the patients in GROUP1 with isometrics training Group 2 & 3 with isotonic eccentric and isotonic concentric training respectively showed no significant difference in pain reduction.

Conflict of interest: Nil

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