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EFFECTS OF SUSTAINED INFERIOR CAPSULAR STRETCHING IN THE TREATMENT OF ADHESIVE CAPSULITIS

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ABSTRACT

Inroduction: Adhesive Capsulitis typically is referred to as the spontaneous onset of gradually progressive shoulder pain and severe limitation of movement. Features of this pathologic condition include microscopic evidence of chronic capsular inflammation with fibrosis and perivascular infiltration. Although several researchers found no evidence of inflammation, they concurred that fibrosis exists in the capsule, characterized by adhesions of synovial folds; obliteration of the joint cavity; and a thickened, contracted capsule that eventually becomes fixed to the bone. **Aim:** To compare the effectiveness of sustained inferior capsular stretching versus passive joint mobilization in the treatment of Adhesive Capsulitis. **Objectives:** 1)To compare effectiveness of sustained inferior capsular stretching versus passive joint mobilization in treatment of Adhesive Capsulitis 2)To compare the efficacy of sustained inferior capsular stretching and passive joint mobilization for the improvement in Range Of Motion(ROM) 3)To assess & compare pain reduction with both techniques. **Method:** 30 subjects of grade II Adhesive Capsulitis were randomly allocated to equal groups A and B of 15 each to receive sustained inferior capsular stretching and passive joint mobilization respectively. The outcome measures used were goniometer measurements and NPRS on day 1 and day 14 of treatment. **Results and Conclusion:** The study concluded that Sustained inferior capsular stretching is more effective than passive joint mobilization in treatment of Adhesive Capsulitis. In 14 So it can be further used as an alternative to joint mobilization.

KEYWORDS: Sustained Inferior Capsular Stretching, Adhesive Capsulitis, Passive Joint Mobilization. NPRS, Goniometer.

INTRODUCTION

Adhesive capsulitis clinically referred to as adhesive capsulitis has been described as a condition of "unknown etiology characterized by gradually progressive, painful restriction of all joint motion with spontaneous restoration of partial or complete motion over months to years"[1]

Adhesive capsulitis or frozen Shoulder is a condition of uncertain etiology characterized by substantial restriction of active & passive shoulder movements and occurring in absence of a known shoulder intrinsic disorder.[1]

Adhesive capsulitis affects approximately 2% to 5% of general population and 10% to 15% of the population with diabetes. It is often considered a self limiting condition[2,3] but there are studies showing a considerable number of untreated patients with long term disability & pain. It affects people in their fourth to sixth decade of life and more often women and especially patients with diabetes are more prone to get adhesive capsulitis.[5] The predominant features of this condition are pain, restricted motion or stiffness in shoulder. Studies have been done on the relationship between shoulder ROM & function. The results showed that people with loss of shoulder ROM have difficulty in completing their activities daily living. Overall condition affects work, leisure & general quality of life.

Despite the relatively low percentage of general population affected by idiopathic loss of shoulder ROM, the long term limitations experienced by these patients suggest that greater understanding of the condition & more effective intervention approaches are needed. One of the major current treatment options available for frozen shoulder is physiotherapy through the use of modalities such as application of moist heat or cold, ROM & strengthening exercises, stretches & manual therapy along with providing patient education & home exercise programme.

Results of studies regarding the relationship between shoulder ROM & functional status of patients support impairment based rehabilitation approach, because the impairment measures were substantially associated with functional activity status.

Mobilization techniques applied close to the articular surface in ventral, dorsal and inferior directions of the gleno-humeral joint are frequently used by physical therapists as an intervention for limited joint range of motion. Passive stretching is a therapeutic maneuver

designed to lengthen pathologically shortened soft tissue by using an external force, applied either manually or mechanically and thereby facilitate increase in range of motion.[4]

Joint motion stimulates biological activity by moving synovial fluid, which brings nutrients to the avascular articular cartilage of the joint surface & intra-articular fibrocartilage of menisci, and hence help to increase range of motion of the joint.[8]

Joint mobilization technique such as traction & glide area used to stretch the adhered capsule & improve the physiologic accessory movement. Traction involves distraction of one articular surface perpendicular to other & gliding involves translation movement of one articular surface parallel to other. These techniques are considered capable of stretching the particular connective tissues that may limit joint motion without impingment, resulting in an improvement of limited ROM & reduction in pain.

The effectiveness of these approaches were reported in a Cochrane review which included approximately 32 studies, of which 28 were randomized controlled trials. The conclusion was, although exercises and mobilization is effective for frozen shoulder, there is no evidence that physiotherapy alone is beneficial. Each of the studies had variability in methods. In addition, the quality of study was poor, making the task of finding the effective treatment strategy more difficult.

This study attempts to find out the effect of capsular stretching & passive mobilization in the management of adhesive capsulitis.

METHODOLOGY

The participants were attending the out patient physiotherapy department of the college, Dr. D. Y.Patil medical college & research center & Dr. D.Y. college of physiotherapy, Pimpri, pune Subjects fulfilling the inclusion and exclusion criteria were selected from target population by a Simple Random sampling. All 30 subjects willingly participated in the study and their written informed consent form was taken. Detailed assessment was taken from each individual. Instructions were given to the subjects regarding the techniques to be performed. Proper care was taken in terms of patient's privacy and physiotherapist's safety. After recording the demographic data, the following procedure was done.

Inclusion Criteria

a) Pain and Restricted movements of unilateral shoulder.

b) Both sexes.

c) Adhesive capsulitis stage II referred by orthopedician.

Exclusion Criteria

a) Fracture of the humerus, scapula, or clavicle.

b) Shoulder dislocation, subluxation or ligament injury of the shoulder.

c) Peripheral neurological involvement in the upper extremity.

d) Shoulder arthroplasty

e) Shoulder impingement syndrome

f) Mentally unstable patients.

Procedure

A total of 30 subjects were divided equally into two groups A and B by random lottery method. Each group had 15 participants. The group A received sustained inferior capsular stretching and the group B received passive joint mobilization. Before that interventions of each group started with moist heat as passive warm up and end with cryotherapy as passive cool down for 14 days. The outcome measures used were goniometer measurements for flexion and abduction of affected shoulder & NPRS for pain. Data was analyzed.

Each patient assessed on day 1st i.e. pre-treatment and on day 14th i.e. post- treatment.

Group A

The subjects of group A received sustained inferior capsular stretching with the help of coutertraction. The shoulder countertraction apparatus constitutes a overhead pulley on a wall-fixed L- shaped steel frame (2.5 feet in length) with free weights of approximately 2 to 3 kg fixed at one end of the rope (3 m in length) passing through the pulleys while the other free end of the rope is connected to the distal end of the subject's affected upper limb which is covered with a cuff and medium- sized bandage (similar to the application of a crepe bandage for skin traction) just above the elbow. The ends of the rope are connected with an S hook. The patient was positioned comfortably to sit upright in a chair with a back rest. Weight was added based on the body weight cutoff of 60 kg. If the patient weighs more than the cutoff value (≥ 60 kg), 3 kg was set as the distracted load, whereas if the patient weighs less than the cutoff value (< 60 kg), 2 kg was set as the distracted load. The intervention

started by moist heat for 5 minutes, sustained inferior capsular stretching for 10 minutes and cryotherapy for 5 minutes. The total treatment time was 20 minutes once a day for 5 days per week for 2 weeks.[17]

Group B

Intervention started with moist heat for 5 minutes. Maitland mobilization posterior and inferior glide grade 3-4, for improvement in flexion and abduction respectively.

For posterior glide (fig 1) patient in Supine, with the arm in resting position, grasping the distal humerus with lateral hand. The lateral border of top hand just distal to the anterior margin of the joint, with fingers pointing superiorly. This hand gives the mobilizing force. Glide the humeral head posteriorly by moving the entire arm.

For inferior glide (fig. 2) patient in supine position with the arm abducted to the end of its available range, the patient's arm against trunk with the hand farthest from the patient. the web space of other hand just distal to the acromion process on the proximal humerus. With the hand on the proximal humerus, glide the humerus in an inferior direction.

These interventions administered for 2 minutes interspersed with a rest period of 30 seconds for 10-15 repetitions[23], for 10 minutes. Every session end with cold therapy for 5 minutes. The total treatment time was 20 minutes once a day for 5 days per week for 2 weeks.[17]

Outcome measures

Goniometer

Numerical pain rating scale

Data interpretation

Table. 1: Comparison of Age of patients between two groups.

Parameter	Group A	Group B	'P' Value
Age(yrs)	51.86 ± 4.62	50 ± 5.51	0.325

(t-test is applied, p value is significant if $p<0.05$ and highly significant if $p<0.01$.)

Both groups were comparable with respect to age without any statistically significant difference.

Table. 2: Comparison of weight of patients between two groups.

Parameter	Group A	Group B	'P' Value
Weight(kg)	67.86 ± 7.08	66.73 ± 11.03	0.741

(t-test is applied, p value is significant if p<0.05 and highly significant if p<0.01.)

Both groups were comparable with respect to weight without any statistically significant difference.

Table. 3: Pretreatment ROM (Range of Motion).

ROM	Group A	Group B	'P' Value
Flexion	106.66 ± 10.12	108.33 ± 9.57	0.646
Abduction	92.33 ± 8.63	93.33 ± 8.38	0.750

(t-test is applied, p value is significant if p<0.05 and highly significant if p<0.01.)

Both groups were comparable with respect to average blood loss without any statistically significant difference.

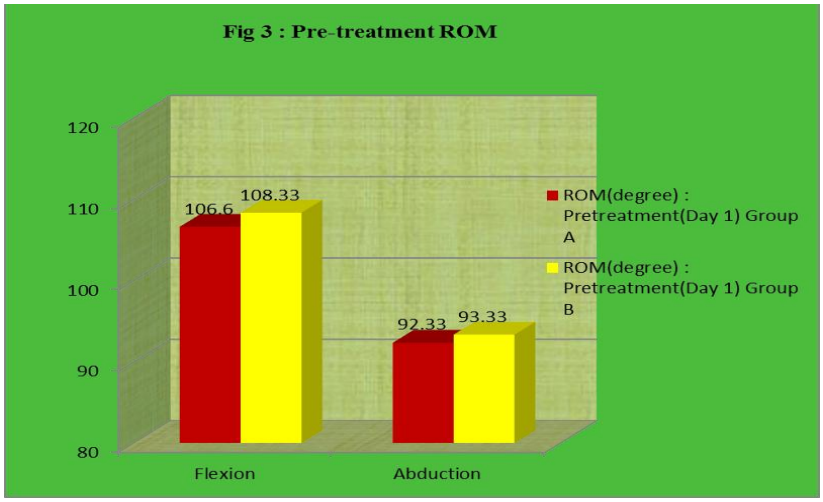


Table. 4: Pretreatment NPRS in both groups.

Parameter	Group A	Group B	'P' Value
Pretreatment NPRS	7.86 ± 0.64	7.73 ± 0.70	0.161

(t-test is applied, p value is significant if p<0.05 and highly significant if p<0.01.)

Both groups were comparable with respect to average duration of surgery without any statistically significant difference.

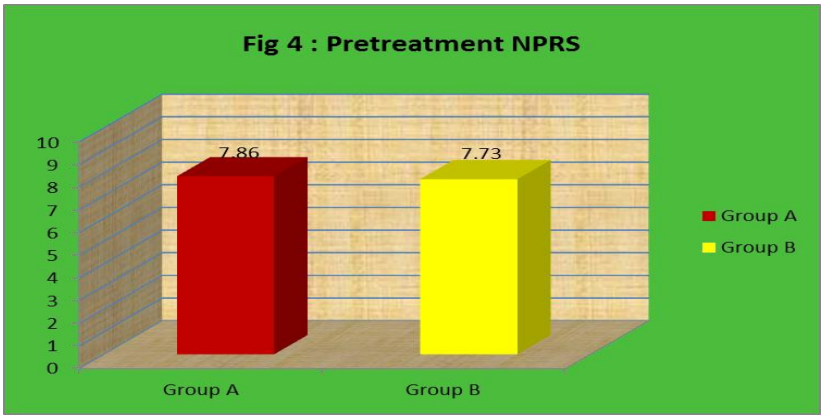
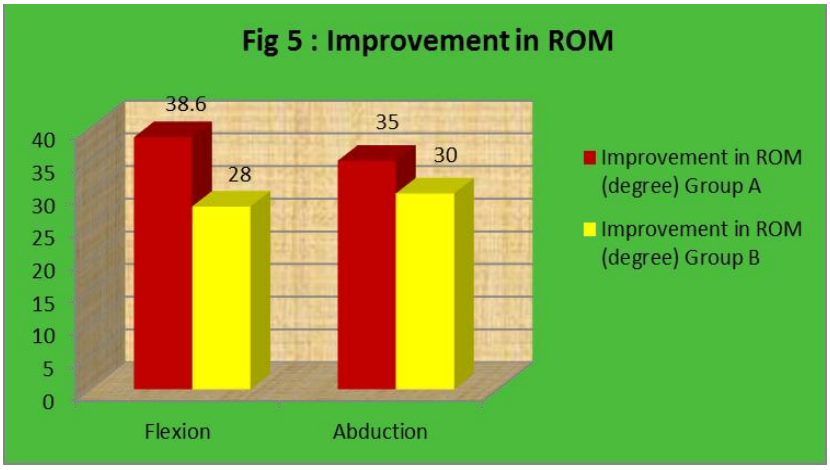
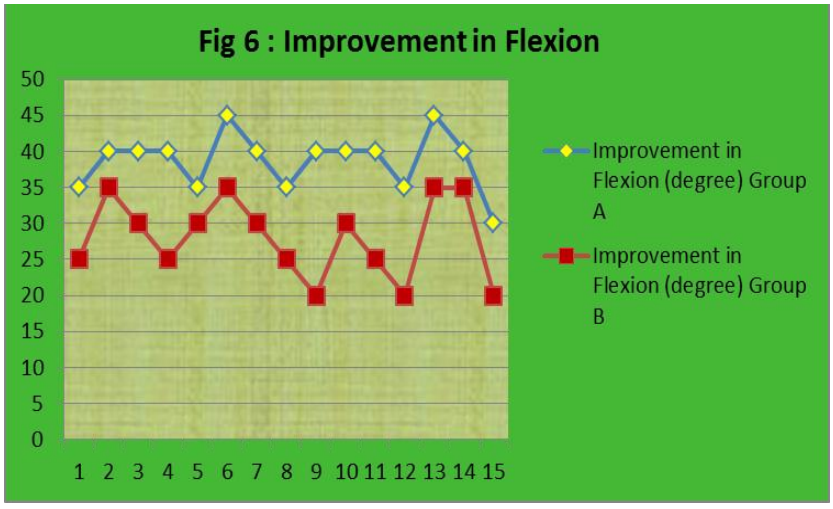


Table. 5: Improvement in ROM (Range of Motion).

Improoement in ROM	Group A	Group B	'P' Value
Flexion	38.66° ± 3.99	28° ± 5.60	<0.001
Abduction	35° ± 4.22	30.33° ± 5.81	<0.001

(t-test is applied, p value is significant if p<0.05 and highly significant if p<0.01.)





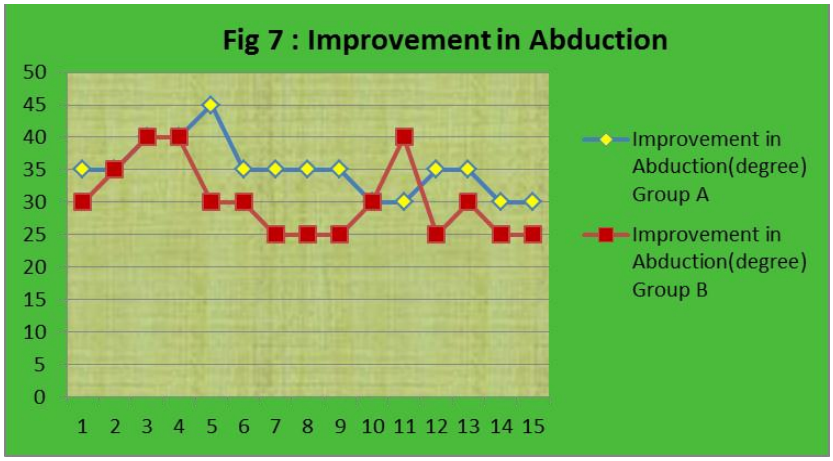
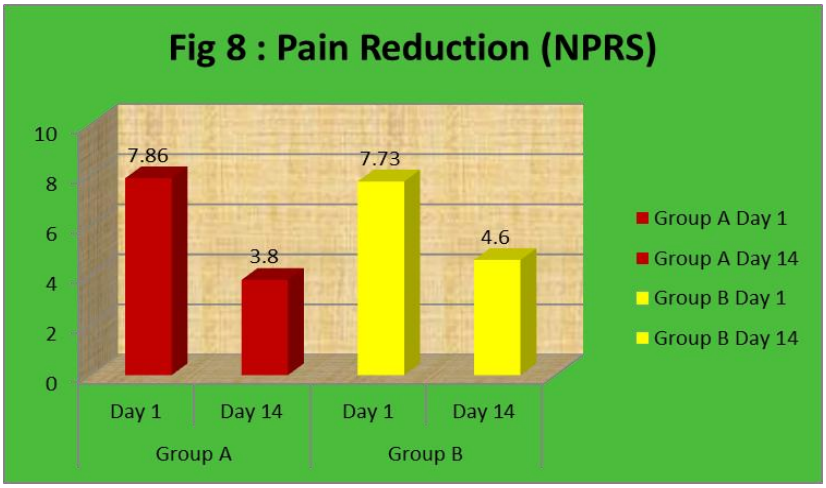


Table. 6: Post-treatment NPRS in both groups.

Parameter	Group A	Group B	'P' Value
Post- treatment NPRS	3.8 ± 0.67	4.66 ± 0.62	0.001

(t-test is applied, p value is significant if $p<0.05$ and highly significant if $p<0.01$



RESULTS

In the study 30 participants were devided equally i.e. 15 in both group A and group B. Participants were comparable without any statistically difference between their age, sex, weight, pre-treatment ROM and pre-treatment NPRS.

Data analyzed by using paired t test. Both groups achieved improvement in range of motion and pain reduction, however more improvement seen in group A.

In group A improvement in flexion and abduction is 38.6±3.9 and 35±4.2 respectively, while in group B improvement in flexion and abduction is 28±5.6 and 30±5.8 respectively. (P value = $P \leq 0.005$).

The data analysis was done using the WINPEPI software version 11.38.For the analysis of matched observations the paired T test was applied using the PAIRS etc version 3.32 of the WINPEPI software version 11.38 programmes.

The paired T[43] test was done to test the intergroup significance. The Two-Sample t-Test analysis tools test for equality of the population means that underlie each sample. The paired test is used when there is a natural pairing of observations in the samples, such as when a sample group is tested twice — before and after an experiment. In paired t test the two samples represent before-treatment and after-treatment observations on the same subjects.[24]

FORMULA

Sample size =n=

$4\sigma^2/L^2$

Where, 4 is the constant

σ is the SD [standard deviation]

L is the standard error

Mean=$\bar{x}$=

ΣX/n

Where, X is the given variable

n is the total number of variables

Standard deviation=SD=

$$\sqrt{\frac{\sum(x-\bar{x})^2}{(n-1)}}$$

Where, x is the sample mean

n is the sample size.

Paired't' test=t=

$$\frac{\sum d}{\sqrt{\frac{n\sum d^2 - (\sum d)^2}{n-1}}}$$

Where d = difference between each subject pair of scores

$\sum d$ = the total of difference.

$(\sum d)^2$ = the total of differences, squared.

$\sum d^2$ = the total of the squared differences

n = number of subjects or pairs of matched subjects.

DISCUSSION

Various physiotherapy techniques have been described for treatment of frozen shoulder, but some studies of these techniques did not have a complete management program[40,41,42] Few of the studies focused on capsular tightness and functional outcomes when compared with pain and stiffness.[43,44,45,46] From studies showing evidence of previous interventions such as manual therapy, stretching, and exercises for a frozen shoulder[47,48,49,50] we focused on manually treating the affected shoulder either by passive joint mobilization or with sustained inferior capsular stretching.

Sustained inferior Capsular stretching & passive joint mobilization both proved to be effective in the treatment of adhesive capsulitis. In this context the present study was conducted to test whether inferior capsular stretching is better than passive joint mobilization for improvement of ROM in stage II Adhesive Capsulitis. The secondary outcome studied was betterment of NPRS for pain reduction.

Patients were randomly allocated to two groups of 15 each to receive either passive joint mobilization or sustained inferior capsular stretching and designated as:

Group A: Received **sustained inferior capsular stretching**

Group B: Received **passive joint mobilization**

Before starting the study, each patient was explained the need of study, the condition causing pain, cause of pain, treatment to be given, and few ergonomic advice. Every patient underwent examination process assessing the range of motion of shoulder flexion and abduction. The outcome measures used were goniometer measurements for flexion and abduction of affected shoulder & NPRS for pain reduction. Each patient assessed on day 1st i.e. pre-treatment and on day 14th i. e. post treatment. The results were then compared and contrasted with other studies done on similar lines.

Passive joint mobilization

Many authors and clinicians advocate joint mobilization for pain reduction and improved ROM.[51,52,53,54] Unfortunately, little scientific evidence exists to demonstrate the efficacy of joint mobilization over other forms of treatment for Adhesive capsulitis. However, patients

treated with joint mobilization, with or without concurrent interventions, had better outcomes.[31,55,52,53,54] Specific joint mobilization techniques are believed to selectively stress certain parts of the joint capsule; for example, an inferior glide with the arm at the side, while in external rotation, would stress the Rotator cuff interval (RCI). While this may be true, it may be more beneficial to view the capsuloligamentous complex (CLC) through the circle concept. The circle concept refers to all regions of the CLC providing stability in all directions (ie, anterior structures providing anterior as well as posterior stability).[56] When this concept is applied to the shoulder with limited glenohumeral motion, improved extensibility of any portion of the CLC results in improved motion in all planes. High-grade joint mobilizations (grades III and IV) are used to promote elongation of shortened fibrotic soft tissues. High-grade mobilizations should be performed with the joint positioned at or near its physiologic end range. It should be noted that immediate ROM gains made with manual techniques (joint mobilization or end-range stretching) represent transient tissue preconditioning.[40]

Sustained inferior capsular stretching

The basic strategy in treating structural stiffness is to apply appropriate tissue stress.[62] It is helpful to think of the total amount of stress being applied as the "dosage," in much the same way that dosage applies to medication. The primary factors that guide this process are pain and ROM. Adjusting the dose of tissue stress results in the desired therapeutic change (increased motion without increased pain). Three factors should be considered when calculating the dose, or total amount of stress delivered, to a tissue: intensity, frequency, and duration. The total end range time (TERT)[63,64] is the total amount of time the joint is held at or near end-range position. TERT is calculated by multiplying the frequency and duration of the time spent at end range daily, and is a useful way of measuring the dose of tissue stress.[63,64] Intensity remains an important factor in tensile stress dose but is typically limited by pain. Traditional ROM exercises are considered lower forms of tensile stress, while the highest tensile stress doses are achieved by low-load prolonged stretching (LLPS), because TERT is maximized. Therefore, the goal with each patient is to determine the therapeutic level of tensile stress.

Tissue stress is progressed primarily by increasing stretch frequency and duration, while keeping the intensity in tolerable limits. The patient may be asked to hold the stretch for longer periods and increase the number of sessions per day. The patient is instructed to avoid

excessive scapular compensation while performing exercises to minimize carryover of abnormal movement patterns as motion returns. As the patient's irritability level becomes low, more-intense stretching and LLPS using a pulley or device are performed to influence tissue remodeling. Tissue remodeling refers to a physical rearrangement of the connective tissue extracellular matrix (fibers, crosslinks, and ground substance). Collagenous tissues respond to increased tensile loading by increasing the synthesis of collagen and other extracellular components.[69,70,71]

The collagen is oriented parallel to the lines of stress, and tensile strength is increased. It is important to note that biologic remodeling occurs over long periods (months), in contrast to mechanically induced change, which occurs within minutes.[72] Brand[73] describes this phenomenon as "growth," not stretch, of the contracted tissue. This growth process is consistent with the recovery process seen in primary frozen shoulder. Commercially available devices, such as the Dynasplint (Dynasplint Systems Inc, Severna Park, MD), and continuous passive motion units can provide LLPS; however, these devices require specific positioning and dedicated time during the day.

CONCLUSION

Hence from the study we conclude that Sustained inferior capsular stretching is more effective than passive joint mobilization in treatment of Adhesive Capsulitis. So it can be further used as an alternative to joint mobilization.

LIMITATIONS

Small sample size

Less reliability of measurement tools.

we could not show in detail with advanced measurement tools the rationale behind the effect of countertraction on capsular stretching.

we did not consider all possible movement of shoulder.

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