

Research Article**The Effect of Isometric and Isotonic Exercise
on Shoulder Impingement Syndrome****¹Allah Ditta, ²Muhammad Sohaib Yousaf,****³Hassam aziz and ⁴Junaid Ijaz Gondal**¹Physiotherapist in Rising sun institute for special children defence Lahore, Pakistan.²Medical officer BHU 67 ML, Bhakkar, Pakistan. sohaibyousaf251@gmail.com³Medical officer, DHQ Bhakkar, Pakistan.hasaamaxix6789@gmail.com⁴HEC PhD Scholar, Physiotherapist Mayo Hospital Lahore. Pakistan.**ABSTRACT**

Objective: The purpose of this study was to see the comparison of effectiveness of isometric and isotonic exercises on shoulder impingement syndrome.

Methodology: This randomized controlled trail was conducted at OPD physiotherapy department, Mayo hospital, Lahore. In this study 40 patients were randomly selected in two groups. **Group A** patients were treated with isometric exercise. **Group B** patients were treated with isotonic exercise Performa was filled and Informed consent was taken from each patient. Questioner used for data collection was SPADI, and Hawkins Kennedy and Neer impingement test, were also used for assessment of shoulder impingement syndrome.

Results:The patients in group A showed marked improvement as compare to group. P-value (0.000) less than 0.05 is considered significant

Conclusion: It is concluded from the study that isometric exercise in shoulder impingement syndrome is a significant treatment outcome on SPADI SCALE. when both groups were compared it was seen that group a shows more significant results on shoulder pain and disability index.

Keywords: Isometric exercise, isotonic exercise, shoulder impingement syndrome.

INTRODUCTION:

Neer described the shoulder impingement syndrome SIS and is defined as compression of rotator cuff muscles, sub acromial, bursa ,and bicep tendon against the anterior under surface of acromion and curacao acromial ligament mostly during which we elevate the arm[1]. It is said that shoulder impingements are common cause of pain in shoulder and there are many theories that impingement is the primary cause in many rotator cuff disorders[2]. Since the main problems of clients with SIS are pain in joint, stiffness and functional activities restricted[3].These agents included are disorganized form and shape of acromion process. [4]abnormal kinematics pattern which occurs as a result of weakness of muscles of rotator cup [5] and action of scapular muscles.

Faulty posture[6]and excessive use secondary to continuously eccentric weight or repetitive action of arm above 90 degrees of activities [7]. Impingement syndrome occurs as a result of shoulder joint dysfunction and irregular stability and instability [8]. Muscle weakness static and dynamic instability, capsule and ligaments and labarum pathologies which occurs due to overhead and throwing activities of athletes leads to secondary shoulder impingement syndrome [8]. It can also occur due to increased translation of shoulder joint, impingement of bicep tendon and rotator cuff muscles, instability, loss of dynamic functions of shoulder, fatigue and overload [9].These effects progress to rotator muscles tear and sub acromial impingement syndrome. Internal

impingement which occurs in younger athlete's shoulder. It occurs when younger athlete shoulder is adjusted in 90/90 position means 90 abduction position and 90 external rotation which leads to infra spinatus muscle and supra spinatus muscle tendons to move in posterior direction [10]. When the movement of tendons occur posteriorly then the inferior surface of tendons is rubbed on the backward superior glenoid surface of the lip. It causes compression among humeral head and posterior surface of the glenoid rim [11]. This situation occurs most commonly in labourers and industrial workers and sports man.

LITERATURE REVIEW:

There are three bones which make the shoulder, the humerus, clavicle and the scapula (shoulder blade). The latter providing the glenoid fossa, acromion and coracoid processes. The bones are held together by associated muscles, ligaments and tendons. The joints are Glenohumeral joint, Sternoclavicular joints, Acromioclavicular joint. Main stabilizers are supraspinatus, infraspinatus, teres minor and subscapularis (SITS). The action of these muscles is to stabilize the capsule of shoulder joint in order to prevent dislocation of joint. The capsule of shoulder joint is loose, that is lax inferiorly, therefore is at risk to dislocate inferiorly. Long head of the biceps brachii muscle goes beneath the capsule to attach to the supraglenoid tubercle of the scapula. Rotator cuff muscles provide support to the shoulder [20]. In daily practice SIS is the most commonly reported diagnosis of the shoulder with incidence of 5 per 1000 patients per year. The incidence of shoulder complaints is 9.5 per 1000 patients [20]. It has been described that the prevalence of pain in shoulder is among 2.4% to 4.8% in the overall population [12].

95% of all primary mechanical impingement include rotator cuff tears. [13] Van and Govsa described that particularly exercise programmes are used in the initial stage of IS and surgical treatment should be done for those clients which do not give results to the conservative management for 3 to 6 months. [14] Ludewig & Borstad investigated the result of home based exercises of ten weeks duration. He obtained

good results in work related pain and disability in patients of SIS with evidence based study. Bangs & Deyle study results express that exercises plus manual therapy reveal good results in the short term in pain and functioning in the clients of SIS. Brox et al. studied 125 patients with SIS. There is moderate to strong evidence that physiotherapy training has positive effect in decrease pain and disability in patients of SIS. The first target of these exercises is to create high levels of supra spinatus, infraspinatus, subscapularis and teres minor and muscles of scapular region activation by the use of activity patterns and positions that does not cause especially sub acromial contact or unnecessary tension to the static muscles of stabilization of the shoulder joint., the isometric and isotonic exercise is applied for the muscles of supra spinatus, infra spinatus, sub scapulars and teres minor with the target of increasing strength and endurance in the muscles locally and for surrounding muscles of the shoulder joint [15].

joint power is described by the calculation of external moment arm and force created by the involving muscles among maximum and self. Control effort. These parameters change with the position of the joint and velocity of joint and reveal difficult association among joint geometry and physiology of muscle. The geometric association among path of muscle and the axis of joint describe the excursion of the muscle or group of muscles. (change in length on the range of motion of the joint) or mechanical benefits at the glenohumeral joint. In this way work performed by the muscles indicate length of the muscle fibres and velocity in which a muscle can shorten. In this way we depict the force producing capacity of muscle. Many studies have shown strength gain in muscles and joints of upper limb and lower limb and back. Shoulder joint is a major joint human body and it has weak power due to its shoulder girdle morphology. [16] The group of muscles surrounding the shoulder girdle work together to give the stabilization force to scapula and allow all possible range of movements in all directions with coordination of movements. It is important that agonist and antagonist of glenohumeral

joint strength is necessary for glenoid fossa proper alignment and decreasing the chances of shoulder joint instability and above head rotator cuff injuries [17]. It is concluded that isometric exercise give strength to the shoulder joint and increase rehabilitation and functional status and decrease reading on pain scale. A systemic review of glenohumeral joint and upper limb evaluation should be performed to exactly identify the cause or causes causing rotator cuff impingement or sub acromial impingement pathology [18]. Special tests are performed to check the status of shoulder joint these tests are multidirectional sulcus sign instability test, anterior and posterior humeral head translation test, drawer test, relaxation and relocation test [19]. Brighton hypermobility test we perform these tests to check the increase mobility and instability at the glen humeral joint of upper limb. Mobilisation of shoulder joint is also an important part of shoulder pathologies, mobilization is performed to check the hypomobility and alter stiffness and restriction and increase kinetics of shoulder joint of upper limb [20]. Neer test is performed by stabilizing the scapula and passive abduction of the arm is performed in the plane of scapula and arm must be internally rotated. When a local anaesthetic is introduced in sub acromial space of shoulder it is termed as Neers test. Decrease in pain is a positive test [21].

AIMS AND OBJECTIVES:

To determine the advantages of isometric with isotonic exercise on shoulder impingement syndrome SIS.

HYPOTHESIS

Null hypothesis

There is no difference between the treatment outcome of isometric and isotonic exercise.

Alternative Hypothesis

There is a difference between the treatment outcome of isometric and isotonic exercise.

MATERIAL & METHODS

Study Design It was an interventional study.

Settings: Data was collected from physiotherapy Department, Mayo hospital Lahore

Duration of Study: Study was completed in 6 months after the approval of synopsis.

Sampling Technique

A lottery method was used in sampling technique.

Target Population

All patients coming to physiotherapy department Mayo hospital Lahore during next 6 months, fulfilling the inclusion criteria will be taken as sample.

Sample Size

Patients who were presented with shoulder impingement syndrome given inclusion criteria Total 40 patients were taken.

Methodology:

In group-A patients were treated with isometric exercise. Group-B patients were treated with isotonic exercises. Procedure was done by the researcher and data was collected by the assessor by using a pre-designed Performa. Improvement regarding the outcomes of the treatment was measured by using SPADI scale.

Study Groups

Group-A: isometric exercise

Group-B: isotonic exercise

Sample Selection

Sample selection will be done on the following inclusion and exclusion criteria.

Inclusion criteria:

- Patients with shoulder impingement syndrome,
- Pain with overhead activities; Painful arc sign.
- Hawkins –Kennedy test, Neer impingement sign;
- All the clients older than 16 years of age.

Exclusion criteria:

Frozen shoulder, Systemic infection, Osteoarthritis, Shoulder fractures, Neoplasm, Systemic disease, Diabetes mellitus, Rheumatoid arthritis, Prolong use of steroid history, Metabolic disease, Neck fractures, Neck surgery and Shoulder surge.

DATA ANALYSIS

SPSS-21 was utilised for the analysis of the data and quantitative variables of mean, SD and frequency were described by Mean \pm SD. Appropriate graphical presentation was used as applicable either by frequency tables or by graphs. On SPADI for the treatment of outcomes AVONA was applied.

RESULTS

Study Groups			Mean	Number	Standard Deviation
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value	66.6	20	13.252
		Shoulder Pain and Disability Index post treatment value for pain	28.9	20	13.369
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value	55.8	20	12.53
		Shoulder Pain and Disability Index post treatment value for pain	39.7	20	12.62

Paired Samples Statistics

Study Groups			Standard Mean Error
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value	2.963
		Shoulder Pain and Disability Index post treatment value for pain	2.989
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value	2.802
		Shoulder Pain and Disability Index post treatment value for pain	2.822

Paired Samples Correlations

Study Groups			Number	Correlation	Sig.
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value & Shoulder Pain and Disability Index post treatment value for pain	20	0.551	0.002
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value & Shoulder Pain and Disability Index post treatment value for pain	20	0.733	0

Paired Samples Test

Study Groups			Paired Differences		
			Mean	Standard Deviation	Standard Error Mean
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value - Shoulder Pain and Disability Index post treatment value for pain	37.7	12.62	2.822
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value - Shoulder Pain and Disability Index post treatment value for pain	16.1	9.188	2.054

Paired Sample Test

Study Groups			Paired Differences		t
			95% Confidence Interval of the Difference		
			Lower	Upper	
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value - Shoulder Pain and Disability Index post treatment value for pain	31.793	43.607	13.359
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value - Shoulder Pain and Disability Index post treatment value for pain	11.8	20.4	7.837

Paired Sample Test

Study Groups			df	Sig. (2-tailed)
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value - Shoulder Pain and Disability Index post treatment value for pain	19	0
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment pain value - Shoulder Pain and Disability Index post treatment value for pain	19	0

Paired Sample Statistics

Study Groups			Mean	Number	Std. Deviation
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability	54.1	20	11.675
		Shoulder Pain and disability index post treatment value for Disability	44.05	20	12.416
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability	55.45	20	10.002
		Shoulder Pain and disability index post treatment value for Disability	35.45	20	6.573

Paired Sample Statistics

Study Groups			Std. Error Mean
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability	2.611
		Shoulder Pain and disability index post treatment value for Disability	2.776
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability	2.237
		Shoulder Pain and disability index post treatment value for Disability	1.47

Paired Sample Correlations

Study Groups			Number	Correlation	Sig.
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability & Shoulder Pain and disability index post treatment value for Disability	20	0.953	0
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability & Shoulder Pain and disability index post treatment value for Disability	20	0.401	0.08

Paired Sample Test

Study Groups			Paired Differences		
			Mean	Std. Deviation	Std. Error Mean
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	10.05	3.776	0.844
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	20	9.515	2.128

Paired Sample Test

Study Groups			Paired Differences		t
			95% Confidence Interval of the Difference		
			Lower	Upper	
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	8.283	11.817	11.902
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	15.547	24.453	9.401

Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	19	0
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	19	0

Paired Sample Test

Study Groups			do	Sig. (2-tailed)
Isometric Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	19	0
isotonic Exercises	Pair 1	Shoulder Pain and Disability index pre-treatment value of disability - Shoulder Pain and disability index post treatment value for Disability	19	0

Group Statistics

Study Groups		Number	Mean	Std. Deviation	Std. Error Mean
Shoulder Pain and Disability index pre-treatment pain value	Isometric Exercises	20	66.6	13.252	2.963
	isotonic Exercises	20	55.8	12.53	2.802
Shoulder Pain and Disability Index post treatment value for pain	Isometric Exercises	20	28.9	13.369	2.989
	isotonic Exercises	20	39.7	12.62	2.822

Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	T
Shoulder Pain and Disability index pre-treatment pain value	Equal variances assumed	0.321	0.574	2.648
	Equal variances not assumed			2.648
Shoulder Pain and Disability Index post treatment value for pain	Equal variances assumed	0.113	0.738	-2.627
	Equal variances not assumed			-2.627

Independent Sample Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Shoulder Pain and Disability index pre-treatment pain value	Equal variances assumed	38	0.012	10.8
	Equal variances not assumed	37.881	0.012	10.8
Shoulder Pain and Disability Index post treatment value for pain	Equal variances assumed	38	0.012	-10.8
	Equal variances not assumed	37.875	0.012	-10.8

Independent Sample Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Shoulder Pain and Disability index pre-treatment pain value	Equal variances assumed	4.078	2.544	19.056
	Equal variances not assumed	4.078	2.543	19.057
Shoulder Pain and Disability Index post treatment value for pain	Equal variances assumed	4.111	-19.12	-2.478
	Equal variances not assumed	4.111	-19.12	-2.477

Group Statistics

	Study Groups	N	Mean	Std. Deviation	Std. Error Mean
Shoulder Pain and Disability index pre-treatment value of disability	Isometric Exercises	20	54.1	11.675	2.611
	isotonic Exercises	20	55.45	10.002	2.237
Shoulder Pain and disability index post treatment value for Disability	Isometric Exercises	20	44.05	12.416	2.776
	isotonic Exercises	20	35.45	6.573	1.47

Independent Sample Tests

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	T
Shoulder Pain and Disability index pre-treatment value of disability	Equal variances assumed	1.38	0.247	-0.393
	Equal variances not assumed			-0.393
Shoulder Pain and Disability index pre-treatment value of disability	Equal variances assumed	9.841	0.003	2.738
	Equal variances not assumed			2.738

Independent Sample Test

		t-test for Equality of Means		
		do	Sig. (2-tailed)	Mean Difference
Shoulder Pain and Disability index pre-treatment value of disability	Equal variances assumed	38	0.697	-1.35
	Equal variances not assumed	37.126	0.697	-1.35
Shoulder Pain and disability index post treatment value for Disability	Equal variances assumed	38	0.009	8.6
	Equal variances not assumed	28.875	0.01	8.6

Independent Sample Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Shoulder Pain and Disability index pre-treatment value of disability	Equal variances assumed	3.438	-8.309	5.609
	Equal variances not assumed	3.438	-8.315	5.615
Shoulder Pain and disability index post treatment value for Disability	Equal variances assumed	3.141	2.241	14.959
	Equal variances not assumed	3.141	2.174	15.026

DISCUSSION

The purpose of this study was to compare the effect of isometric and isotonic exercise on shoulder impingement syndrome. In this study 40 forty patients were taken including both males and females. The subjects were allocated into two groups. Group-A was treated with isometric exercise and Group-B was treated with isotonic exercise. First of all, active and passive movements of shoulder were checked and then Hawkins-Kennedy and Neers impingement tests were applied and then Womack scale was applied. Observation were taken before and after the treatment session. The results showed that there is a significant difference between these two groups.

A randomized control trial on 40 subjects was conducted to find the effects of isometric and isotonic exercise on shoulder impingement syndrome [44].

Recent few research studies are striving for the measurement of the strength of shoulder girdle in direct way. According to Cool (2002), he observed isokinetic retraction and protraction shoulder strength girdle in the plane of scapular. Total work and unit-lateral maximum force was also reported in the research paper without the consideration of joint position role. Previously baseball players have been studied for their 4 directional shoulder movements and male isometric strength. But the strength was observed at one place at one time with the full description of measurement technique. Till now no report have been acknowledged for the conduct of research on the topic of shoulder girdle strength for female and male [44] for position and function. Previously research was aimed at the measurement of isometric maximum level in the course of retraction,

protraction, depression and elevation and assessment of interdependence of these forces in each direction with the position of joint. Following objectives contributed to the impingement syndrome for the shoulder improvement function such as Posture correction, Patient education, Strengthening, Re-education of muscle recruitment, improving proprioception, Adaptation, Stretching, Isotonic and Isometric exercise. Classification can also be done in progression about impingement syndrome including categories like chronic and degeneration inflammation (tendinosis), acute inflammation (bursitis /tendinitis) and patients observed movement pattern by the contribution of dysfunctional rupture. Protraction narrows the sub acromial space and it is widened through the scapula retraction. It may result in a dysfunctional movement. It is also observed that typically in posterior glen humeral joint capsule SIS is tighter that may also result into structures compression passing through subcarinal space. Individuals reporting shoulder issues have also been diagnosed with diminishing of humeral normal translation on the application of force by the clinician in exertion of posterior-lateral force [45].

Our research outcomes reflect that shoulder exercises and combined modalities are supportive in the muscle and function strength and it also decreases the pain of SIS patients.

Outcomes of previous research studies of RCT demonstrated effective PMEF intervention in three weeks for pain relief and function improvement in the SIS patients. Overall strength and effective can also be increased through exercises of the shoulder that also help in the improvement of strength of the muscle. These exercises help in the relief of pain and

also aid the strength of the muscles. Skin ulcers, diabetic neuropathic pain, knee oesthorises and fibromyalgia can best be healed through the electromagnetic tool treatment and isotonic and isometric exercises [47]. Exercises of cuff muscles, scapular stabilisation, strengthen of cuff muscles, stretching and pendulum aid in the muscle and motion pattern and relaxation. Our evaluation is based on the scales those are validated through literature, after validation they were implied on the impingements shoulder syndrome. Author supports and speaks for the exercise effectivity in the relief of pain and strength of the muscle [48]. This information is agreed upon rapidly as exercises lead to the pain relief and also improvement the overall function. It also contributes in the overall strength of the muscles.

SPADI is self-reported and self-specific questionnaire that helps in the scaling of disability and pain. Sub-scales for function and pain range from 0 – 100 for scoring purpose. Higher level of disability and pain is associated with higher scores as mentioned from 0 – 100. Teo sub-scales were used to find out the average for the scoring of SPADI. A minimum change in the clinical findings was considered as eleven points according to SPADI. Less risky and less expansive is exercise. In addition, infraspinatus and supraspinatus activity, subscapularis muscles and minor terespotently help in the reduction of acromial pressure [49].

CONCLUSION:

It is concluded from the study that isometric exercise in shoulder impingement syndrome is a significant treatment outcome on SPADI scale. When both groups were compared it was seen that group a shows more significant results on shoulder pain and disability index.

LIMITATIONS:

Study in the dimensions of its limitations was centred around single area of concern. No financial assistance was provided for the completion of the research. It was completed in limited duration of time. Because time span was limited that is why the size of the sample was also kept short.

RECOMMENDATIONS

It has to be a multicentred study. It should be funded to make it better. The time duration should be given more so that follow up can be taken. Sample size should be large so that more significance of results can be found out.

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