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Original Article

Physiotherapy Section

Assessment of the Effectiveness of Kinetic Chain Approach for Primary Adhesive Capsulitis of Shoulder- An Experimental Study

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ABSTRACT

Introduction: Idiopathic adhesive capsulitis is characterised by gradual onset of pain in shoulder and its limited mobility of motion due to a thickened capsule with an unknown cause. The peak incidence rate is between the age group of 40 and 60 years with less chances of occurrence in the younger group and individuals, who engage in physical labour are far less likely to experience it. In order to determine whether the kinetic chain approach is more effective, researchers tested it on individuals with adhesive capsulitis.

Aim: To assess effectiveness of the kinetic chain approach for treating primary adhesive capsulitis.

Materials and Methods: This pre and postexperimental study was conducted at the Department of Physiotherapy, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India, for a period of one year from January 2020 to December 2020. A total of 60 patients with primary adhesive capsulitis were included in the trial and were divided into group A and group B using a systematic random sampling process. Group A received traditional physiotherapy in addition to the Kinetic chain technique. In group B, regular physiotherapy was the only treatment provided to patients. The Range of Motion (ROM), Visual Analog Scale (VAS) and the Shoulder Pain and Disability Index (SPADI) were measured in both groups pretreatment, mid and post-treatment groups. Non parametric statistical techniques were used to analyse the data owing its originality.

Results: A total of 30 patients in each group (A and B) were provided with Kinetic chain approach (mean age=53.93 years) and conventional physiotherapy (mean age=55.40 years), respectively. For comparing data within the same group, Wilcoxon signed-ranks test was used for this. Mann Whitney U-test was used to compare the data between groups. The p-values for the VAS, SPADI, and ROM showed statistical significance at the <0.001 level. In terms of pain, functional impairment, and range of motion, with group A showing greater strides than group B.

Conclusion: The combination of kinetic chain technique and traditional physiotherapy was more beneficial than either group when used singularly to reduce discomfort, increase the range of motion, and enhance functional capacity in adhesive capsulitis patients.

Keywords: Disability index, Range of motion, Shoulder pain, Visual analogue scale

INTRODUCTION

Capsular limitation of passive lateral rotation and abduction describes adhesive capsulitis which is a common shoulder disorder with uncertain aetiology [1]. Common symptoms include pain, restricted motion {Range of Motion (ROM)} and weak muscles due to inactivity [2-4]. The condition is often seen in individual between 40 and 60 years of age mostly in the females, and is rare amongst 20 and 40 years. It is also rarely seen in individuals who engage in physical labour for a living [5]. Adhesive capsulitis is thought to affect 3-5% of the population and in 20% diabetic patients [6]. Adhesive capsulitis of the glenohumeral joint has been associated to several symptoms, including capsular extensibility, adherent axillary recess, loss of proprioception, and poor bicep tendon extensibility [7,8].

Several physical therapy methods exist for the intention of relieving symptoms of adhesive capsulitis. Mobilisations, short wave diathermy, stretches, exercises, heated packs, and soft tissue manipulations are common treatments for adhesive capsulitis [9]. Recently, healthcare professionals have paid a lot of attention to kinetic chain workouts for the treatment of shoulder joint disorders. The glenohumeral joint and its surrounding muscles, ligaments, and joint capsule are rich in receptors for kinaesthesia and joint position. Lesions to the shoulder capsule reduce receptor sensitivity, which can cause a shutdown in proprioceptive and neurological feedback loops in the shoulder joint [10].

Kinetic chain rehabilitation has been studied in patients with shoulder injuries in athletic population which causes improved proprioceptive feedback and activation of muscles of the entire kinetic chain leading to improvement in shoulder strength, ROM and function [11]. Swanik KA et al., stated that the improvement in proprioception with plyometrics occurs due to peripheral adaptation, owing to the stimulation of articular mechanoreceptors repeatedly [12]. Even though many studies have evaluated the effects of Closed Kinetic Chain and Open Kinetic Chain exercises in the management of different shoulder pathologies, however, there appears to be scarcity in documentation regarding effectiveness of rehabilitation of the entire kinetic chain, in treating adhesive capsulitis. Therefore, current study was designed to compare the effectiveness of Kinetic chain approach and conventional physical therapy in managing patients with adhesive capsulitis.

Overhead lifting, reaching, and throwing are all examples of complex upper-body movements that require the coordinated action of many muscle groups and the activation of multiple joints at multi-segmental levels is called as kinetic chain [11]. The kinetic chain efficiency is determined by, how much force can be produced in the core and how well it can be transmitted to the arm during these activities. The kinetic link model is a biomechanical framework for analysing motion in a variety of sports. It represents the body as a network of interconnected parts that move in concert from the proximal to the distal levels to produce an intended result [13,14].

When designing a rehabilitation plan to restore function, it is important to consider this proximal-to-distal sequencing [15].

Functional restoration through a rehabilitation strategy should consider this proximal-to-distal sequence, but conventionally rest, anti-inflammatory medication, and targeted strength training are most used [16,17]. Shoulder rehabilitation regimens often include scapular-stablising exercises, proprioceptive activities, and closed kinetic chain routines to help strengthen the injured shoulder. Nevertheless, these workout routines often focus only on the affected area, ignoring the importance of the trunk and limbs [18-21]. While clinicians understand that the lower extremities and trunk are important to shoulder function and overall conditioning, they typically wait until late in the rehabilitation process to include it [16,17]. But most shoulder exercises in kinetic chain rehabilitation begin with the legs and trunk involved. This facilitates the recovery of normal movement patterns and lessens the difficulty of learning new motions required for rehabilitation [15]. Other conventional therapies for adhesive capsulitis focuses on relieving symptoms locally while paying less attention to the role that the nervous system plays in causing the problem, nonetheless, with this kinetic chain method, the therapist focuses on the faulty kinetic chain, assessing and correcting the movement pattern as a whole, to restore neuromuscular control and normal recruitment of the shoulder musculature and thereby, reduces muscle tone and improve functional ability in adhesive capsulitis.

Primary adhesive capsulitis is a leading temporary work disability cause, and is linked to substantial healthcare costs, less productivity at work, and lowered quality of life for affected individuals. The authors were unable to locate any studies that directly compared the outcomes of patients treated with the kinetic chain technique with conventional physiotherapy to those treated with conventional physiotherapy alone for adhesive capsulitis. The present research aims to propose an exercise plan for people with shoulder adhesive capsulitis that would facilitate to maximise kinetic chain use and output by improving scapular control, building core muscle endurance, and strengthening the lower body, enhance scapular control and boost muscular endurance. The purpose of the current investigation was to assess effectiveness of the kinetic chain approach for treating primary adhesive capsulitis.

MATERIALS AND METHODS

This pre and postexperimental study was conducted at the Department of Physiotherapy, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India, for a period of one year from January 2020 to December 2020. Those, who satisfied the inclusion and exclusion criteria and have been diagnosed with primary adhesive capsulitis by an Orthopaedician were eligible for the study that was approved by the Institutional Ethical Committee.

Inclusion criteria: Participants included shoulder pain and stiffness lasting more than three months in people aged 40 to 65 years, with a limitation of passive range of motion of more than 30° in atleast two of the three motions evaluated (flexion, abduction, external rotation) compared to normal side.

Exclusion criteria: Systemic illnesses like rheumatoid arthritis, diabetes mellitus, thyroid dysfunction, and a torn rotator cuff, as well as, shoulder ligament problems, neurological conditions, previous surgery, pregnancy, were excluded from the study.

Sample size calculation: It was calculated using N master software with power of 80% and alpha error 5%, SPADI values=32.69 with SD=14.82, the authors achieved the sample size as 28 per group. Since the present study is a follow-up study, attrition of participants were predicted and the effective sample size has been approximated for each group as 30. Statistical significance is considered to be 0.05 level (p-value <0.05).

Single mean test, calculated as:

$$n=\frac{Z^2\times SD^2}{L^2}$$

where, Z=95% Significance Level

L=Precision level

Systematic random sampling method was used.

Study Procedure

Using a systematic random sampling method, the study's participants were allotted in two groups with 30 participants in each group. Participants who matched the study requirements were included and randomly assigned to group A or group B. When patients were given information about the procedure, they were asked for their written consent. Before starting treatment, the patient was assessed with a Visual Analogue Scale (VAS), a shoulder pain and disability index, and goniometry. Group A had three physiotherapy sessions each week for a total of six weeks; these sessions included both conventional physiotherapy and the kinetic chain method. Group B received three sessions per week of conventional physiotherapy for a whole of six weeks. Both groups of patients were assessed twice each treatment period, first after week 3 and again after week 6. Shoulder range of motion, the SPADI, and the VAS for pain all were compared. Patients in group A was given kinetic chain approach along with conventional physiotherapy and in group B only conventional physiotherapy was given.

Exercises

1. Forward flexion of the shoulder accompanied by an anterior step-up on the same side [Table/Fig-1]: Shoulder flexion with ipsilateral step-up is an exercise to engage the hip extensors which allows the patient to flex the shoulder more easily. Extension of the trunk facilitates scapular retraction, which also helps the patient to flex the arm up more easily as rotator cuff muscles gets a more stable base to contract. Thus, the cue to "grow tall" promotes thoracic extension, which in turn makes it easier to raise one's arms. So, forward flexion of the shoulder requires scapula retraction and to get full scapula retraction, ipsilateral hip extension and trunk extension and so on, is required [13,22-24]. In kinetic chain pattern for shoulder flexion, the ipsilateral hip extensors are activated before deltoid recruitment [23]. Hence, in this exercise, the activation of the hip extensor and thoracic extension is more important to lift the arm. So when there is synchronised recruitment of shoulder stabilisers and hip extensors, it helps to increase shoulder flexion ROM. These exercises were done after conventional physiotherapy treatment, which includes capsular stretching exercises along with shoulder anteroposterior, posterioanterior and inferior glides. In the initial 3-4 sessions doing this exercise was difficult, but later it becomes easy as the range improves [13,15,23,24].

2. Shoulder-dump exercises [Table/Fig-2]: The patient stands with their left foot forward, flexes their left hip, rotates their torso, and brings their right arm down to the level of their left knee [Table/Fig-2a]. Then, he or she rotates and extend the trunk to the right while shifting weight to the back foot. This change in weight shift and extension of the trunk is accompanied by retraction of right scapula and external rotation of right arm [Table/Fig-2b]. By increasing mobility in the hips and trunk, shoulder function improves. According to PNF, proximal to distal muscle activation in rotational pattern can improve shoulder Internal and external rotations [25]. In this exercise the patient must consciously concentrate on retraction of scapula, and do the exercise in the available ROM, and as session progresses, after 3 to 4 sessions as ROM improves and the patient can do this exercise better.

3. Modified shoulder-dump exercise with arm sling [Table/Fig-3]: Patient begins in a left foot-forward stance with [Table/Fig-3a] shows the starting position, with the trunk flexed and rotated to

[Table/Fig-1]: Exercise 1 Shoulder flexion with ipsilateral step-up.

[Table/Fig-2]: a,b) Shoulder-dump exercises.

the left and the right arm held close to the body in a sling, with the scapulae protracted passively due to gravity. [Table/Fig-3b] shows the ending position, with the scapulae retracted actively along with spinal extension and ipsilateral rotation. Stability of the shoulder blades and scapular retraction may be improved with this exercise. By eliminating the arm motion, this scapular exercise becomes a trunk-facilitated shoulder-dump [15]. This helps to facilitate scapular retraction with trunk motion. Two sets of 10 repetitions were done twice everyday.

4. Sternal lifts [Table/Fig-4]: By performing a sternal lift, the shoulders are retracted and the chest is extended in a symmetrical motion. [Table/Fig-4a] shows the patient slouching forward to begin, and [Table/Fig-4b] shows the patient in a sternal lift posture [Table/Fig-4b]. It should feel like the patient is pushing up and out on the sternum, but lumbar hyperextension should be avoided. Two sets of 10 repetitions were done twice everyday.

[Table/Fig-3]: a,b) Modified shoulder-dump exercise with arm sling.

[Table/Fig-4]: a,b) Sternal lifts exercises.

5.Tubing fencing exercise: Scapular retraction is targeted in the frontal plane by tubing fencing. In a lateral lunge affected arm, the patient reaches for the tube [Table/Fig-5a]. Scapular depression is promoted when the tube is either horizontal or inclined downward. After getting into a reaching and lunging stance, the patient should next push off the involved leg and drag the involved arm into adduction [15]. In the final posture, the weight of the body is resting on the uninvolved leg, the affected arm's elbow is pressed up against the ipsilateral hip, while the affected shoulder is externally rotated to the possible extend [Table/Fig-5b]. A lunge and parry in fencing is a good analogy for this action. The patient must concentrate and emphasis, extension of thoracic spine during the concentric portion of the exercise and bring shoulder blade medially without shrugging. Two sets of 10 repetitions were done twice everyday.

[Table/Fig-5]: a,b) Tubing fencing exercise.

6. Athletic stance during ball stabilisation exercise [Table/Fig-6]: The patient should adopt an "athletic" stance, standing erect with feet hip-width apart, body weight distributed evenly, knees and hips bent slightly, back straight, and head held high. To promote proximal-to-distal activation patterns, an athlete may load the hips and trunk during these stationary workouts [15]. These exercises may be started from the proximal leg and trunk, with the hand sliding over the ball in a variety of directions (including flexion, abduction, diagonal, and curvilinear) [Table/Fig-6]. Two sets of 10 repetitions were done twice everyday.

[Table/Fig-6]: Exercise 6: Athletic stance during ball stabilisation exercise.

7. Axially loaded wall-slide exercise [Table/Fig-7]: By reducing the intrinsic weight of the arm, axially loaded workouts may unload the weak muscles in the shoulder girdle and allow the kinetic chain to work more efficiently. The result is lessened compensating patterns and a larger pain-free active range of motion in the shoulder. The movement may be activated from the legs and trunk's proximal regions, and then sliding hand can proceed in any of four directions: flexion, abduction, diagonal, or curvilinear. Two sets of 10 repetitions were done twice everyday [15].

Conventional physiotherapy: Traditional physiotherapy includes activities like 10 mins of hot packs, 10 mins of ultrasound, Codman's pendular exercise, capsular stretching, self-stretching exercises, wand exercises and shoulder anteroposterior, posterioanterior and inferior glides, 30 repetitions and three sets, in grade III and IV.

RESULTS

A total of 30 patients in each group (A and B) were provided with Kinetic chain approach and conventional physiotherapy, respectively with p-value of 0.335 as shown in [Table/Fig-8]. There were no significant differences between groups of patients in the trial at baseline demographics between the two groups. [Table/Fig-9] depicts the details about the demographic data analysis of both the study groups with p-values of 0.607, 0.452 and 0.6 in the height, weight and BMI categories, respectively.

[Table/Fig-7]: Exercise 7: Axially loaded wall-slide exercise.

Groups	N	Mean	Std. Deviation	p-value
Group A	30	53.93	6.097	0.335
Group B	30	55.40	5.568	

[Table/Fig-8]: Mean and standard deviation of age in the study samples.
Group A: Kinetic chain group; Group B: Conventional group

		N	Mean	Std. Deviation	p-value
Height (cms)	Group A	30	163.60	8.807	0.607
	Group B	30	164.70	7.621	
Weight (in kg)	Group A	30	67.40	8.641	0.452
	Group B	30	68.93	6.958	
BMI (kg/m^2)	Group A	30	25.1342	2.01524	0.600
	Group B	30	25.4039	1.94152	

[Table/Fig-9]: Demographic data analysis of both the groups.
Group A: Kinetic chain group; Group B: Conventional group

[Table/Fig-10] shows the gender wise distribution of both the groups with p-value of 0.793. The research began with a pretreatment assessment, and further assessments were performed every three weeks: a mid-test at the end of the third week and a post-test at the end of the sixth week. Comparison of VAS scale between group A and group B is depicted in [Table/Fig-11], with p-values of 0.278, 0.014, <0.001 for pretest, mid-test and post-test, respectively. Although in comparing group A and group B, there was no discernible statistically significant difference at pretest but, there was a difference ($p<0.05$) on the mid-test and post-test. It was thus concluded that the pain-relieving effects of the kinetic chain method to the treatment of adhesive capsulitis much outweigh those of traditional physiotherapy. The authors, thus draw the conclusion that the pain-relieving effects, as per pain score in SPADI, of the kinetic chain method, to the treatment of adhesive capsulitis much outweigh those of traditional physiotherapy and that the kinetic chain method is

superior to traditional physiotherapy in the management of adhesive capsulitis as per disability score in SPADI [Table/Fig-12a,b].

			Group A	Group B	Total	p-value
Gender	Male	Count	13	12	25	0.793
		% within group	43.3%	40.0%	41.7%	
	Female	Count	17	18	35	
		% within group	56.7%	60.0%	58.3%	
Total		Count	30	30	60	
		% within group	100.0%	100.0%	100.0%	

[Table/Fig-10]: Gender-wise distribution of both the groups.

VAS	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	6.33	0.994	6.57	0.568	0.278
Mid-test	4.27	0.785	4.8	0.714	0.014
Post-test	2.13	0.730	3.6	0.675	<0.001

[Table/Fig-11]: Comparison of VAS scale between Group A and Group B.

Pain score	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	65.80	3.418	64.93	2.333	0.499
Mid-test	47.87	3.060	57.60	1.522	<0.001
Post-test	42.20	3.764	48.27	2.016	<0.001

[Table/Fig-12a]: Comparision of pain score in SPADI between group A and group B.
p-value <0.05 considered significant

Disability score	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	68.833	4.834	66.833	2.219	0.328
Mid-test	55.583	1.962	60.667	1.382	<0.001
Post-test	44.875	3.479	54.792	1.676	<0.001

[Table/Fig-12b]: Comparision of disability score in SPADI between group A and group B.
p-value <0.05 considered significant

[Table/Fig-13] concludes that the kinetic chain method is superior to traditional physiotherapy in the management of adhesive capsulitis in terms of reducing functional Impairment. [Table/Fig-14] shows the comparison of ROM- Flexion of shoulder, between Groups A and B with p-values of 0.970 in the pretest and p-value <0.001 in mid and post-test. This depicted that the kinetic chain method is more successful than traditional physiotherapy in restoring shoulder flexion range of motion in patients with adhesive capsulitis. [Table/Fig-15] shows the comparison of ROM- Abduction of shoulder, between Groups A and B with p-value of 0.23 in pretest and 0.001 in mid and post-test, thus illustrating that the kinetic chain method is more successful than traditional physiotherapy in restoring Shoulder Abduction ROM in patients with adhesive capsulitis.

SPADI	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	67.666667	3.3407046	66.102564	0.8312734	0.198
Mid-test	52.615385	1.4926877	59.487179	0.8410343	<0.001
Post-test	43.846154	2.0896066	52.282051	0.8684859	<0.001

[Table/Fig-13]: Comparison of SPADI Score between group A and group B.
p-value <0.05 considered significant

ROM- Flexion of shoulder	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	101.8	13.697	101.9	13.687	0.970
Mid-test	127.5	10.003	117.33	7.102	<0.001
Post-test	163.7	4.348	137.9	3.537	<0.001

[Table/Fig-14]: Comparison of ROM- Flexion of shoulder, between groups A and B.
p-value <0.05 considered significant

ROM- Abduction of shoulder	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	86.37	5.893	84.77	5.673	0.23
Mid-test	98.9	5.604	94.83	5.925	0.001
Post-test	128.2	8.892	108.03	4.81	<0.001

[Table/Fig-15]: Comparison of ROM- abduction of shoulder, between groups A and B.
p-value <0.05 considered significant

[Table/Fig-16] shows the comparison of ROM- Internal rotation of shoulder, between groups A and B with p-values of 0.694 in the pretest and p-value <0.001 in mid and post-test, thus concluding that the kinetic chain method was more successful than traditional physiotherapy in restoring internal rotation of the shoulder after treatment for adhesive capsulitis. [Table/Fig-17] shows the comparison of ROM- External rotation of shoulder, between groups A and B with p-value of 0.923 in the pretest and p-value <0.001 in mid and Post-test, thus showing that the kinetic chain method is more successful than traditional physiotherapy in restoring shoulder external adhesive capsulitis and rotational mobility.

ROM- Intenal rotation of shoulder	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	29.1	4.205	28.63	4.038	0.694
Mid-test	37.47	4.208	33.27	3.648	<0.001
Post-test	50.1	4.294	42.63	3.2	<0.001

[Table/Fig-16]: Comparison of ROM- Internal rotation of shoulder, between groups A and B.
p-value <0.05 considered significant

ROM -External rotation of shoulder	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Pretest	17.47	4.659	17.5	4.74	0.923
Mid-test	34.9	4.205	24.43	4.485	<0.001
Post-test	59.93	5.413	42.23	4.725	<0.001

[Table/Fig-17]: Comparison of ROM- External rotation of shoulder, between groups A and B.
p-value <0.05 considered significant

DISCUSSION

Those who suffer from Adhesive Capsulitis (AC) have discomfort in their active and passive Glenohumeral (GH) joint motion at the onset of the condition, followed by a gradual restriction of their range of motion that may or may not improve spontaneously. Physiotherapy has shown promise as a treatment for adhesive capsulitis. It helps patients go back to regular life. With mobilisation and exercises, physiotherapy may help increase joint mobility and range of motion. The primary goal of the present research was to evaluate the efficacy of the kinetic chain method in the management of adhesive capsulitis. Subjects were divided at random into two groups, and each received three therapy sessions weekly for a total of six weeks. Unfortunately, the effectiveness of the kinetic chain method in adhesive capsulitis has not yet been adequately investigated in published research. Adhesive capsulitis of the shoulder in the Indian population has not yet been analysed, however few research has investigated the efficacy of kinetic chain method in shoulder injuries. Pain, range of motion, and functional impairment all improved more for patients with adhesive capsulitis after treatment with kinetic chain method as opposed to conventional physiotherapy. According to the author's understanding, this is one of the first studies to assess the performance of the kinetic chain method for treating adhesive capsulitis. A combination of closed kinetic chain workouts and proximal to distal muscle activation pattern using Proprioceptive Neuromuscular Facilitation (PNF) analysed to increase shoulder musculature's strength and range of motion [15].

The theory of kinetic chain approach emphasises on leg and trunk muscle activation which enhances both strength and range

of motion in shoulder pathologies. In the present research also, functional activities, discomfort, and range of motion all improved considerably in the kinetic chain exercise group compared to the traditional exercise group in patients with adhesive capsulitis. The reason for this improvement may be due to the fact that kinetic chain workouts that prioritised proximal muscle activation before distal movement aided in the recovery of patients with shoulder and scapula injuries by activating the muscles of legs and trunk helps to propel the shoulder blades [22,23,26].

The benefits of PNF were compared to those of traditional physical therapy treatment for frozen shoulder in a study by Prasanna K et al., [27] Adhesive capsulitis might be effectively treated using scapular PNF procedures, together with shoulder joint stretches and mobilisation [27]. Similar to the current research, the individuals in this investigation received, traditional physiotherapy along with PNF exercises which is similar to kinetic chain exercises. Thus, proprioceptive exercises such as PNF or kinetic chain exercises were shown to decrease discomfort, increase abduction and external rotation and enhance functional capacities, according to both investigations.

The muscles, ligaments, and joint capsule surrounding the glenohumeral joint have an abundance of mechanoreceptors that are sensitive to kinesthesia and joint position. Damage to the capsule of the shoulder may reduce the sensitivity of the receptors there, resulting in a loss of proprioceptive and neurological feedback responses [10]. As a result, the motor pattern of the body or entire kinetic chain is disrupted in people with adhesive capsulitis, and locally, mechanoreceptor activation in shoulder joint is reduced. In this research functional activities and mobility are enhanced in kinetic chain exercise group compared to the traditional exercise group in adhesive capsulitis. By activating the neuromuscular system, kinetic chain exercises make use of these innate motor programming which restores natural movement patterns which helps in rehabilitation within the context of normal function for the neuromuscular system [15]. Locally, the joint surfaces are compressed during Closed Kinetic Chain (CKC) training, which is said to be the most effective way to excite the mechanoreceptors responsible for proprioception and neuromuscular control [28].

Functional activities, flexibility, range of motion, had improved with activation of the trunk and hip musculature, in kinetic chain group in adhesive capsulitis in the current research. The possible explanations for this improvement include the synergistic activation of muscles in patterns extending from the hip and trunk to the scapula and arm, which allows for maximal activation of the muscles attached to the scapula [29]. When the scapula is retracted, it provides a stable base for the insertion of the rotator cuff muscles, allowing for the correct compression of the humeral head in the glenoid fossa [30]. Thus, scapular stabilisation exercises that also incorporate the activation of the muscles of the lower extremities and trunk are needed in the rehabilitation of the shoulder pathologies.

Functional activities, pain, and ROM all improved considerably in experimental group after performing closed kinetic chain workouts on an unstable surface, compared to the control group for people with adhesive capsulitis. One possible explanation for this improvement is that CKC exercises become more complex when exercises are performed on an unstable surface, such as by pressing the hand over a medicine ball [31]. It causes increased muscular co-activation due to the increased effort placed on the neuromuscular system as a result of the instability caused by the supporting the hand on an unstable surface [19]. There was an increase in strength, which was another benefit associated with unstable CKC training. Improvements in the strength gains from CKC exercises are due to the coordinated activation of agonist, antagonist, synergist, and stabilising muscles [32,33].

Adhesive capsulitis can be treated with a variety of physical therapy modalities, including electrotherapy, manual therapy, and exercise therapy, all of which have been extensively described in the medical literature. Various physical therapy strategies have been demonstrated to be effective in the treatment of adhesive capsulitis in several studies [34-38]. In accordance with previous research, the current study has also found that traditional physical therapy methods may be helpful to treat individuals with adhesive capsulitis. Reduced discomfort and increased Range of Motion (ROM) are two of physical therapy's most noticeable effects, which lead to enhanced functional capacity. Joint mobilisation and therapeutic exercises as part of physical therapy treatment and are highly recommended for people with adhesive capsulitis with the goals of improving mobility, alleviating discomfort, and boost their ability to perform their daily activities, as reported by a systematic review, conducted by Jain TK and Sharma NK [37-40].

The present study evaluated the effectiveness of the kinetic chain technique with conventional physiotherapy in treating adhesive capsulitis by measuring the patients' reported levels relief, increased mobility, and enhanced function. Limitations in comfort, mobility, and functional impairment all decreased in both groups, although group A showed much greater improvement than group B.

CONCLUSION(S)

The present research found that a kinetic chain approach, as opposed to traditional physiotherapy for adhesive capsulitis treatment, resulted in a significant difference in pain-free range of motion and improved functional outcomes. The outcome measures include VAS scale that can be used to assess the pain. ROM can be assessed using goniometer and shoulder disability can be assessed using SPADI.

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