

EFFICACY OF KINESOTAPING AS AN ADJUNCT TO POSITIONAL STRETCHING OF CORACOHUMERAL LIGAMENTS IN PATIENTS WITH PRIMARY ADHESIVE CAPSULITIS.

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ABSTRACT

Adhesive capsulitis is a condition of uncertain aetiology characterized by a progressive loss of both active and passive range of motion of shoulder. Approximately 2-3 % of adults aged between 40-65 years develop adhesive capsulitis with greater occurrence in women than man. The Etiological factors contributing for primary adhesive capsulitis is iopathic in nature. However the pathological changes in primary adhesive capsulitis has been proposed by many researchers, According to Desai the primary area of pathology in adhesive capsulitis is Coracohumeral ligament (CHL) and rotator interval. Various physiotherapy intervention has being applied to adhesive capsulitis of shoulder not considering importance of primary pathology of coracohumeral ligament and scapula dyskinesis effect on adhesive capsulitis. So the study is proposed to find the efficacy of kineso tape adjunct to positional stretching of CHL against only CHL positional stretching in adhesive capsulitis. Methodology; Subjects fulfilling the inclusion criteria were randomly divided into two group's Group A and Group B, twenty subjects in each group. Each subject underwent assessment to predict the base line values of parameters like VAS, and ROM and DASH SCORE. Level of inferior angle of scapula with respect to T₇ level noted in neutral standing position. Group A underwent treatment with positional stretching for CHL alone while Group B subjects were treated with kinesio tape in addition to positional stretching of CHL. The subjects received 3 sessions of treatment per week for 4 weeks. Result shown highly significant improvement in all parameter pre and post of each group. Between group CHL positional stretching with Kineso tape shown significant improvement in all parameter than only CHL positional stretching. Conclusion; kinesotape with CHL positional stretching is effective in overcome pain and disability in patient suffering from adhesive capsulitis.

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INTRODUCTION

Adhesive capsulitis is a condition of uncertain aetiology characterized by a progressive loss of both active and passive range of motion of shoulder¹. Approximately 2-3 % of adults aged between 40-65 years develop adhesive capsulitis with greater occurrence in women and usually non dominant arm is involved². The primary adhesive capsulitis is Etiologic factors contributing is idiopathic in nature. However the pathological changes in primary adhesive capsulitis has been proposed by many researchers as follows According to DePalma stated that pathological changes in adhesive capsulitis occur primarily in normally flexible fibrous capsule, which becomes progressively non elastic and shrunken. Initially the capsule becomes contracted, with loss of inferior capsular fold. Later stages there will be increased capsular fibrosis and resulting in loss of elasticity of tissues. J. S.Neviaser³

stated that the absence of synovial fluid in the glenohumeral joint , tightly contracted and thickened joint capsule, cellular changes of chronic inflammation with fibrotic and perivascular infiltration in the synovial layer of capsule with reparative inflammatory process are the pathological process of adhesive capsulitis. According to Desai the primary area of pathology in adhesive capsulitis is Coracohumeral ligament (CHL) and rotator interval⁹ Coracohumeral ligament plays a major role in counteracting the downward pull of gravitational force on arm and in maintaining glenohumeral relation. They proposed that (mengiardi, Omari et al) in adhesive capsulitis there will be fibroblastic proliferation and thickening of coracohumeral ligament and the capsule at the rotator cuff interval there will be complete obliteration of the fat triangle under the coracoid process are the most

characteristic pathological changes found in adhesive capsulitis instead of axillary recess through MRI^{11,12}. Although primary area of pathological process of adhesive capsulitis is in coracohumeral ligament, Still physiotherapy intervention on CHL has not applied in adhesive capsulitis. Jose Orlando Ruiz did a case study on effect of positional stretching of Coracohumeral ligament in adhesive capsulitis and found improvement in range of motion and ADLs following intervention¹⁷. This technique is found to be effective in gaining the plasticity of collagen than that of Mobilization and other passive technique. In adhesive capsulitis there will be change in kinematic aspect of scapula. Studies identified significant increases in scapular upward rotation supporting the premise that the increased scapular upward rotation was compensatory to maximize overall range of motion overhead in the presence of reduced mobility at the glenohumeral joint¹⁹⁻²¹. Potential contributing mechanisms to abnormal scapular kinematics include pain, soft tissue tightness, muscle activation or strength imbalances, muscle fatigue, and thoracic posture²³. So maintaining the normal kinematic, the scapular movement are important to get normal functions in Adhesive capsulitis. One of the techniques popularly used to correct the scapular kinematics is taping. Recently developed and popularly used tape is kinesio tape. The K-Tape follows the path of a muscle or nerve. It can be freely applied to any part of the body, and do not limit the patient's freedom of movement, this is the advantage of kinesio tape then the classic tape. So by considering primary pathology CHL in adhesive capsulitis and importance of positional stretching and K tape, study was conducted to predict efficacy of kinesotaping as an adjunct to positional stretching of coracohumeral ligament (CHL) in patients with primary adhesive capsulitis.

The objective of the study is to To evaluate the effectiveness of positional stretching of CHL alone against CHL positional stretching and kinesi taping effect on Range of motion, disabilities of shoulder arm and hand (DASH), visual analog scale (VAS) in primary adhesive capsulitis.

EXPERIMENTAL WORK

Methodology; An ethical clearance for the study was obtained from the ethical committee of JSS College of physiotherapy. Subjects fulfilling the inclusion criteria made to sign the consent form prior to intervention and explained regarding the study. Subjects were randomly divided into two group's Group A and Group B, twenty subjects in each group. Each subject underwent assessment to predict the base line values of parameters like VAS, and ROM and DASH SCORE. Level of inferior angle of scapula with respect to T₇ level noted in neutral standing position. Group A underwent treatment with positional stretching for CHL alone while Group B subjects were treated with kinesio tape in addition to positional stretching of CHL. The subjects received 3 sessions of treatment per week for 4 weeks. Each subject underwent a warm up session of 8 min for upper body prior to the intervention. Warm up exercise included: Stretching of shoulder muscles and Active movements for shoulder.

Procedure: Positional Stretching Technique Coracohumeral Ligament; The patient is made to lie on unaffected side and a pillow is placed below the head. The affected arm is rested on the side. The patient is instructed to grab a 20- 22 inch dowel with the affected arm by the

therapist, always keeping the left forearm supinated in order to encourage shoulder external rotation. One end of the dowel is placed on the table, the therapist instructed the patient to hyperextend the shoulder approximately 10° and then adduct the arm as close to the body as tolerated by sliding the hand down the dowel. The patient was instructed to concentrate on keeping the proximal humerus adducted and extended, and the forearm supinated and to avoid compensatory trunk rotation. The dosage of CHL stretching is based on the principal of TOTAL END RANGE TIME (TERT) or the total amount of time the joint is held near end range position. The dose formula is based on intensity, frequency and duration of tensile stress applied to tissues that are restricting the motion. Intensity is limited to the patient's pain tolerance. Initially the duration of stretch is applied for 5 min and progressed to 15 min by the end of second week³².



Positional Stretching of CHL (PSCHL)

Procedure for kinesio tape;

Application of kinesio-tape; for supraspinatus muscle; The patient is made to sit on the chair and neck is kept in lateral flexed to opposite side. Affected arm is adducted and internally rotated. A kinesio Y strip of 2 inches is applied from below the greater tuberosity of humerus without tension. A light tension or paper of tension is been applied to the k tape Y strip. The superior tail is applied superior to the spinous process of the scapula between the upper end and middle trapezius muscles and ends at the supraspinous fossa on the superior medial border of scapula. The inferior tail is applied along the spinous process of scapula, the distal 1-2 inches without tension. For deltoid muscle; a kinesio Y strip is applied with paper-off tension from insertion to origin. The first tail of y strip is applied to the anterior Deltoid with the arm in horizontal abduction and external rotation, along the outer border of the anterior deltoid to acromioclavicular joint. The second tail is applied to posterior deltoid with the arm in horizontal adduction and internal rotation, along the outer border of posterior deltoid to the acromioclavicular joint. Last 2 inches been applied without tension. For assisting external rotation by releasing tension of internal rotation; kinesio Y strip is applied to the base of posteriolateral border of humerus.

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Very light to light tension (15-25%) is applied to the tails of the kinesio Y strip. The superior tail is applied inferior to clavicle and end of the sternoclavicular joint and the inferior tail is applied following the lower fibers of the pectoralis major to the costochondral joint⁴².



Home exercise program was given for both groups which includes; Forward flexion; (3x10) repetitions. Seated external rotation with the arm at 70 degree of abduction resting on a table. ; (3x10) repetitions. All the parameters like VAS, DASH, and shoulder ROM were taken at the end of 4 weeks of intervention. Level of inferior angle of scapula with respect to T7 level noted in neutral standing position after 4 weeks of intervention.

Result; The Statistical software SPSS for windows (version 18) were used for the analysis of the data, Microsoft word and Excel have been used to generate graphs, tables etc. Descriptive statistical analysis has been carried out in the present study. Results were analyzed repeatedly pre and post-test values following intervention using the repeated measure ANOVA test taking level of significance $p < 0.05$.

Discussion; The result of the study has shown highly significant improvement with $p < 0.000$ in relation with range of motion, pain reduction and improvement in disability aspect of shoulder joint in both groups (i.e. positional stretching of CHL with KT and only positional stretching of CHL group) following 4 weeks of intervention. Even though statistically highly significant improvement is shown in both the groups in all the parameters following the intervention, the percentage of improvement in flexion, abduction and external rotation and reduction in pain and disability is more in PSCHL with KT group in comparison with PSCHL only group.

According to many researchers (Depalma, Lundburg, Ozaki et al) stated that primary pathophysiology of adhesive capsulitis is by reducing the flexibility of capsule leading to fibrous capsule. They have also stated that the changes happens due to increase in hexosamine,

glycosaminoglycans, heparin sulfate, chondroitin-6 sulfate and dermatan sulphate and reduction in hyaluronic acid^{4,5,6}. However (Mengiardi and Omari et al) from there research stated that primary pathophysiology behind adhesive capsulitis is due to fibroblastic proliferation and thickening of coracohumeral ligament, capsule at the rotator cuff interval, as well as complete obliteration of the fat triangle under the coracoid process are the most characteristic pathological changes found through MRI in adhesive capsulitis instead of axillary recess^{11,12}. This was supported by Desai et al on his experience of surgical procedures in patient with adhesive capsulitis found CHL were felt like thick cord, was tightened further limiting ER movement. He found significant improvement in ER as soon as CHL was stretched. So by considering the study on CHL tightness done by Desai and Jose Orlando Ruiz³². We proposed to apply intervention on CHL specifically which is not consider in earlier studies⁹.

Several studies have shown significant improvement in range of motion in frozen shoulder by applying mobilization techniques, but the improvement in there range lasts only for few hours. This is because the time duration of force application was short period and was not effective to gain plastic changes in the viscoelastic components of the tissue because lack of hysteresis and creep formation in connective tissue¹⁶. Desai and Ellen Becker stated that joint mobilization are not effective in improving range of joint with arthro fibrosis as the interventions are not effective to realign the collagens in connective tissues⁴⁴. So considering these above studies positional stretching technique of CHL intervention was applied in such a way that CHL was kept in stretched position at end range for longer duration. The dosage applied in this technique is total end range time (TERT) dosage where the stretch was held for 5minutes initially progressed gradually to 15minutes at the end of 4weeks. This application was introduced by Jose Orlando Ruiz, where in his study shown highly significant improvement in range following the intervention, also shown greater intra-tester reliability than inter-tester reliability¹⁷. According to Fe-land et al; long duration stretch is a force applied more than 30seconds for 1repetition⁴⁵. According to Hepburn.G. Short duration stretching of high intensity favours the elastic response, whereas prolonged duration of stretching of low intensity favours plastic response⁴⁶. There is direct correlation between duration of stretch and proportion plastic changes. These above studies correlate with the result of the study where ROM of shoulder showed significant improvement after applying positional stretching of CHL on the basis of TERT dosage for 4weeks. This technique might have assisted in greater plastic deformation in connective tissues as well as realigning the collagens in the line of stress due to greater hysteresis and creep formation, because of longer duration end range positional stretch.

According to Mengiardi and Omari et al there will be capsular contracture and fibroblastic changes in CHL leads to pain and disability in shoulder^{11,12}. TERT positional stretching is effective on gaining the extensibility of CHL might have assisted in increased extensibility of capsule leading to reduction in pain and disability of shoulder. However in adhesive capsulitis there will be tightness of soft tissue, muscles around the glenohumeral joint that might restrict normal scapular motion leading to scapulothoracic alteration. The important muscles or

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tissues that get tightened around shoulder are pectoralis minor and posterior shoulder musculature^{47, 48}. The excessive active and passive tension in pectoralis minor will resist the normal scapular upper rotation, posterior tilt leading to greater scapular elevation during arm elevation⁴⁸. The tightness of posterior capsule of glenohumeral joint or posterior shoulder has been theorised as the postural mechanism for altering the scapular kinematics by passively pulling the scapula laterally over thorax particularly during the arm elevation⁴⁹. According to Ebaugh and McQuade et al shown fatigability of several muscles will restrict elevation in condition like adhesive capsulitis. Based on electromyographic of medium frequency shown deltoid muscle as well as scapulothoracic muscles are the muscles gone for more fatigue during resisted elevation leading to further compensatory greater scapular kinematic upward rotation and reduced posterior tilt of scapula^{50,51}. According Kebaetse M et al study Thoracic posture or slough posture is adapted or developed in adhesive capsulitis which further reduces upward rotation and posterior tilt as well as increase in scapular internal rotation and elevation⁵².

So the scapular kinematics alteration in adhesive capsulitis is due to alteration in muscle activities, muscle fatigue, posterior shoulder tightness as well as thoracic kyphosis⁵³. Even though CHL is effective in improving the range, its lasting effect can be improvised by correcting the scapular kinetics, by inhibiting the over activated internal rotators, reducing the tension of muscle due to fatigue like deltoid, supraspinatus muscle and retraining the scapulothoracic muscle, for which we have applied kinesio taping on the basis of text book by Kenzo kase⁴². The kinesio tape is found to be advantageous than classic tape. As it does not limit the patients freedom of movement. The K tape was applied to the deltoid to reduce the passive tension caused due to prolonged fatigability. For supraspinatus KT was applied to reduce tension due to prolonged elongation. Also the strips was applied in such a way that it was assistive in increase the tension of external rotators by inhibiting the internal rotators. The above standard procedure was applied on the basis of Kenzo Kase, Jim Walls, Ts'uyoshikase. 'Clinical Therapeutic Application of the Kinesio Taping Method'⁴².

The results showed highly significant improvement statically in all parameters as of CHL stretching only. However the percentage of improvement in all parameters by PSCHL and KT was higher compared to CHL only. According to Mark D Thelan and Kumbrick KT activates skin receptors as well as proprioception, in skin assist in increasing tonus regulation and position of body respectively K tape helps in elimination of circulatory impairment in muscular by lifting the skin in area increasing the space decreasing the pressure and lymphatic drainage. K tape also stimulates mechanoreceptors in skin helps in inhibiting the nociceptive stimulation at spinal level on basis on pain gate control theory^{31,33}. These above factors might have assisted in gaining improvement in all parameter compared to PSCHL only. However PSCHL and KT application for 4 weeks was effective in bringing back scapula to its normal level as compared to PSCHL only. This could be due to its beneficial effect in inhibiting the over tensed muscle and retraining the weekend muscles. This along with home exercise programme assisted in bringing

back scapula to normal posterior tilt and downward rotation.

The study concludes that the KT with positional stretching of CHL is more effective in reducing symptoms and improving Range motion compared to positional stretching of CHL alone in patients suffering from adhesive capsulitis

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FIGURES AND ILLUSTRATION;

TABLE 2: Inter and Intra subjects analysis of FLEXION SHOULDER ROM

GROUP		Mean	Std. Deviation	N
FLEXPRES	Kinesio tape	97.2500	9.79729	20
	CHL stretch	103.5000	8.44487	20
	Total	100.3750	9.56674	40
FLEXPOST	Kinesio tape	156.0000	9.81406	20
	CHL stretch	152.5000	8.35086	20
	Total	154.2500	9.16725	40

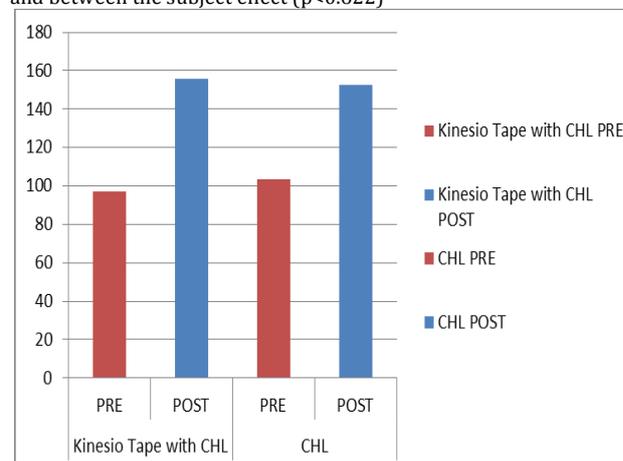
Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
CHANGE	58050.312	1	58050.312	4309.474	.000
CHANGE GROUP	475.313	1	475.313	35.286	.000
Error(CH ANGE)	511.875	38	13.470		

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	1296677.812	1	1296677.812	8463.555	.000
GROUP	37.813	1	37.813	.247	.622
Error	5821.875	38	153.207		

Results of the study shown significant improvement in FLEXION SHOULDER ROM with significant difference within the subjects (p<0.000) and between the subject effect (p<0.622)



Pre and post values of FLEX in both groups

TABLE 3 Inter and Intra subject analysis of ABDUCTION SHOULDER ROM

GROUP		Mean	Std. Deviation	N
ABDNPRE	Kinesio tape	92.0000	10.18254	20
	CHL stretch	97.5000	7.16350	20
	Total	94.7500	9.12520	40
ABDNPOST	Kinesio tape	150.0000	9.86754	20
	CHL stretch	146.7500	7.65627	20
	Total	148.3750	8.87141	40

Tests of Within-Subjects Effects

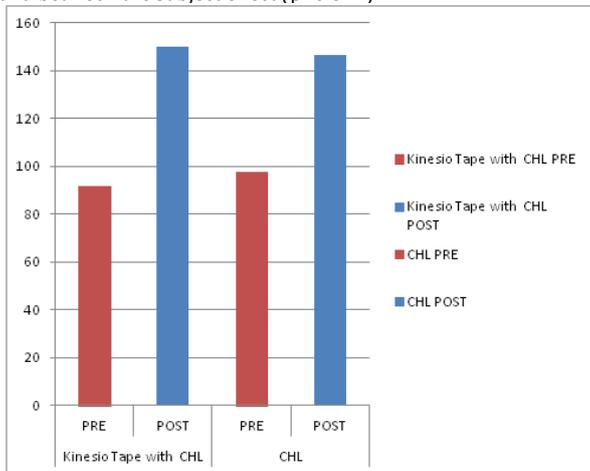
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
CHANGE	57512.812	1	57512.812	4033.194	.000
CHANGE GROUP	382.812	1	382.812	26.845	.000
Error(CHANGE)	541.875	38	14.260		

Tests of Between-Subjects Effects

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Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1182195.312	1	1182195.312	8370.499	.000
GROUP	25.312	1	25.312	.179	.674
Error	5366.875	38	141.234		

Results of the study shown significant improvement in ABDUCTION SHOULDER ROM with significant difference within the subjects ($p < 0.000$) and between the subject effect ($p < 0.674$)



Pre and post values of ABDN in both groups

TABLE 4 Inter and Intra subjective analysis of INTERNAL ROTATION SHOULDER ROM

GROUP		Mean	Std. Deviation	N
IRPRE	Kinesio tape	39.2500	6.54438	20
	CHL stretch	55.5000	6.26183	20
	Total	47.3750	10.37672	40
IRPOST	Kinesio tape	65.2500	5.72966	20
	CHL stretch	65.5000	6.27183	20
	Total	65.3750	5.92555	40

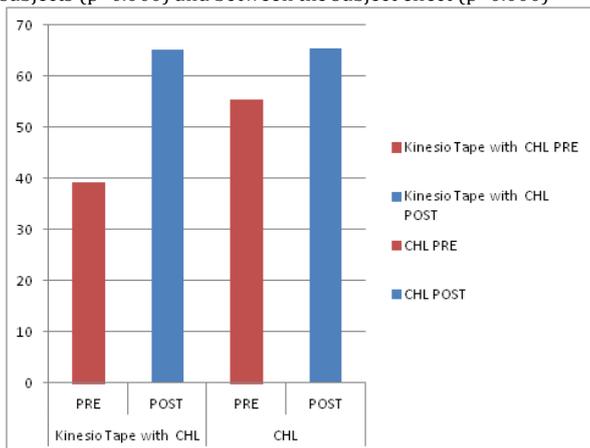
Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
CHANGE	6480.000	1	6480.000	849.103	.000
CHANGE GROUP	1280.000	1	1280.000	167.724	.000
Error (CHANGE)	290.000	38	7.632		

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	254251.250	1	254251.250	3663.146	.000
GROUP	1361.250	1	1361.250	19.612	.000
Error	2637.500	38	69.408		

Results of the study shown significant improvement in INTERNAL ROTATION SHOULDER ROM with significant difference within the subjects ($p < 0.000$) and between the subject effect ($p < 0.000$)



Pre and post values of IR in both groups

TABLE 5 Inter and Intra subject analysis of EXTERNAL ROTATION SHOULDER ROM

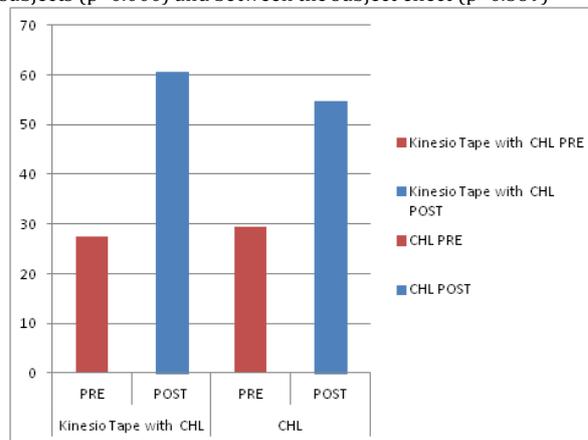
GROUP		Mean	Std. Deviation	N
ERPRE	Kinesio tape	27.5000	9.24804	20
	CHL stretch	29.5000	5.35576	20
	Total	28.5000	7.52773	40
ERPOST	Kinesio tape	60.5000	7.23660	20
	CHL stretch	54.7500	5.72966	20
	Total	57.6250	7.06993	40

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
CHANGE	16965.312	1	16965.312	2371.244	.000
CHANGE GROUP	300.312	1	300.312	41.975	.000
Error (CHANGE)	271.875	38	7.155		

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	148350.312	1	148350.312	1602.932	.000
GROUP	70.312	1	70.312	.760	.389
Error	3516.875	38	92.549		

Results of the study shown significant improvement in EXTERNAL ROTATION SHOULDER ROM with significant difference within the subjects ($p < 0.000$) and between the subject effect ($p < 0.389$)



Pre and post values of ER in both groups

TABLE 6 Inter and Intra subject analysis of VAS

GROUP		Mean	Std. Deviation	N
VASPRE	Kinesio tape	8.0000	.85840	20
	CHL stretch	7.5000	1.00000	20
	Total	7.7500	.95407	40
VASPOST	Kinesio tape	2.2000	.83351	20
	CHL stretch	3.3500	1.03999	20
	Total	2.7750	1.09749	40

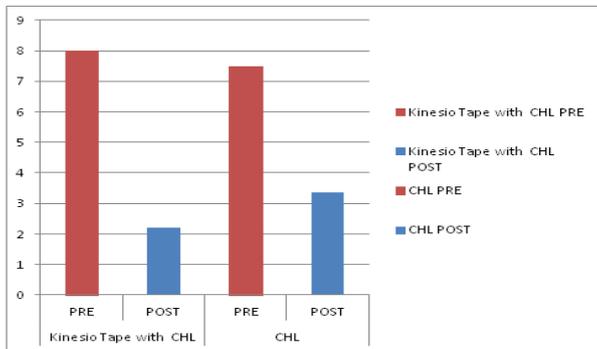
Tests of Within-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
CHANGE	495.012	1	495.012	6542.774	.000
CHANGE GROUP	13.612	1	13.612	179.922	.000
Error (CHANGE)	2.875	38	.076		

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
intercept	2215.512	1	2215.512	1318.035	.000
GROUP	2.113	1	2.113	1.257	.269
Error	63.875	38	1.681		

Results of the study shown significant improvement in VAS with significant difference within the subjects ($p < 0.000$) and between the subject effect ($p < 0.269$)

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Pre and post values of VAS both groups

TABLE 7 Inter and Intra subject analysis of DASH

GROUP		Mean	Std. Deviation	N
DASHPRE	Kinesio tape	42.8500	9.33739	20
	CHL stretch	44.0000	9.41443	20
	Total	43.4250	9.27331	40
DASHPOST	Kinesio tape	12.4000	5.12373	20
	CHL stretch	21.2500	5.74800	20
	Total	16.8250	6.99776	40

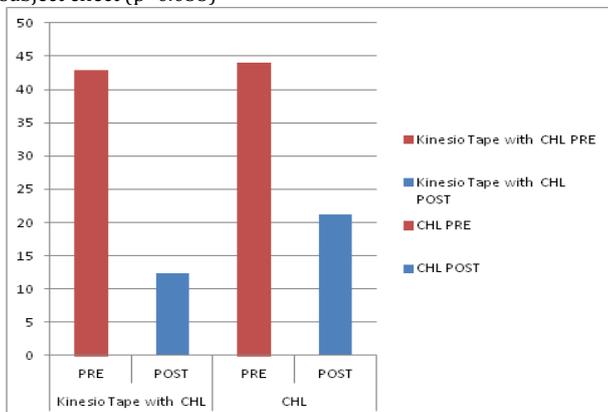
Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
CHANGE	14151.200	1	14151.200	928.188	.000
CHANGE GROUP	296.450	1	296.450	19.444	.000
Error(CHANGE)	579.350	38	15.246		

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	72601.250	1	72601.250	709.626	.000
GROUP	500.000	1	500.000	4.887	.033
Error	3887.750	38	102.309		

Results of the study shown significant improvement in DASH with significant difference within the subjects ($p < 0.000$) and between the subject effect ($p < 0.033$)



Pre and post values of DASH score in both groups

TABLE 8 The pre and post measurements of scapular level with respect to T7 level in both PSCHL with KT and only PSCHL groups.

PSCHL with KT	
Pre(cms)	Post(cms)
11	9
9	7
10	8
8	7
10	8
11	9
8	7
9	7
10	8
8	7
11	9
12	10
10	8
9	7
10	9
8	7

ONLY PSCHL groups.	
Pre(cms)	Post(cms)
11	10
10	9
9	8
8	8
10	9
12	11
11	10
10	9
8	8
7	7
9	8
11	10
10	9
9	8
11	10
8	8

7	6
10	8
9	7
11	9

7	7
9	8
10	9
11	10

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