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RESEARCH ARTICLE

COMBINED EFFECT OF SOFT TISSUE MOBILISATION WITH PNF ON GLENOHUMERAL RANGE OF MOTION AND OVERHEAD REACH IN FRONTAL PLANE ALONG WITH PAIN PERCEPTION

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Abstract

Introduction: Shoulder pain is very common (7-20%) in the adult population. A community survey of identifiable symptomatic shoulder disorders revealed a prevalence of 21%. Shoulder disorders were more common in women (25%, versus 17% in men). This shoulder pain and disability leads to restricted ROM. In this study Soft tissue mobilization (STM) and proprioceptive neuromuscular facilitation (PNF) was given to increase ROM.

Purpose of the study: Purpose of the study was to determine whether the soft tissue mobilization and PNF producing improvement in glenohumeral ROM overhead reach and pain.

Methodology: Twenty four Subjects were included in the study with age group of 25-60 years. All the subjects were randomly selected according to inclusion and exclusion criteria. Subjects will be included in the study who has limitation in overhead reach in frontal plane as well as decreased glenohumeral external rotation measured at 45 degree of shoulder abduction and limited shoulder abduction. Subjects will be excluded if they had a surgical procedure to shoulder less than 4 weeks, total shoulder arthroplasty and Rheumatoid arthritis.

Result: The treatment group improved by a mean of 0.0001, 0.016 and 0.0001 abduction, external rotation and overhead reach respectively.

Conclusion: The study concluded that the combined effect of STM with PNF is effective in gaining glenohumeral ROM, overhead reach in frontal plane along with pain perception.

Introduction

The shoulder complex consists of the clavicle, scapula, and humerus; the glenohumeral and acromioclavicular (AC) joints that unite them; and the sternoclavicular **(SC)** joint, the only connection of the complex to the axial skeleton. (**Elsie Culham, Malcolm Peat, 1993)**[12]. The glenohumeral joint is considered by many to be the most important joint of the shoulder girdle. It is a synovial ball-and-socket joint between the humeral head and glenoid fossa of the scapula. **(Judith P. DeLany, 1997**[19]**William Cornelis1998)**[40]

However, when the glenohumeral joint is restricted, there will be little or no use of the arm. The cause of limited shoulder range of motion can be structural changes in the periarticular structures. **(Judith P. DeLany, 1997**[19]**, Philip W McClure 1992)**[28]

Community pain surveys have shown very high prevalence rates of shoulder pain of 20% prevalence.(**Badley EM 1992**[5]**, Andersson HI 1993**[3]**),** Prevalence studies suggest that shoulder pain and disability is common in one or both shoulder in 21%.**(D. P. Pope 1996)**[9]**.**A community survey of identifiable symptomatic shoulder disorders revealed a prevalence of 21%. (**M. D. Chard MB 1991)**[23]In spinal cord injury patients prevalence is up to 70% of the subjects with tetraplegia and 29% of those with paraplegia. (**Eriks-Hoogland IE 2009)**[13]**.** Shoulder pain was present in 25.7% of diabetic patients. (**Thomas sj 2007)**[37]

Subscapularis, a particularly important muscle when considering shoulder dysfunctions, is almost hidden from palpation. **(Judith P. DeLany, St. Petersburg FL1997)[19]** Subscapularis provides medial rotation of the humerus which is assisted latissimus dorsi, pectoralis major and teres major. It also provides adduction of humerus. **(Amy Sewick, John D. Kell, Brian Leggin 2011)[2], (Thomas W. Woodward, 2000)[37], (Judith P.DeLany1997)[19].** In cases of stabilization surgery limited range of motion is the common complication. In anterior stabilization, range-of-motion loss occurs primarily in the plane of external rotation because of selective tightening of the anterior capsule. **(Richard W. Kang, 2009)[30]**Shoulder pain is a common musculoskeletal complaint in the general population. Subscapularis is the main internal rotator of the shoulder, **(Glenn C. Terry, 2000)[14](Khurana N., .2011)[20]**

Cadaver studies and outcomes of subscapular surgical releases suggests that subscapularis muscle flexibility deficits are responsible for glenohumeral external rotation limitation in lower ranges of abduction.**(A. F. DePalma 2008[1], Jmrrgen Oveses, 1985[17])** A primary indication for treatment of subscapularis is loss of lateral rotation and or abduction of the humerus. Mostly the subscapularis muscle is torned when the humerus is hyper extended and externally rotated. **(D. Jankovic and A. 2006[8], Michael J. Decker, 2003[25])**

A contrasting clinical and cadaver finding is where glenohumeral external rotation becomes more limited as the humerus moves toward 90° of abduction, suggestive of gleno-humeral capsular restrictions**., (Jmrrgen Ovesen, 1985)[17]**Thus, a patient who has greater limitation of glenohumeral external rotation at 45° of abduction, when compared to the available external rotation at 90° of abduction, may have a subscapularis muscle flexibility deficit. In this instance, an appropriate intervention may include procedures purporated to improve muscle extensibility, such as soft tissue mobilization (STM) and proprioceptive neuromuscular facilitation (PNF). PNF stretching techniques are effective in increasing range of motion. **(Decicco PSV, 2005[11] Godges JJ, 1989[15]Melanie J. 2006[24], Wallin D, 1985[39])**It is an experimental study and the need of this study is to improve the glenohumeral ROM, overhead reach and pain and purpose is to determine whether the soft tissue mobilization and proprioceptive neuromuscular facilitation producing improvement in glenohumeral ROM overhead reach and pain. In this study it is hypothesized that there will be significant difference among STM with PNF contract- relax on glenohumeral ROM, overhead reach and pain. The study was conducted for 4 weeks at Prayas health care centre and Bala pritam charitible trust and on the population of the same.

Methodology

Sample: Twenty four Subjects were included in the study with age group of 25-60 years. All the subjects were randomly selected according to inclusion and exclusion criteria. All the subjects were included in the study who have limitation in overhead reach in frontal plane as well as decreased glenohumeral external rotation measured at 45 degree of shoulder abduction and limited shoulder abduction. Subjects were excluded if they had a surgical procedure to shoulder less than 4 weeks, total shoulder arthroplasty, Reflex sympathetic dystrophy and related syndromes and Rheumatoid arthritis. Ethical approval for ethical committee of "SBSPGI" was taken to conduct study and informed consent was taken for each subject to be included in the study. All the subjects were randomly assigned into two groups; one experimental and other was control group. All the subjects of experimental group were received soft tissue mobilization, PNF and hot pack whereas in control group subjects received only hot pack and soft tissue mobilization. Outcome measures were noted as glenohumeral external rotation by using goniometer, overhead reach by using measuring tape and Pain by using VAS. All the measurements were done before the treatment session, after 1st week, after 2nd week and after 4th week.

Methods

Measurement of Glenohumeral external rotation: subjects were asked to lying supine on a treatment table with a pillow under their knees. Stabilization of the scapula is achieved by depressing the shoulder girdle. Reference line for abduction was drawn on the skin over the midline of the axilla for stationary arm of the goniometer and the anterior aspect of the midline of the humerus for movable arm of the goniometer. A reference point was used for fulcrum of the goniometer drawn on the skin over the anterior aspect of the acromion.

Measurement of Overhead reach: it was measured with the subjects in standing position facing a wall with the tips of their toe align with the pre marked line on the floor 30.5 cm from the wall. The subjects were asked to actively walk their fingers up the wall to reach as far as they could. Overhead reach was first measured at the distance in cm. from the floor to the tip of the middle finger using a measuring tape.

Application Of Soft tissue mobilization: The subjects to be positioned with the humerus abducted to approximately 45 degree with the elbow flexed to 90 degree ,the humerus was to be externally rotated to a mid range position typically about 20-25 degree. The subscapularis muscle was to be palpated in the axilla to identify the areas of

myofacial mobility restrictions, taut bands, or trigger points. Application of STM utilizing a combination of sustained manual pressure and slow deep strokes to the subscapularis myofacial was used for 7 minutes.
Application of PNF: The subjects were positioned in the same position used for the STM. With application of PNF contract-relax to subscapularis and other glenohumeral internal rotator first ask patient to perform maximal glenohumeral internal rotation against an opposing manual resistance or the extent that is comfortable for the patient for 7 seconds. The patient then performs an end-range contraction for about 5 seconds, which is followed by voluntary relaxation of the subscapularis or the internal rotators. The arm is then passively moved into the new range that is in full external rotation. This was repeated 5 times. Subjects were then instructed to actively move through the PNF flexion-abduction external-rotation diagonal pattern for 5 repetitions with manual facilitation. STM with PNF contract-relax was given for 4 weeks and then final analyses was done after 4 weeks of intervention.
The control group subjects received STM and hot pack for 10 minutes.

Data Analysis: One way ANOVA was used to compare the abduction, external rotation, overhead reach in between the groups, in starting day, 1st week, 2nd week, and 4th week and post hoc analysis was done using tukey's multiple comparison test. t-test was done or measuring the significant level between the groups. Significant level has been selected as $p < 0.05$.

Results

Result of between the groups for abduction, external rotation and pain showed significant but overhead reach showed non-significant [table 5.1]One way ANOVA result showed significant differences for abduction, external rotation, and pain in group A and abduction, and pain in group B and result was non-significant for overhead reach in group A and external rotation, and overhead reach in group B.[table 5.3]

Table 1: t-test between the groups

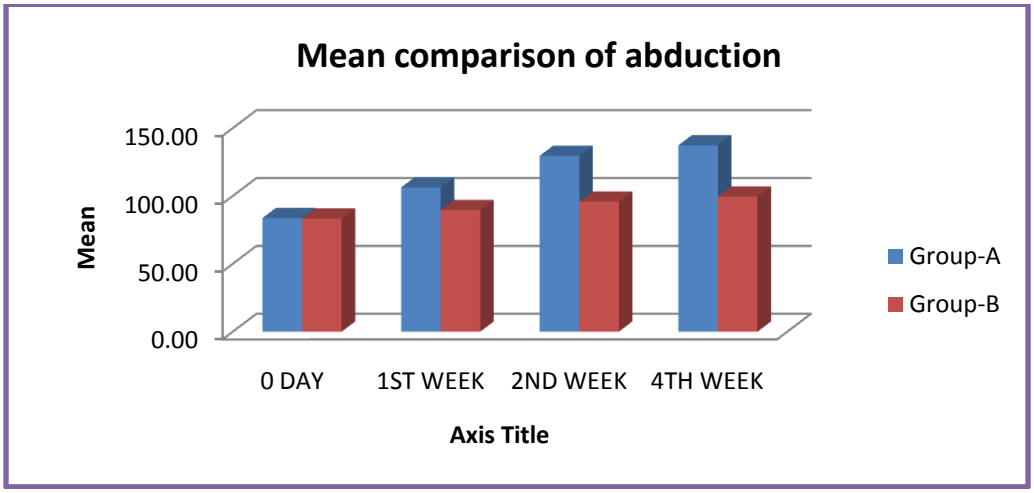
	ABDUCTION	EXT-ROTATION	OHR	PAIN
t-Value	4.067	.153	2.886	-1.813
p-Value	0.001	.880	.010	.084

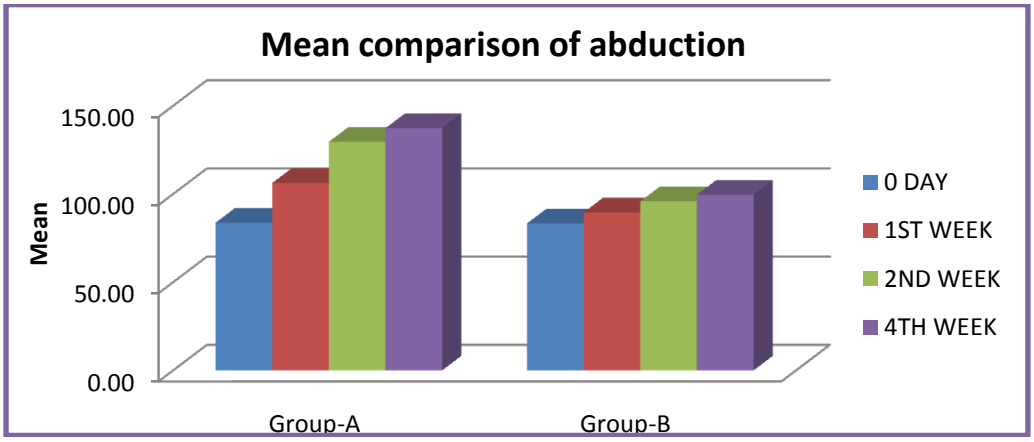
Table 2: One way ANOVA within the group A

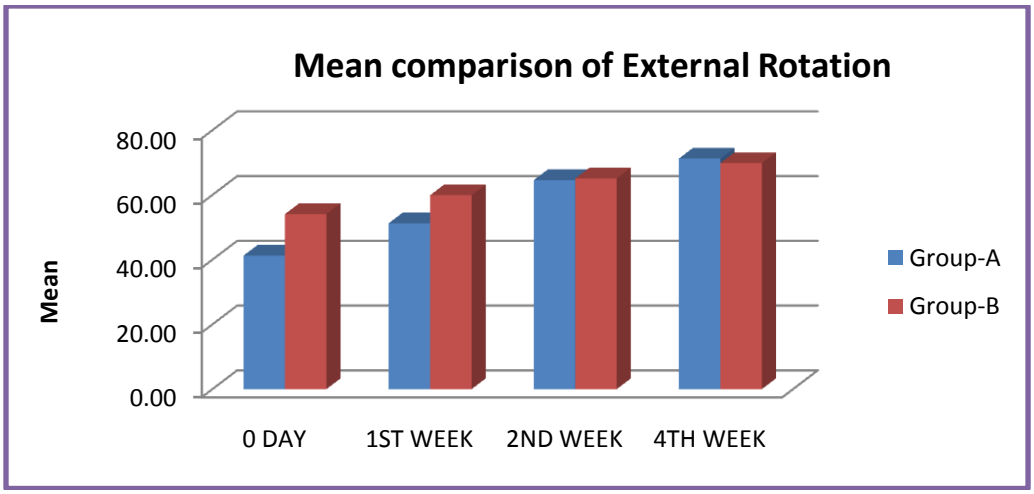
	F-value	p – Value
ABDUCTION	9.712	0.0001*
EXT-ROTATION	3.822	0.016*
OHR	1.558	.213
PAIN	19.690	.0001*

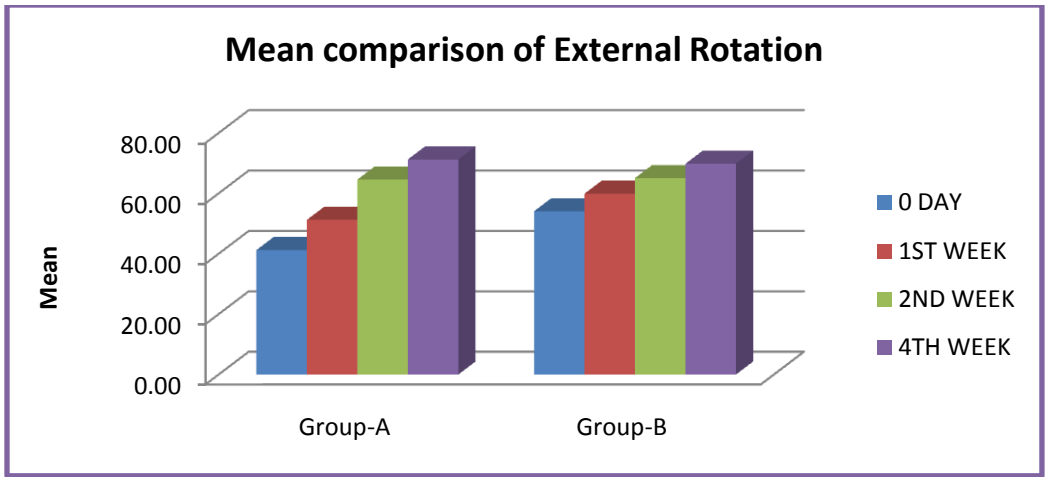
Table 3:One way ANOVA within the group B

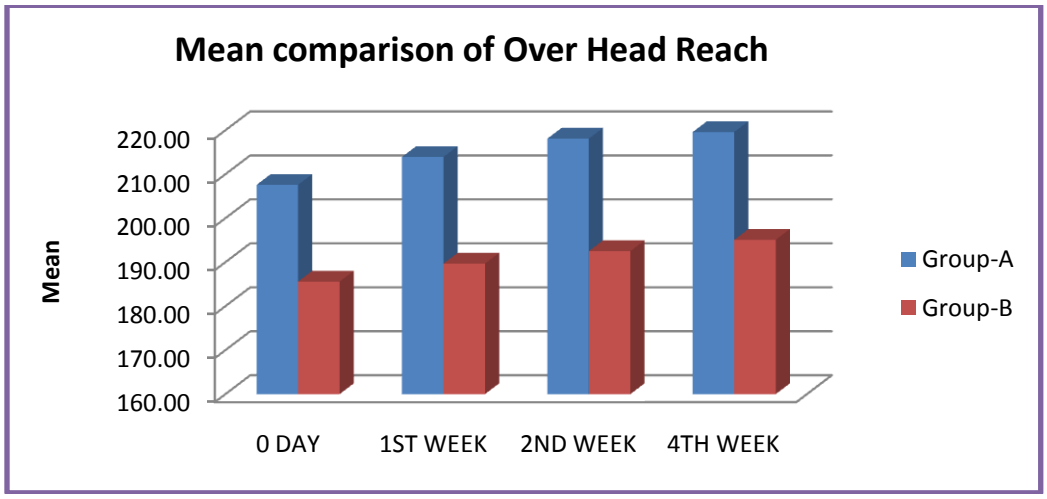
	F-Value	P-value
ABDUCTION	3.767	.017
EXT-ROTATION	1.415	.251
OHR	.275	.843
PAIN	18.375	.000

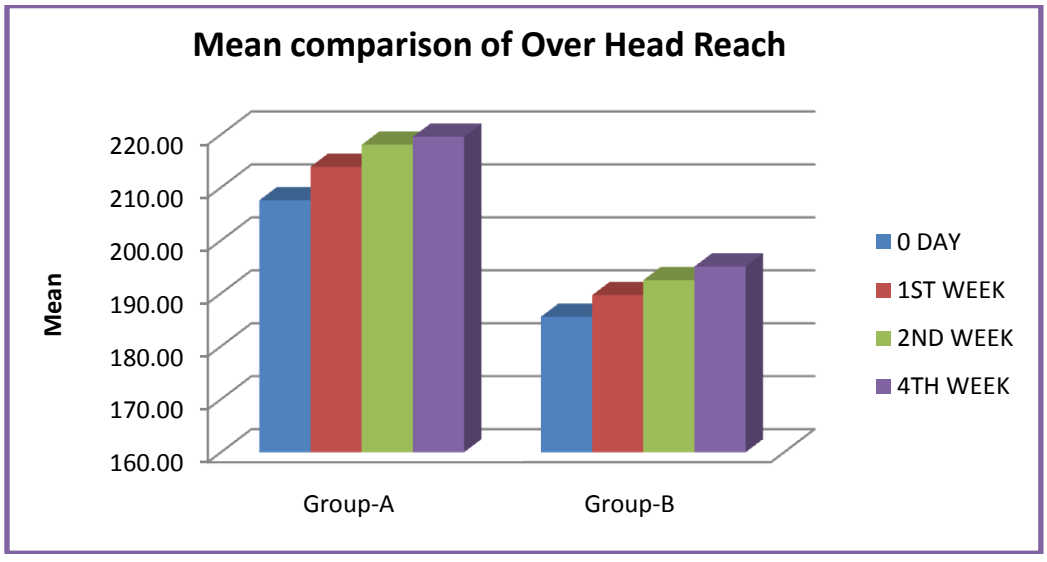

Mean comparison of abduction
150.00
100.00
50.00
0.00
Mean
0 DAY
1ST WEEK
2ND WEEK
4TH WEEK
Axis Title
Group-A
Group-B

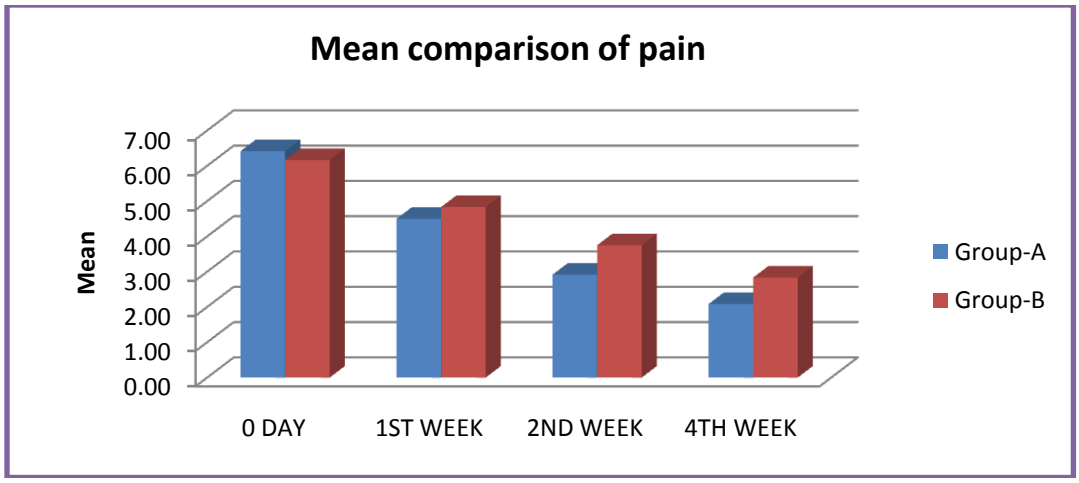

Mean comparison of abduction
150.00
100.00
50.00
0.00
Mean
Group-A
Group-B
0 DAY
1ST WEEK
2ND WEEK
4TH WEEK

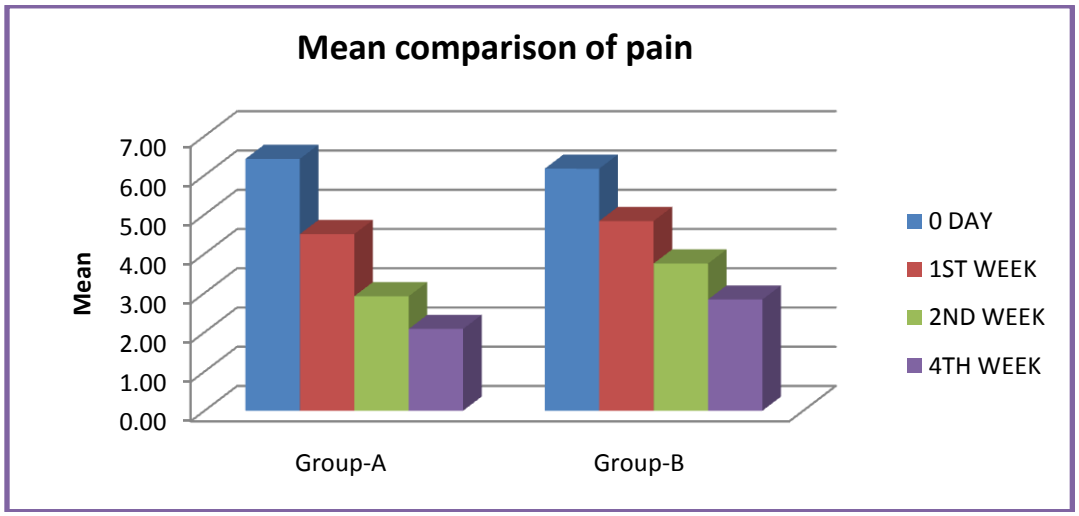

Mean comparison of External Rotation
80.00
60.00
40.00
20.00
0.00
Mean
0 DAY
1ST WEEK
2ND WEEK
4TH WEEK
Group-A
Group-B


Mean comparison of External Rotation
Mean
80.00
60.00
40.00
20.00
0.00
Group-A
Group-B
0 DAY
1ST WEEK
2ND WEEK
4TH WEEK


Mean comparison of Over Head Reach
Mean
220.00
210.00
200.00
190.00
180.00
170.00
160.00
0 DAY
1ST WEEK
2ND WEEK
4TH WEEK
Group-A
Group-B


Mean comparison of Over Head Reach
Mean
220.00
210.00
200.00
190.00
180.00
170.00
160.00
Group-A
Group-B
0 DAY
1ST WEEK
2ND WEEK
4TH WEEK





Discussion

This experimental study was designed to determine the combined effect of soft tissue mobilization with proprioceptive neuromuscular facilitation on glenohumeral range of motion, overhead reach in frontal plane along with pain perception in patients with shoulder disorders. The results of the present study showed that these procedures were able to produce a significant difference in overhead reach and abduction after the treatment procedure. Some author supports these results in a previous study, where a combined STM and PNF intervention produced improvements in mobility in a healthy population, to patients with shoulder disorders. **(Godges JJ et al 1989[15], Melanie J. Sharman et al2006[25], Reed Ferber et al 2002[30])**

Zachazewski et al (1989) stated that primarily limiting factor to movement at end range is muscle and its facial sheath, the capsule and the tendon in that order. On applying PNF contract-relax the muscle spindle and Golgi tendon organ have an important role in a muscle ability to lengthen adequately, the muscle spindle also stretches, exciting the Ia afferent fibers. This results in alpha-gama co activation. The Golgi tendon organ is sensitive to the tension changes within the muscle as it stretches or contracts, The resulting reflex is inhibitory and acts to inhibit its own and excites the antagonist muscle and increases the range of motion. **(Zachazewski et al 1989)[42]**

Many have assumed that on applying PNF technique muscle experiences a refractory period after contraction known as 'autogenic inhibition', where muscle relaxes due to Neuro-reflexive mechanisms, thus increasing muscle length. Interestingly, electromyographic (EMG) studies have shown that muscle activation remains the same or increases after contraction. **(Phil Page 2012)[28]**

On applying STM there is increase in ROM. On the basis of physiology Cottingham, Ward and Schleip said that Golgi receptors are said to be found all over in dense proper connective tissues. They exist in ligaments (here called *Golgi end organs*), in joint capsules, as well as around myotendinous junctions (here called *Golgi tendon organs*). These sensory receptors are arranged in series with facial fibers and respond to slow stretch by influencing the alpha motor neurons via the spinal cord to lower their firing rate, i.e. to soften related muscle fibers. Cottingham suggested that during STM these Golgi receptors are stimulated, which results in a lower firing rate of specific alpha motor neurons, which then translates into a tonus decrease of the related tissues. **(Schleip R. 2003[35])** Leon Chaitow (2010) says that after applying STM there is Changes of blood levels of b-endorphin serotonin, endogenous cannabinoids which improves circulation and drainage and decreases the muscle spasm which further induces relaxation. Then there is re-alignment of soft tissue takes place and breaking of adhesions which leads to increased range of motion. (**Leon Chaitow 2010[22])**

The another result of present study showed no improvement in glenohumeral external rotation and overhead reach in subjects who had received STM alone but there is improvement in the glenohumeral external rotation, abduction and pain in subjects who had received STM and PNF together but there is also no improvement in overhead reach. So in present study result was showed that STM and PNF together are more beneficial for restricted range of motion than STM alone.

Godges J (1989) supported the present study result and proved that STM and PNF together improve range of motion. After applying PNF it induces greater relaxation in the muscle by employing both the 2 neurophysiological and the mechanical components of musculotendinous flexibility which produces greater elongation of the muscle belly and tendon. **(L R Osternig et al 1987[21], Osternig LR 1990[27], S. P. Magnusson E. B. 1995[33], Sandra M. Condon et al 1987[34], Taylor DC 1990[36], Reed Ferber 2002[30]).** PNF and STM together beneficial for increasing ROM because they provide changes in the myofacial length. **(Philip W McClure et al 1992[29])**STM is effective in increasing ROM but patients who received STM alone can began to experience an increase in their symptoms once again. **(Anita R. Gross, 2004[4])**

Treatment of the internal rotation contracture and pain can be done by releasing subscapularis. **(MacDonald PB et al 1992)[23]**Flexibility is considered to be a valuable component of athletic performance**. (Decicco PV et al 2005[11], Jiwu Chen et al 2012[16]).** Limitation of the study was that we did not touched the capsular structures, and we used only one technique of PNF i.e. Contract-relax. Future studies can be done by utilizing capsular stretching. Limited shoulder ROM is a common problem in shoulder disorders, so we can use PNF with STM to increase ROM. The study concluded that combined effect of STM with PNF is effective in gaining glenohumeral ROM, overhead reach in frontal plane along with pain perception.

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