SHORTEN PECTORALIS MINOR: THE HIDDEN COMPONENT AND EFFECTS OF KINESIOTAPING IN PATIENTS WITH SUBACROMIAL IMPINGEMENT

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Abstract

Subacromial impingement syndrome causes disability and functional loss in the shoulder. It affects the shoulder joint the most frequently. It can occur for a variety of reasons, such as stiffness in the posterior glenohumeral capsule or weak or dysfunctional rotator cuff muscles. It has been demonstrated that tightness of the pectoralis minor will cause the subacromial space to decrease, which will result in subacromial impingement. In patients with impingement, there was less upward rotation, less posterior tilting, and more internal rotation of the scapula during arm abduction motion. Kinesiotape is an advanced treatment technique for reducing pain, and improving joint proprioception and muscle function. Kinesio tape has emerged into the physiotherapy stream, giving the best results for physiotherapy conditions. Various studies on kinesiotaping in subacromial impingement reduce pain and stabilization of scapula and improve ROM. The analysis shows that the experimental group gave the best results when compared with the control group. This study concluded that giving Kinesio tape to subacromial impingement patients will reduce pain and disability and increase the length of the pectoralis minor muscle.

Keywords: Subacromial impingement, kinesiotaping, shorten pectoralis minor, scapular kinematics

INTRODUCTION

A symptomatic irritation of subacromial bursa in subacromial space can be defined as subacromial impingement syndrome. Symptoms like pain while abducting the arm, decreased range of motion and limited range of motion of scapula. It is most common in 40 – 50 years and it is mostly associated with shoulder pain (Singh *et al.,* 2015). According to SS Lumine shoulder pain is the common complaint with prevalence of 6.9%-26% (McClure *et al.,* 2006). People with high level of above shoulder activity, like teachers, painters, athletes are at higher risk of developing subacromial impingement syndrome.

Singh *et al.,* (2015), conducted a cross sectional study to know the prevalence of shoulder disorders in tertiary care center. It is observed that 130 patients 13.8% of people were suffering with subacromial impingement and males were more prone to subacromial impingement (17.24%) (Singh *et al.* 2015).

Mathew J. Steffes stated that subacromial impingement is most common cause of shoulder pain which account 44-65% of shoulder disorders (Van der Windt *et al.,* 1995).

ANATOMY

Most mobile joint in the human body is shoulder joint. The articular surfaces which forms the shoulder joint were glenoid fossa of scapula and the head of humerus. This joint is a type of ball-and-socket joint. There are two processes project off from scapula they are: acromial process and coracoid process.

TYPE	SHAPE	ACROMION PROCESS SHAPE	SPACE
Type-I	Flat	Flat	More
Type-II	Curved	Curved	Little space
Type-III	Hooked	Hooked	Almost no space likelihood of impingement is increased

More often there are anatomically there are three types of acromion process were present.

In type-III hooked shaped acromion process is high risk of getting the subacromial impingement (Paraskevas *et al.,* 2008).

There are two mechanistic types in SAIS depending on pathology of reducing the subacromial space they are: Structural and Functional impingement. Structural impingement is caused mainly by the physical loss of area in the subacromial space due to bony growth, Functional impingement is a relative loss of subacromial space secondary to altered scapulohumeral mechanics which results from glenohumeral instability and muscle imbalance (Page, 2011).

SUBACROMIAL SPACE

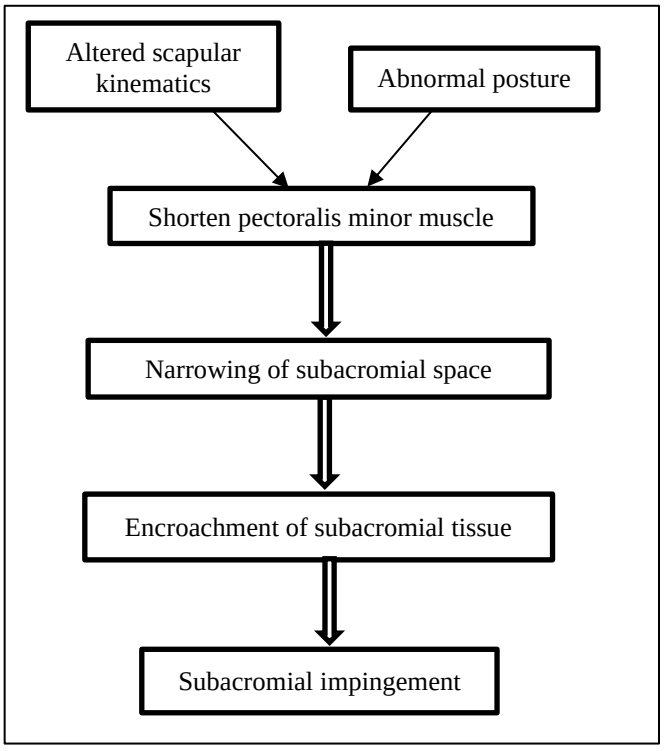
Subacromial space is formed superiorly by acromioclavicular ligament and acromion and inferiorly by head of humerus. The space ranges from 1.0-1.5 CM. In this subacromial space subacromial bursa and tendons of rotator cuff were present (Umer *et al.,* 2012). If the change in this subacromial space creates encroachment of the structures present inside the space leading to SAIS.

The anterior third, fourth, and fifth ribs are the source of the pectoralis minor muscle origin, which inserts in the medial border of the scapula at the upper surface. The pectoralis muscle's purpose is Minor rotation, protraction, and depressions are downward scapular bone (Chaurasia, 2004).

If your pectoralis minor shorten or tighten it, the scapula will tilt forward; as a result, Different scapula kinematics will result in subacromial space getting smaller.

PATHOLOGY

It is commonly experienced by the patients with subacromial impingement, since the pectoralis minor's insertion is near the coracoid process of the scapula, one of the key components composing the subacromial space; it lies frequently experienced by patients with subacromial impingement. Any changes to the pectoralis minor will affect the construction of the subacromial space. To accomplish this goal, a review of the literature on the tightness/shortness of the pectoralis minor in subacromial impingement was done.



KINESIOTAPE

Kinesiotape is an advanced treatment technique for reducing pain, improving joint proprioception and muscle function. Muscle contributes a part of the regular function as the movement of the body they also do circulation of lymph and venous and regulate the body temperature.

It was discovered by many investigators that using elastic tape helped by giving out-sided assistance. By improving the elastic tape kinesiotape was discovered and used in Olympic volley ball players for preventive maintenance in Japan after that whole world used it for athletes. Now kinesiotape has emerged into the physiotherapy stream, giving the best results for physiotherapy conditions.

There are various studies on subacromial impingement reducing pain and stabilization of scapula and improving ROM.

METHODOLOGY AND MATERIALS

Initially, 43 subjects were recruited for this Randomized control trial from the various physiotherapy clinics in Bangalore and Andhra Pradesh. 30 were Screened and eligible for the study based on inclusion and exclusion criteria. The inclusion criteria were: Positive for the Hawkins test**,** Uni-lateral pain localized to the acromion process**,** Age group 30-70 years, Pain increases during flexion and abduction of the shoulder, and Pectoralis minor length (PML) more than 2.54cm. Subjects were excluded based on History of any recent surgery, Allergic to tape Radiating pain, and Age group below 30 years. The sampling used was a simple sampling technique. Baseline measurements of 1. SPADI to find out the pain and quality of life, 2. Pectoralis minor by anthropometric method (supine position and measuring between the coracoid process to the couch), and 3. Universal goniometer for measuring scapular movements was taken. Materials used in this study were Kinesiotape**,** Scale**,** Scissor**,** and Goniometer.

METHOD OF COLLECTING DATA

Patients who are satisfying the inclusion criteria were enrolled and randomly divided into two groups (group-1 experimental group and group-2 control group). The experimental group will receive the interventions for the reduction of pain by kinesiotaping and pectoralis minor release technique. Taping with 50-70% stretch over the anterior and posterior fibres of the deltoid and supraspinatus muscles will be done using the insertion-origin muscle technique. Also, the application of the I band with 50-70% stretch with mechanical correction technique will be done along with Hungston scapular stabilization exercises. The control group will receive the sham type of kinesiotaping one band without tension applied at the insertion point of the deltoid muscle and other bands on the superior portion of the anterior, middle and posterior fibres of the deltoid and Hungston scapular stabilization exercises.

TREATMENT PROTOCOL

5 cm kinesiotape is applied to the experimental group as stated above and sham taping is done to the control group and myofascial release and stretchings for pectoralis minor for the experimental group and both of the groups will receive the Hungston scapular stabilization exercises for the duration of 3 days for 4 weeks.

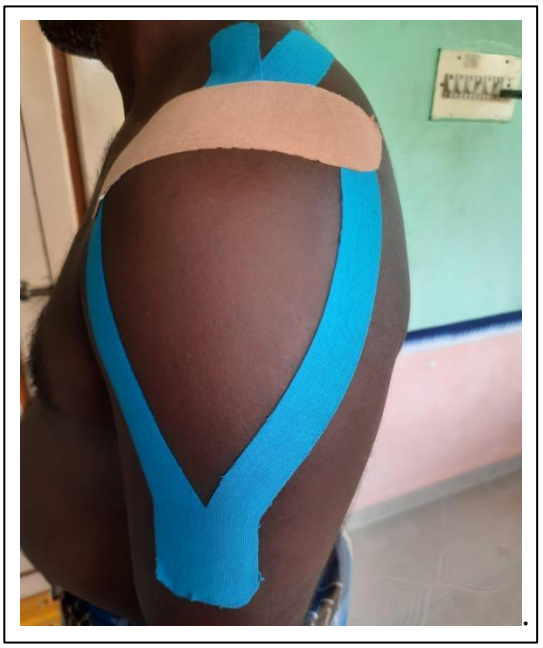


Fig 4: Experimental group Kinesio tape

Fig 5: Control group Kinesio tape

Fig 6: MFR for pectoralis minor muscle

Fig 8: Hughston stabilization exercises

Fig 7: Hughston stabilization exercises

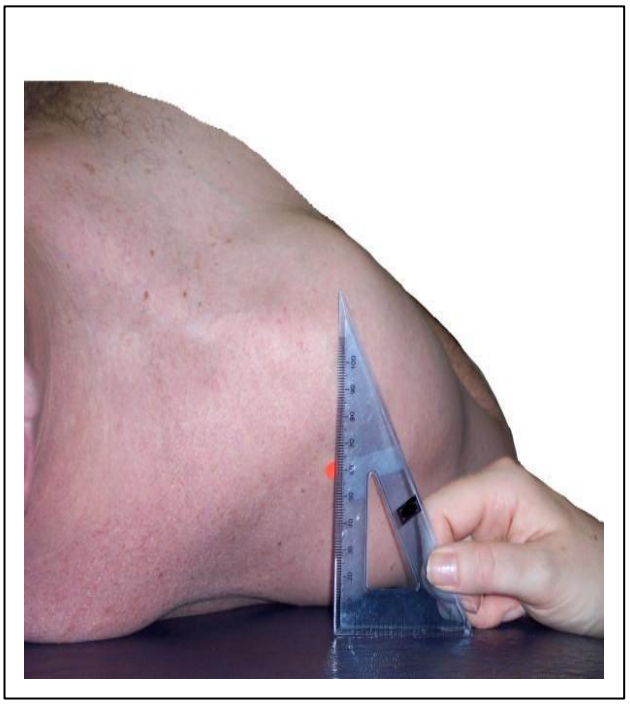


Fig 9: Pectoralis minor length

RESULTS

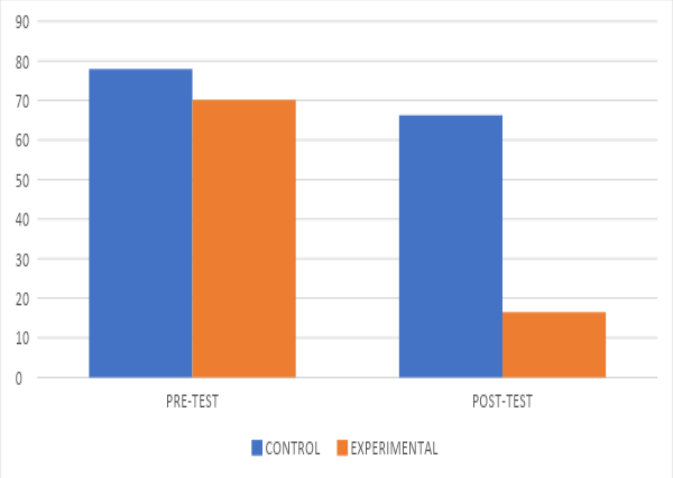
Table 1: Comparison of a controlled group and experimental group with respect to pre-test and post-test SPADI total

Treatment	Control group		Experimental group		T-value	P-value
	Mean	Std. Dev	Mean	Std. Dev		
Pre-test	77.97	6.65	70.113	15.06	1.5912	0.1265
Post-test	66.22	14.05	16.5	8.25	10.45	0.0001

No significant difference between controlled group and experimental group with respect to pre-test SPADI values (t=1.5912, p=0.1265) at 5% level of significance. It means that the pre-test values of the SPADI total are similar in the controlled group and experimental group.

A significant difference between the controlled group and the experimental group with respect to post-test SPADI values (t=10.45, p=0.001) at a 5% level of significance. It means that the post-test values of SPADI total are decreased in the experimental group than in the controlled group.

Graph 1: Comparison of a controlled group and experimental group with respect to pre-test and post-test SPADI total



The above graph represents the mean value of 77.97 and 70.11 pre-test and the mean value of 66.22 and 16.5 post-test SPADI total scores in controlled group and experimental group respectively.

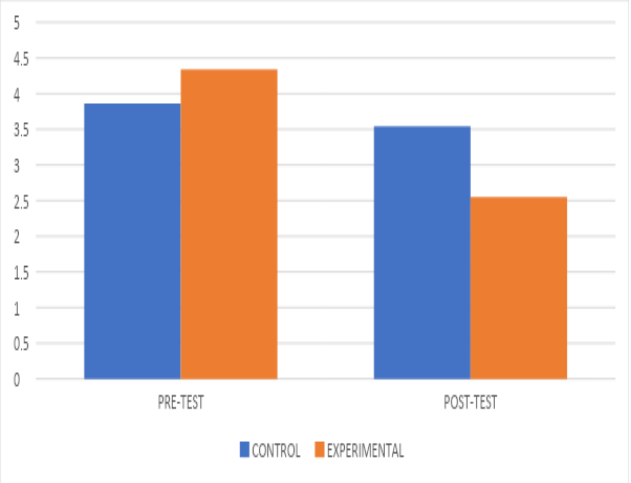
Table 2: Comparison of a controlled group and experimental group with respect to pre-test and post-test Pectoralis minor length

Treatment	Control group		Experimental group		T-value	P-value
	Mean	Std. Dev	Mean	Std. Dev		
Pre-test	3.86	0.636	4.34	0.57	1.889	0.072
Post-test	3.54	0.6	2.55	0.079	5.576	0.0001

No significant difference between the controlled group and experimental group with respect to pre-test pectoralis minor length values (t=1.889, p=0.072) at 5% level of significance. It means that the pre-test values of pectoralis minor length total are similar in the controlled group and experimental group.

A significant difference between the control group and the experimental group with respect to post-test pectoralis minor length values (t=5.576, p=0.0001) at a 5% level of significance. It means that the post-test values of pectoralis minor length are decreased in the experimental group than in the controlled group.

Graph 2: Comparison of a controlled group and experimental group with respect to pre-test and post-test Pectoralis minor length



The above graph represents the mean value of 3.86 and 4.34 pre-test and the mean value of 3.54 and 2.55 post-test Pectoralis minor length score in controlled group and experimental group respectively.

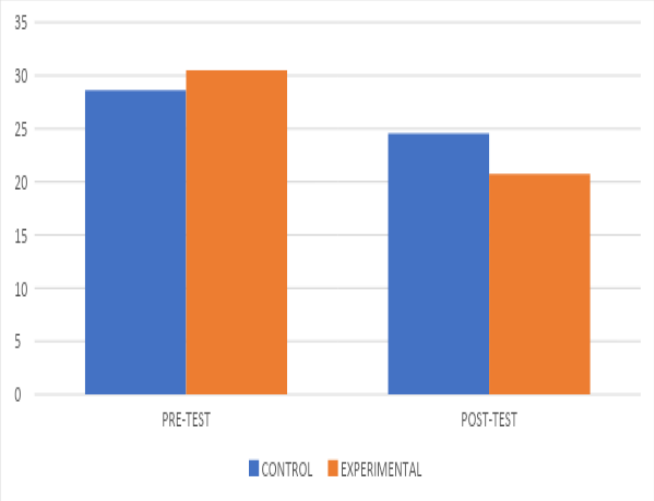
Table 3: Comparison of a controlled group and experimental group with respect to pre-test and post-test scapular protraction

Treatment	Control group		Experimental group		T-value	P-value
	Mean	Std. Dev	Mean	Std. Dev		
Pre-test	28.64	2.46	30.5	4.66	1.18	0.25
Post-test	24.55	1.75	20.75	1.48	5.61	0.0001

No significant difference between controlled group and experimental group with respect to pre-test scapular protraction values (t=1.18, p=0.25) at 5% level of significance. It means that the pre-test values of scapular protraction are similar in the controlled group and experimental group.

The significant difference between the controlled group and the experimental group with respect to post-test scapular protraction values (t=1.18, p=0.0001) at a 5% level of significance. It means that the post-test values of scapular protraction are decreased in the experimental group than in the controlled group.

Graph 3: Comparison of a controlled group and experimental group with respect to pre-test and post-test scapular protraction



The above graph represents the mean value of 28.63 and 30.5 pre-test and the mean value of 24.54 and 20.75 post-test scapular protraction score in controlled group and experimental group respectively.

DISCUSSION

Subacromial impingement syndrome is by far the most common form of shoulder impingement and occurs secondary to attrition between the coracoacromial arch and underlying supraspinatus tendon or subacromial bursa (Aquino & Ivanov, 2019) .

It is observed by Labriola *et.al.* (2005) that there is a tight/shortened pectoralis minor muscle when compared with normal individuals which will create scapular kinematics disturbances. Since the insertion point of the pectoralis minor is at the coracoid process of the scapula any changes happening in the pectoralis minor length will directly lead to altered kinematics of the scapula. This will in turn lead to upward and external rotation and posterior tilting of the scapula causing altered kinematics of the scapula (Labriola *et al.* 2005) .

According to Michener LA et.al., a tight pectoralis minor makes the scapular protraction by tilting the scapula anteriorly. Since the mechanics of the scapula have been changed this decrease the subacromial space (Lewis & Valentine, 2007) . Once the subacromial space has reduced, there will be an encroachment of the structures present in the space will happen which induces pain in the anterior region of the shoulder joint.

In this study pectoralis, minor length was measured by the anthropometric method as prescribed by Sahrmann et.al., the patient is instructed to lie supine lying on the table and hands rested gently on the abdomen. Right angle protractor is used to measure the distance which is 12 cm. without giving any downward pressure on the table, the base of the protractor was placed on the treatment table and the vertical side was placed on the lateral aspect of the acromion process and the distance was measured and 2.6 cm is noted as the normal length for pectoralis minor more than this length is noted as shortening or tight pectoralis minor length (Dawson *et al.*, 2016).

There are so many scales for measuring the pain and disability of subacromial impingement. D.J. Cloke et.al. conducted a comparative study and concluded that SPADI given a good correlation with diagnosing the subacromial impingement and knowing pain intensity and disability. So that SPADI is used in this current study for knowing the pain intensity and disability faced by the patient (Dawson *et al.*, 2016).

For measuring the scapular protraction in this study, Nathan Short OTD et.al., a method for goniometric measurement of scapular protraction and retraction was used and the patient is instructed to sit with the arm relaxed at the side, the superior medial angle of the scapula is chosen as a fulcrum and maintain static arm at the midpoint of the thorax and moving arm placed superiorly over acromion process, let the patient perform protraction and retraction and note the value (Aquino& Ivanov, 2019).

The experimental group received the interventions for the reduction of pain by Kinesio taping and pectoralis minor release technique. Taping applied in such a manner with 50-

70% stretch over the anterior and posterior fibres of the deltoid and supraspinatus muscles will be done using the insertion-origin muscle technique. Also, the application of the I band with 50-70% stretch with mechanical correction technique will be done along with Hughston scapular stabilization exercises (Simsek *et al.*, 2013) .

Pectoralis minor release includes MFR and pectoralis minor stretching. Gandhi VM et.al., perform an experimental study to know the effectiveness of MFR and observed it reducing pain and increasing function in subacromial impingement. For MFR patient is instructed to lie supine and with arms on the abdomen and from origin to insertion of pectoralis minor muscle kneading is given for 3 minutes. Borstad & Ludewig, (2006) conducted a comparative study to compare 3 stretches of pectoralis minor for improving SIS and concluded Unilateral self-stretch gave the greatest length change, the same protocol was used in the current study (Borstad & Ludewig, 2006). The patient affected forearm is stabilized by a vertical plane before the trunk is rotated in the opposite direction and advised the patient to hold the position for 15 seconds.

The Control group received the sham type of kinesiotaping one band without tension applied at the insertion point of the deltoid muscle and another band on the superior portion of anterior, middle, and posterior fibers of the deltoid and Hughston scapular stabilization exercises.

Kinesiotape reduces the pain by lifting the skin, in turn, it will increase blood and lymph flow. Neurophysiologically it is believed that kinesiotape will prevent the transmission of pain in the spine by pain-gate theory. In several studies, Kinesio tape has been applied to the shoulder, waist, and neck giving the best results (Gandhi *et al.*, 2016).

Kinesiotape creates mechanical support which will give joint stability and restore movement biomechanics. This helped patients to get the scapular protraction normal (Gandhi *et al.*, 2016). Lin et.al., conducted a study and concluded that there is an increase in proprioception and a change in scapular muscle activity in subjects with no shoulder problems (Short et al., 2016) .

MFR for pectoralis minor increases the scapular protraction in which MFR will improve the viscoelastic properties of muscle and helps in resorting to the biomechanics of the scapula which makes the change in scapular protraction (Gandhi *et al.*, 2016).

CONCLUSION

The purpose of the study was to extend the knowledge concerning the effect of kinesiotape on subacromial impingement and its impact on shortening pectoralis minor muscle by giving the releasing techniques. The data analysis and results attained reveal that applying kinesiotape for subacromial impingement will reduce the pain and release techniques will make the shortened pectoralis minor normal. Significant changes were observed in scapular kinematics (scapular protraction).

However, the between-group analysis proved that the kinesiotape group gave the best results in reducing pain and disability, increasing the scapular protraction, and normalizing the pectoralis minor length compared with the control group.

Hence, the study concludes that applying kinesiotape will reduce the pain, and disability and improve the scapular protraction angle while simultaneously giving release techniques (MFR and Pectoralis minor length) for the pectoralis minor muscle which is shortened while being normalized which in turn, even more, reduce the pain.

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