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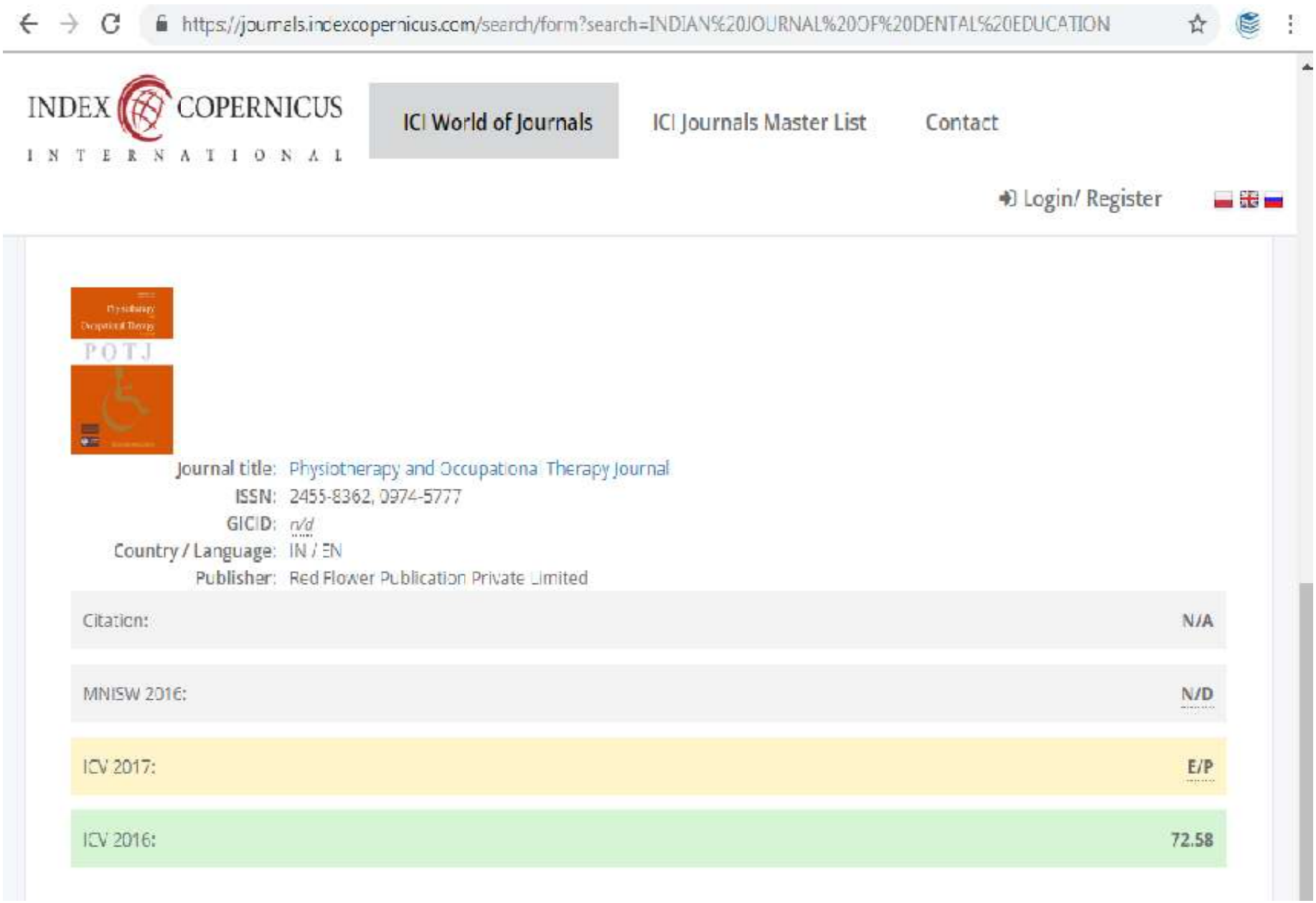
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Effect of Fatigue Exercise on Scapular Stability

Potsangbam Nandita[1], Niraj Kumar[2], Onkar Singh[3]

Abstract

Introduction: The scapula is a flat blade lying along the thoracic wall. It is central in proficient shoulder activity providing a stable base from which glenohumeral (GH) mobility occurs [1]. Any abnormal biomechanics and physiology occurring around the shoulder create abnormal scapular position and motions termed as scapulothoracic dyskinesis [13,8] 'floating scapula' or lateral scapular slide [4]. As rotator cuff functions to depress the humeral head within the glenoid cavity where as scapula rotators position the glenoid in proper place for stability with arm motion [6,4]. Fatigue represents the decline in muscle tension(force) capacity with repeated stimulation hence muscular fatigue worsen or impair joint position sensibility and deterioration in muscle conductivity, contractile and elastic properties [8]. *Need for the study:* The study was undertaken to determine the effect of fatigueness on scapular positioning after exercise and to understand the importance of using fatigue as rehabilitation tool for safe return of athlete to competitive performance level. *Methodology:* There are two groups *Group A*- Right side Dominant shoulder of the same 30 individuals assessed with LSST, MVIC and were given exercise in D2 flexion pattern i.e. shoulder flexion, adduction and external rotation till fatigueness. *Group B*- left side non-dominant shoulder of the same 30 individuals assessed with LSST, MVIC and given exercise in D2 flexion pattern i.e. shoulder flexion, adduction and external rotation till fatigueness. *Limitations:* 1. The study comprises of a small sample size. 2. The study could not be able to do over the overhead throwing athlete. 3. In my study I checked the lateral scapular slide immediately 1min. after the exercise but could not recheck it again after few min or hours in the same day. 4. I neither compare nor correlate the results with the actual muscle activity and power of the muscular, which are responsible for abnormal scapular position. *Scope of Future Study:* 1. Further studies can be done in a well set up laboratory with the usage of Biodex dynamometer for accurate estimation of isometric strength at various degrees 2. Future study can be done on population having proprioceptive loss due to some injury or degeneration. 3. The effect of exercise on scapular stability can be seen for longer period of time i.e., 30 min-1hr or any particular time of the day. 4. Further studies can be done to correlate among larger group of subjects. *Conclusion:* The study concluded that a fatigue induced strength deficit of the shoulder musculature can have an adverse affect on scapular positioning by allowing the scapula to glide more laterally during functional activities. It also come to the conclusion that increase displacement of scapula as a result of fatigue of the shoulder girdle could interfere with normal coordination and joint stability thus can impair function around the shoulder girdle. Thus rotator cuff strengthening has been an obvious treatment for various pathologies.

Keywords: LSST; MVIC and D2 Flexion Pattern; Strain Gauge; Goniometer; Wrist Cuff; Stationary Frame; Hooks And Inch-Tape.

Introduction

The scapula is a flat blade lying along the thoracic wall. It is central in proficient shoulder activity providing a stable base from which glenohumeral (GH) mobility occurs [1].

As rotator cuff functions to depress the humeral head within the glenoid cavity where as scapula rotators position the glenoid in proper place for stability with arm motion. All these groups of muscles are defined by agonists and antagonist working together as force couples providing not only the dynamic glenohumeral stability but also maintain optimal length tension relationship. The appropriate force couples include the upper and lower trapezes working together with rhomboids, paired with the Serratus anterior. Their motor activation patterns are specific for different desired activities. These muscles work together to coordinate the balance of movement between the shoulder joint thereby maintaining scapulohumeral rhythm, which is in the ratio of 2:1 throughout the

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full range of elevation. When musculature weak or fatigued, scapulohumeral rhythm compromised and shoulder dysfunction results [6,4,7,5].

Any abnormal biomechanics and physiology occurring around the shoulder create abnormal scapular position and motions termed as scapulothoracic dyskinesis [13,8] 'floating scapula' or lateral scapular slide [14].

Hypothesis

There will be decrease in isometric strength of scapular stabilizer muscles and increase in lateral scapular slide due to exercise induced fatigue.

Purpose of the study

1. To establish the profile of fatigueness in the scapular stabilizers.
2. To determine the net effect of fatigueness and recurrent microtrauma to the shoulder.
3. To compare the onset of fatigueness after a set of exercise and its induction in strength deficit of shoulder musculature on scapular positioning in the dominant and non-dominant limb pre and post exercise.
4. To determine the effect of exercise on the lateral scapular slide in the dominant and non-dominant limb pre and post exercise.

Objectives

1. To determine fatigueness as an intrinsic factor for shoulder instability or pain.
2. To encourage clinicians, coaches and therapists to understand the importance of using fatigue as rehabilitation tool for the safe return of athlete to competitive performance level.

Need for the study

The study was undertaken to determine the effect of fatigueness on scapular positioning after exercise and to understand the importance of using fatigue as rehabilitation tool for safe return of athlete to competitive performance level.

Operational Definitions

Fatigue

It is decline in force during a maximal contraction or duration for which a force can be maintained. It can also be define as a state of increased discomfort and decreased efficiency, power or capacity to respond to stimulation due to prolonged or exercise exertion.

Lateral Scapular Slide test (LSST)

It is use to evaluate scapular stability by comparing the distance between a fixed point on the vertebral column and the scapula on the tested side in various ranges of scapulothoracic and glenohumeral joint.

Flexibility

It deals with a joint or a series of joints used to produce a particular movement. It is both static and dynamic in nature. Flexibility is limited by the ability of the tissues to lengthen quickly.

Isometric strength

It is the static muscle work against maximal resistance at a particular point of the range. The resistance demands the greatest possible increase in intramuscular tension.

Maximum voluntary isometric contraction

It is the maximum amount of tension, which can be generated by scapular stabilizers isometrically without any trick movement.

D2 Diagonal Pattern

These are the diagonal movement i.e. the path in which maximal response of functional relationship can be facilitated.

D2 flexion: - Abduction and External rotation of shoulder

Literature Review

Shoulder Musculature & function

Della Valle CJ et al.,(2001) and Kibler WB,(1998) has reviewed that the shoulder complex muscles can be classified by anatomic and functional groupings. The first anatomic group comprises the trapezius, rhomboids, levator scapulae and Serratus anterior concerned with stabilization and rotation of the scapula. The second group includes extrinsic muscles – the deltoid, biceps and triceps which involved in gross motor functions and movement of the arm and force generation of the hand. The final group includes intrinsic muscles of the rotator cuff –

the subscapularis, the supraspinatus, infraspinatus and teres minor which are responsible for fine motor movements and compression of humerus into shoulder joint [55,57,58,59].

Likewise by Paine R.M, Voight ML in (1993) also mentioned that stability at the scapulothoracic joint depends on the surrounding musculature. When weakness or dysfunction is present, normal scapular positioning and mechanics may become altered and also may predispose the individual to shoulder injury [2].

Shoulder Characteristic in Players

Alfredson et al. (1998) seen that young volleyball players have a higher bone mass in the proximal humerus, distal humerus and distal radius in the dominant compared with non dominant arm and it is more likely a cause effect relationship [32]. Also seen that range of motion was less in dominant side than non dominant side [33,34].

H.K Wang et al. (2001) found active range of internal rotation and concentric rotators strength in dominant arm was significantly less than in non dominant arm but internal rotator were significantly stronger in both concentric and eccentric tests at both testing speeds [35].

Shoulder injuries related with fatigue

Brady L, et al. (2004) proposed a dysfunction mechanoreceptor theory in which muscle fatigue is believe to desensitize the muscle spindle thresholds. This sensitization would serve to decrease afferent feedbacks to the CNS, which is caused by local metabolism interfering at the muscular level, CNS fatigue and neuromuscular fatigue [49].

In 2002, Bryan L, Reinmann & Scott, proposed that joint stability is a phenomenon, which requires the activation and control of dynamic restraints as a result of integration of entire motion control system of body [46]. The motion control is optimized by the proprioceptive information conveyed to all levels of CNS. Hence proprioceptive information is necessary for neuromuscular control of dynamic restraints [47].

Jobe et al. (1989) suggest that mild anterior GH instability is a consequence of the progressive attenuation of the static anterior stabilization structures from repetitive throwing. Also show an injurious cycle ensures, with fatigue of dynamic stabilization leading to further GH anterior translation and encroachment of the coracoacromial arch [62].

Lateral Scapular Slide test (LSST)

Several studies have been performed to determine the reliability and validity of LSST in comparison with radiographic comparison for the validity of LS glide measure was found to have a co-relation coefficient of more than 0.90 [19,29,30].

Kibler has suggested that LSST may be used to monitor the scapular stabilization in any rehabilitation program that involve strengthening exercise [15].

Shoulder Rehabilitation

Lexington Clinic Sports Medicine center unpublished data, 1999 suggested that the PNF D2 pattern exercise can mimic functional directionality and facilitate tripolar conditioning. This exercise can be progressed by using dumbbells, tubing theraband to make it a plyometric exercises [1].

Methodology

Subjects 30 subjects including of boys and girls were included for the study. The study is an experimental study. The study was taken on Sports College, Raipur and SBSPGI, Balawala. There are two groups, Group A- Right side Dominant and Group B- left side non-dominant shoulder of the same 30 individuals. Inclusion criteria Boys and Girls at the age group 20-25 yrs., Overhead throwing sport players, No history of shoulder pain presently or recently, No past history of trauma and surgery undergone, Should not have any cervical pain, neuralgia, elbow pain, wrist pain & neuromuscular disorder, Subjects were excluded history of neuromuscular disorder, History of recent stress fracture or dislocations or subluxation, Non compliance with testing procedures, Hyper trained cervical shoulder, Hyper laxity of shoulder joint and If the subject is unable to understand instruction or to provide informed consent. Instrumentation for data collection includes Strain gauge, Goniometer, Wrist cuff, Stationary frame, Hooks and Inch-tape.

Procedure

Randomly selection of either boys and girls (n=30) of mean age 22.7±1.74, mean height 162.36cm ±7.67cms and mean weight 55.46±5.72 kgs were included.

There are two groups, Group A- Right side Dominant shoulder of the same 30 individuals

assessed with LSST, MVIC and were given exercise in D2 flexion pattern i.e. shoulder flexion, adduction and external rotation till fatigueness. Group B- left side non-dominant shoulder of the same 30 individuals assessed with LSST, MVIC and given exercise inD2 flexion pattern i.e. shoulder flexion, adduction and external rotation till fatigueness.

All the participants were given verbal instructions for the testing and a signed consent form was obtained from each of them prior to the participation in the study. Each subject's descriptive data and information regarding arm dominance, injury status and game history were recorded to satisfy the subject selection criteria. An objective examination was done to evaluate and observe the scapula both statically and dynamically in relation to its role in the entire kinetic chain for both the limb from behind the patient and looked for any asymmetry, deformity, atrophy etc. A physical examination was done which consisted of thorough evaluation of both shoulder range of motion. The LSST begins with the establishment of a measurement reference point on the nearest spinous process to the inferior angles of the scapula. With the subject's arm at the sides in the anatomical resting position, the distance from the inferior angle of the involved (first the dominant side) scapula in measured from the reference point. The second position of measurement is with the patients hands on the hips, with the finger anterior and the thumb posterior. This position places the humerus in approximately 45° of abduction (Fig. 4). The third measurement position of 90° of arm elevation with maximal internal rotation (thumb to floor) at the glenohumeral joint. This final position was chosen because it presents a challenge to the scapula stabilizing muscles in a much more functional position. Range of motion was assured by goniometer measurement of shoulder abduction while the subject was in standing position (Fig. 2 & 3).

For measuring isometric strength, a strain gauge was used. Arm dominance was determined first then the MVIC was obtained in the position of D2 flexion pattern i.e. shoulder flexion, adduction and external rotation (Fig. 1). Three isometric muscle contractions of three seconds duration were performed and the maximum force elicited was used as a criterion score. After these examinations, exercise was given. The exercise using the surgical tubing was performed by the subject to the point of fatigue or until the subject, loses the ability to maintain the shoulder in a 90° abducted position Rest was given for 1 min after the exercise and again MVIC was checked same as before in the same position repeated for three times each of three seconds duration and within 2 min the LSST were again investigated in the three positions. The same procedures described above were repeated for the non-dominant side limb and the same readings were taken and compared between them.

Data Analysis

There are two groups, Group A- Right Group B- left.

Fig. 1: D2 Pattern Exercise

Fig. 3: LSST at 90

Fig. 2: LSST at 180

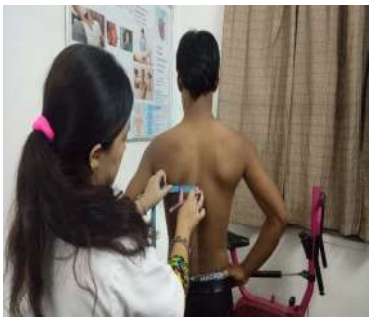

Fig. 4: LSST at 45

In this study lesser than 0.05 has been considered statically significant and greater than 0.05 as not significant. Mean (standard deviation) was computed for each groups in each particular degrees and compared within same groups using paired t test and between the different groups using independent t test.

Results

30 subjects including of boys and girls, who were randomly selected, in age group of 20-25 years (mean 22.7±1.74) with mean height (162.3±7.67cm) and mean weight (55.46±5.72) were included and within the same subject they were divided into group A for right side and group B for left side and were co-related for changes in scapular displacement at 0°, 45° and 90° between pre and post exercises and also the isometric strength was compared pre and post exercise.

Range of Motion

Paired 't' test has been performed to compare between pre and post exercises at different degrees(0°, 45° and 90°) within group A and B and the results were significant ($p<0.05$) for each group at each particular degrees. Unpaired 't' test has been performed to compare between group A and B for mean difference at various degrees. The result shows significant ($p<0.05$) difference at only 45°, there mean difference and SD were 0.97±0.83 for group A and 0.47±0.72 for group B and non significant ($p>0.0°$ 5) difference at 0and 90°. Student 't' test has been performed for comparing the mean of AROM of scapular abduction, pre exercise between 0° vs. 45°, 0° vs. 90° and 45° vs. 90° within the same group and result shows that significant differences are there. Same t-test was performed for comparing the mean for post exercise in same pattern and significant differences are present. ($p<0.05$) Student paired t-test performed to compare pre and post exercise for changes in isometric strength within same group and result are significant. Un-paired t-test was performed to compare the group A and group B for isometric strength for mean differences and the result show non significant ($p>0.05$). Their mean diff. and SD were 0.74±0.72 for group A and 70±0.71for Group B Student un-paired t test was performed to compare pre exercise between the group and result shows significant differences.

Discussion

This study was designed to obtain more thorough understanding of the effect of exercise induces fatigue in the D2 pattern flexion- extension on the amount of scapular lateral displacement and in the isometric strength. The study was also done to compare the scapular position after exercise in both dominant and non dominant hand.

Before implementing the experiment, the pre values of various ranges of the two group were compared between them using independent t-test and the result shown to be non significant which forms the baseline of my study.

The result of this study shows the pre test measurement of the two groups at various degrees show significant difference with the post test measurement, (Table 1). This significant difference has been resulted from the fatigue induced by the exercise. This result is supported by the study done by Thomson and Mitchell [24] and also Carpenter et al and Voight et al. [25] who suggested that a fatigue induced strength deficit of the shoulder musculature can have an adverse effect on scapular positioning and also on the shoulder proprioception, where joint kinesthesia is decreased.

In my study I have taken healthy subjects which show decreased asymmetry as they progress from the first (0°) to third (90°) position LSS. After the exercise cessation due to development of fatigue there was difference in the range of 0-1.5cm in each particular range in both the group. Kibler recognized a 1cm difference as clinically significant [23]. Recently, he has increased their threshold of abnormality to 1.5cm [19]. When pathology is present, it is not unusual to have

Table 1: t test to compare Pre and Post at different degrees (0^0, 45^0, 90^0) within Group A (Right) and Group B (Left) for lateral scapular slide

Degrees	Group A P value	Group B P value
0	S	S
45	S	S
90	S	S

asymmetry of as much as 3cm. This shows changes in asymmetry at various degrees pre and post exercises showing significant differences (Table 3,4).

Several studies have been performed to determine and validity of the LSST in which it is compared with radiographic examination [19,29,30]. and the result were found to have a correlation co-efficient of more than 0.90 [19].

A significant difference was detected between pre and post fatigue scores. No significant difference was detected between dominant (Group A) and non dominant (Group B) extremities when the arm is in the first and third position i.e. in the anatomical resting position and 90° of arm elevation with maximal internal rotation respectively. But significant difference was detected in the second position which is a transitional, gradual progression of difficulty to the scapular stabilizing musculature [1] (Table 2).

A significant difference was also detected between the pre and post fatigue scores in terms of isometric strength (Table 5). In my study since I used D2 flexion-extension pattern as the means of exercise and this involve the concentric, isometric and eccentric movement of shoulder musculature. So the muscle force may decline after concentric or isometric exercise because of fatigue and this is accompanied by perturbations of force perception. In eccentric exercise, where the active muscle is forcibly lengthened, components of force drop are thought to result from the disruption of sarcomeres and damage to some muscle fibers which may eventually develop localized contracture and lose their ability to generate active tension [45].

Table 2: t test to compare Group A and Group B for mean differences at various degrees For lateral scapular slide

Degrees	Group A Mean differenc ± S.D	Group B Mean difference ± S.D.	P value
0	0.57± 0.53	0.64± 0.62	N S
45	0.97± 0.83	0.47± 0.72	S
90	1.04± 0.76	1.05± 0.79	N S

$p < 0.05$ → Significant(S)
$p > 0.05$ → not significant(NS)

Table 3: t test between Pre exercise at various degrees (00, 450, 900) within Group A (Right) and Group B (Left) for LSST.

Variables	Group A P value	Group B P value
Post 0 vs Post 45	S	S
Post 0 vs Post 90	S	S
Post 45 vs Post 90	S	S

$p < 0.05$ → Significant(S)
$p > 0.05$ → not significant(NS)

Table 4: t test between Post exercise at various degrees (00, 450, 900) within Group A (Right) and Group B (Left) for LSST.

Variables	Group A P value	Group B P value
Pre 0 vs Pre45	S	S
Pre 0 vs Pre 90	S	S
Pre 45 vs Pre 90	S	S

$p < 0.05$ → Significant(S)
$p > 0.05$ → not significant(NS)

Table 5: t test to compare Pre and Post within Group A (Right) and Group B (Left) for Isometric strength

	Group A P value	Group B P value
Pre vs Post	S	S

Table 6: t test to compare Group A and Group B for mean differences for Isometric strength.

Group A Mean diff ±S.D.	Group B Mean diff. ± S.D.	P value
-0.74 ±1.15	-0.70 ±0.71	NS

$p < 0.05$ → Significant(S)
$p > 0.05$ → not significant(NS)

There was no significant difference in the muscle's isometric strength between the group A and group B (Table 6). This result is supported by J. Magalhaer et al. [28] who also didn't show significant difference in leg bilateral deficit between soccer and volleyball players, with the exception for hamstrings muscle group evaluated at 90°/s. In their opinion there was no consistent reason that could justify their difference unless they could speculate about probable unilateral demands of hamstrings recruitment in stabilizing muscle actions in some specific soccer skill.

The primary mechanical factor that may related to fatigue is cross bridge cycling and ATP is needed for both the activation of the cross bridge to cause movement and the dissociation of the cross bride from action. Exercise can cause a physical disruption of the sarcomere and reduce the capacity of the muscle to produce tension. A high H+ concentration due to high rate of lactate ways like reduce the force per cross bridge, inhibit SR Ca++ release.

Limitations

1. The study comprises of a small sample size.
2. The study could not be able to do over the overhead throwing athlete.
3. In my study I checked the lateral scapular slide immediately 1min. after the exercise but could not recheck it again after few min or hours in the same day.
4. I neither compare nor correlate the results with the actual muscle activity and power of the muscular, which are responsible for abnormal scapular position.

Scope of Future Study

1. Further studies can be done in a well set up laboratory with the usage of Biodex dynamometer for accurate estimation of isometric strength at various degree
2. Future study can be done on population having proprioceptive loss due to some injury or degeneration.
3. The effect of exercise on scapular stability can be seen for longer period of time i.e., 30 min-1hr or any particular time of the day.
4. Further studies can be done to correlate among larger group of subjects.

Conclusion

The shoulder must be considered a kinetic chain made up of several joints. The normal function of the scapula and surrounding musculature is vital to the overall normal function of the scapula. The study concluded that a fatigue induced strength deficit of the shoulder musculature can have an adverse affect on scapular positioning by allowing the scapula to glide more laterally during functional activities. It also come to the conclusion that increase displacement of scapula as a result of fatigue of the shoulder girdle could interfere with normal coordination and joint stability thus can impair function around the shoulder girdle. Thus rotator cuff strengthening has been an obvious treatment for various pathologies. Since the origins of the rotator cuff muscles arise from the scapula, an effective exercise regime for rehabilitation should include improving the strength and functions of the muscles that control the position of the scapula. Weakness of these anchoring muscles may lead to altered biomechanics of the glenohumeral joint, with resultant excessive stress impaired to the rotator cuff and anterior capsule.

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Effect of SLR and Isometric Exercise on Quadriceps Lag of Normal Health Individual

Anirban Patra[1], Niraj Kumar[2], Archana Chauhan[3]

Abstract

Introduction: The term "muscle lag" and the more specific term "extensor lag" and "quadriceps lag" have been in use for at least 40 years. Muscle an inability to actively move a joint to its passive limit [5]. Extensor lag accompanying knee lesions is a function of great loss in mechanical advantage of the quadriceps during the last 15 degrees of the extensor range, 60 percent increase inforce being needed to complete the extension [3]. Straight leg raising for increasing quadriceps strength was unable to isolate the vastus medialis from the vastus lateralis muscle [8, 10,12]. *Aim and Objective:* The objective of this study is to determine the effect of SLR and isometric quadriceps exercise on quadriceps lag of normal health individual. *Need of Study:* To best of our knowledge no studies have been done on to determine the effect of SLR and isometric quadriceps exercise on quadriceps lag of normal health individual. *Methodology:* A Total of 60 normal healthy young subjects were recruited for the study. The subjects were divided into two groups. Group A and Group B. Group A 30 subjects were included with their mean age (24.76+3.38) year. Group B 30 subjects were included with their mean age (27.16+3.94) year. A subject was given isometric exercise and Group B subjects were given SLR for 3 weeks. *Results:* Independent t-test was used between the group A and B before and after exercise. It showed that there was no significant difference between the group A and B before exercise. But there was significant difference between the group A and B after exercise ($P < 0.05$). *Future Research:* The present study was done on small sample size. So, future research on large sample population can be done & Present study duration was 3 weeks, so a study of long duration can be done. *Limitation of the Study:* 1. Since the study was conducted with healthy subject the results can not be readily generalized to a patient population without further research. 2. Since the instrumentation used is a universal protractor goniometer (360^{o}) there are some probabilities of errors in the reading as compared to the method incorporating video imaging technique. 3. The sample size is small. *Conclusion:* The study has shown that the quadriceps lag can be greater reduce on isometric exercise compare to SLR exercise. So, the study concluded that the Isometric exercise have more effect on quadriceps lag compare to SLR exercise.

Kyewords: Universal Goniometer; Isometric Exercise & Slr Exercise.

Introduction

The term "muscle lag" and the more specific term " extensor lag" and "quadriceps lag" have been in use for at least 40 years. Muscle an inability to actively move a joint to its passive limit [5].

The main factors may precipitate pathological muscle lag – (1) an abnormal increase in muscle length (as may occur following suture of rupture muscle, or fracture with loss of bone length). (2) Disuse atrophy (3) Myopathy (4) Neurological (5) Pain induced or other arthrogenic muscle inhibition [5].

Force developed by a contracting quadriceps must be increased 60% to achieve the final 15 degrees of active knee extension. Quadriceps weakness will be most evident in this final extension range, and is often accompanied by lag [5,6].

Fredrick J Lieb, et al., found out assign responsibility for the last 15 of knee extension to the vastus medialis. Its action is deemed essential for maximum joint stability [3, 4].

Duchenne described the extensor of the knee as the rectus femoris, vastus lateralis, and vastus medialis and noted vastus medialis has somewhat greater power of extension than does the vastus leteralis. Smillee stated that the " vastus medialis is by far the most important component of the

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extensor apparatus, for not only are these final few degrees of extension the most vital in the whole range, but it is the vastus medialis which is most entirely responsible for the stabilization and protection of the joint from injury [3].

The extensor lag accompanying knee lesions is a function of great loss in mechanical advantage of the quadriceps during the last 15 degrees of the extensor range, 60 percent increase inforce being needed to complete the extension [3].

Knight et al., compared straight leg raising with knee extension and actually found the vastus laterailis muscle more active [10].

Straight leg raising for increasing quadriceps strength was unable to isolate the vastus medialis from the vastus lateralis muscle [8,10,12].

Aim and Objective

The objective of this study is to determine the effect of SLR and isometric quadriceps exercise on quadriceps lag of normal health individual.

Statement of Question

What is the effect of SLR and isometric exercise on quadriceps lag of normal healthy individual?

Hypothesis

On isometric exercise, quadriceps lag will more reduce compare to SLR exercise.

Operational Definition

Extensor lag – This refers to the inability to fully extend the knee actively, although passively full extension is possible. This results from lengthening of the extensor mechanism or weakening of the quadriceps. With an extensor lag, the patient cannot actively extend to a completely straight position (angle of 0 measured between the femur and tibia). Passive extension is not limited however [16,13,17].

Review of Literature

Knee Joint

It is compound synovial joint, incorporating two condyles joints between the condyles of the femur and tibia, joint between the femur and patella [14].

Articular surfaces

The bone involved are the femur, tibia, and patella. The articular surfaces are the large curved condyles of the femur, the flattened condyles of the tibia, and the facets of the patella [1,2].

Movements of the knee joint

When the leg is fully extended, the knee 'locks' owing to medial rotation of the femur on the tibia. This makes the lower limb a solid column and more adapted from weight bearing. To 'unlock' the knee the popliteus muscle contracts, there by rotating the femur laterally so that flexion at the knee can occur [1,2,27].

Joint capsule

The integrity of the joint is maintained by a vast capsular envelope reinforced judiciously by retinaculam, tendons and ligaments [1,2].

To the femur the capsule remains attached Posteriorly around the articular margins at the condyles and above the intercondylar notch. On the lateral condyle this continuity is breached by the popliteus tendon unit panes over the back of the tibia,. Here the capsule forms a free reflection downward and laterally to the head of the fibula on the arcuate ligament. Medially, the capsule is greatly thickened forming the deep capsular ligaments deep to the medial ligament of the knee joint, it forms a thickening of the capsule extending from the medial epicondyle of the femur to the medial meniscus which it holds firmly to the femur [2].

Ligaments

Patellar ligament: This very strong, thick band is the continuation of the tendon at the quadriceps femoris muscle. The patellar ligament is continuous with the fibrous capsule at the knee joint and is most easily felt when the leg is extended. The superior part of its deep surface is separated from the synovial membrane of the knee joint by a mass of loose fatty tissue called the infrapatellar fat pad. The inferior part of the patellar ligament is separated from the anterior surface of the tibia by the deep infrapatellar bursesa [1,2].

Fibular collateral ligament: The fibular collateral ligament (lateral ligament) extends inferiorly from the lateral epicondyle of the femur to the lateral surface at the head of the fibula. The tendon of the poplitens muscle passes deep to the fibular collateral ligament, separating it from the lateral meniscus. The fibular collateral ligament is fused with the fibrous capsule at the knee joint superiorly [1,2].

Tibial collateral ligament

The ligament (also known as the medial ligament) which extends from the medial epicondyle at the femur to the medial condyle and superior part of the medial surface of the tibia. It is a thickening at the fibrous capsule at the knee joint and is partly continuous with the tendon at the adductor magnus muscle. T he inferior end of the ligament is separated from the tibia by the medial inferior funicular vessels and nerve. The deep fibers of the tibial collateral ligament are firmly attached to the medial meniscus and the fibrous capsule of the knee joint [1,2,4,5].

Oblique popliteal ligament

This broad band is an expansion at the tendon ot the semimembranosus muscle. The oblique poplital ligament strengthens the fibrous capsule at the tibia and passes superolaterally to attach to the central part of the posterior aspect of the fibrous capsule of the knee joint [1,2].

Arcuate popliteal ligament

It is a V-shaped band fibers strengthens the fibrous capsule Posteriorly. The stem at the ligament arises from the posterior aspect of the head of the fibula. This ligament spreads out over the posterior surface at the knee joint.

The cruciate ligament of the knee joint

These are very strong ligaments are within the capsule of the joint but outside the synovial cavity. Joining the femur and tibia, they are located between the medial and lateral condyles and separated from the joint cavity by the synovial membrane. The cruciate ligaments are strong, rounded bands that cross each other obliquely in a manner similar to an x. they are named anterior and posterior according to their site of attachment to the tibia i.e. the anterior cruciate ligament attaches to the tibia anteriorly and the posterior cruciate ligament attaches to it Posteriorly. These ligament are essential to the antero-posterior stability of the knee joint, especially when it is flexed [1,2].

Menisci of the knee joint

The medial and lateral menisci are plates of fibrocartilage on the articular surface of the tibia. They act like shock absorbers. Because they are basically C – shaped they were formerly called semilunar cartilages [1].

Medial meniscus: This C- shaped cartilage is broader posteriorly than anteriorly. Its anterior end is attached to the anterior inter condylar area of the tibia, anterior to the attachment of the anterior cruciate ligament [1,2,45].

Lateral meniscus: This C-shaped cartilage is nearly circular and lateral meniscus is smaller and more freely movable than the medial meniscus The tendon of the popliteus muscle separates the lateral meniscus from the fibular collateral ligament [1,2].

Knee joint motions

The primary movements of the knee joint are flexion/extension and, to a lesser extent, medial-lateral rotation. The knee joint can also undergoes tibial or femoral displacement anteriorly and posteriorly, and some abduction and adduction through varus and valgus forces. However, these movements are generally not considered part of the function of the join, but are rather part of the cost at the tremendous compromise between mobility and stability, Normal knee joint motions, including both osteokinematics (degree of freedom) and arthokinematics. (intra-articular movement with in the joint) [45].

Locking and unlocking

Medial rotation of the femur that accompanies the final stages at knee extension is not voluntarily of produced by muscular forces, it is referred to as automatic or terminal rotation of the knee joint. This rotation within the joint that accompanies the end of extension also brings the knee joint into the close packed or locked position. The tibial tubercles are lodged in the interconylar notch, the mechanism or screw home mechanism of the knee. To initiate flexion, the knee must first be unlocked. That is, the medially rotated femur cannot flex in the sagittal plane, but must laterally rotate before flexion can proceed. A flexion force will automatically result in lateral rotation of the femur since the longer medial side will move before the shorter lateral side of the joint [27,45].

Active Insufficiency

Active insufficiency is the diminished ability of a muscle to produce or maintain active tension. It is most commonly encountered when the full ROM is attempted simultaneously at all joints crossed by a two-or multi joint muscle. Therefore, during active shortening a two-joint muscle will become actively insufficient at a point prior to the end of

a joint range, when full ROM at all joints occurs simultaneously. Active insufficiency also may occur in one-joint muscles, but is not as common [45,46].

Biomechanics of the Knee Joint

Knee joint motion is prescribed by the interaction of several biological structures; bone, cartilage, ligaments, tendons, muscle and other soft tissues such as the retinaculum and IT bank. The articulating surfaces of the femur, patella and tibia consist of articular cartilage which in combination with synovial fluid, permit a relatively frictionless contact surface. Extreme range of motion of the tibia relative to the femur is constrained by four ligaments. The medial collateral ligament (MCL) and the lateral collateral ligament (LCL) prevent the femur from translating medially or laterally with respect to the tibia and prevent varus/valgus motion of the knee. The anterior cruciate ligament (ACL) prevents the posterior translation of the femur with respect to the tibia whereas the posterior cruciate ligament (PCL) prevents the anterior motion of the femur relative to the tibia [39,45,46,30].

The Function of the Patella in Joint Mechanics

The function of the patella in patellofemoral joint biomechanics is complex and its importance has been subject to debate. The primary function of the patella is to transmit extension forces from the femur to the tibia. The quadriceps muscle group converges on the superior end of the patella. This centralizes the muscular forces and allows the patella to function as a guide in transmitting those forces to the patella tendon [39,40,45].

Methodology

Sample

A Total number of 60 normal healthy young subjects were recruited for the study. The subjects were divided into two groups. Group A and Group B. Group A 30 subjects were included with their mean age (24.76+3.38) year. Group B 30 subjects were included with their mean age (27.16+3.94) year. The study was conducted in the physiotherapy OPD at Dolphin Institute of Bio Medical and Natural Sciences Dehradun. The subjects were selected on the basis of inclusion criteria- age – 20-35 years, Sex- Male and Female & Normal Knee ROM and exclusion criteria individuals with lower limb lesions or injuries that affects active and passive range of motion at knee joint., With any musculoskeletal disorder, Any underlying knee pathology, Knee surgery, Knee joint pain, Knee deformity, Knee injury, Peripheral neurological deficits, Fracture, Inflammatory joint disease, O.A., Limb length discrepancy, R.A., Diabetic neuropathy, Muscle atrophy Normal healthy individuals. Instrumentation for data collection includes Universal goniometer.

Protocol

Prior to the participation all the subjects were informed about the study and a consent form was signed.

The subjects were asked to sit comfortably on a quadriceps table with the trunk flexed to 45^{o} hamstrings relaxed.

They were asked to perform maximum voluntary active extension of the knee and the angle of the knee extension.

Three readings were taken and reading had taken as close as in between three reading. Then examiner passively extends the subjects knee and with the help of an assistant, the angle of the knee extension. Three readings were taken for this too. The reading had taken as close as in between three reading. The difference between passive limit of extension and active limit at extension is the physiological quadriceps lag. After measuring the quadriceps lag group A subjects were given isometric exercise and Group B subjects were given SLR for 3 weeks.

Procedure

The participants were 60 normal healthy young adults. The procedure starts by asked to sit comfortably on a quadriceps table with the trunk flexed to 45^{o} hamstrings relaxed. supported in approximately 45^{o} flexion to minimize any resistance from hamstring muscle lightness during the tests. So that the knee is approximately at 90^{o} flexion.

Therapist stood on the side of the right leg and places the goniometer on the lateral joint line.

The fixed arm at the goniometer is positioned along the long axis of the femur and moving arm is aligned with the line between femoral head and lateral malleolus. The subject is subject is asked to actively extend the knee to the maximum and angle is measured in respect to the previous position of the leg subsequently three readings were taken.

Now the passive limit of knee extension is determined by the therapist straightening the relaxed knee with a hand be hind the heel until the subjects thigh just cleared the couch.

Subsequently three readings were taken. Between three readings which reading was as close as that was taken.

Isometric Quadriceps Exercise

With the knee slight flexed bend. Place rolled towels under the knee. Try to straighten the knee and push the towels. Tighten the thigh muscles on top of the leg as tightly as possible and hold. The knee will flatten and knee cap will move slightly upward. Hold 10 seconds and then relax (Fig. 1).

Straight Leg Raise

Lie flat on back on either a bed or on the floor. Ben on knee, placing other foot flat on the bed. (This helps to stabilize pelvis and protects lower back). Straighten the other knee. Tighten the muscle on the top of the thigh of the straight leg and slowly raise the entire leg 12 to 18 inches off the bed. Slowly lower the leg and relax. Repeat this exercise 10 times, and then progress to doing 3 sets of 10 repetitions with 1 to 2 minute rest between sets. This exercise is isometric at the knee, but not at the hip (Fig. 2).

Data Analysis: Data analysis was done using SPSS-12.0 version. Independent t-test was used to calculated mean and standard deviation for age, weight and height, AKE, PKE, QL, QLA 21 days.

Paired t-test was used to compare the QL, (Quadriceps lag) QLA 21 days (Quadriceps lag after 21 days exercise) with in group A and group B. Independent t-test was used between the groups. Significant level was set at $p<0.05$.

Fig. 1: Isometric Quadriceps Exercise

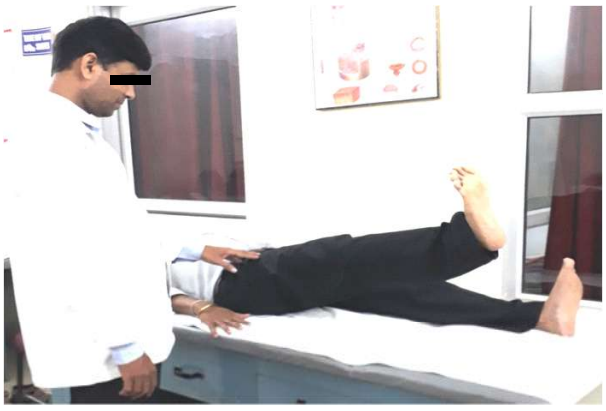

Fig. 1: Straight Leg Raising (SLR)

Results

Mean and standard deviation of age, weight and height was calculated for all subjects of group A and group B showed significant in age ($p < 0.05$) in significant weight and height ($p > 0.05$) (Table 1 & Fig. 3).

Mean and standard deviation of AKE, PKE, QL, QL, AL 21 days of exercise was calculated for the all subjects of group A and B (Table 2 & Fig. 4).

Paired t-test was done with in the group to compare the QLA within the group. That is before and after 21 day exercise shows significant change in QLA ($P < 0.05$) (Table 3 & Fig. 5).

Independent t-test was used between the group A and B before and after exercise. It showed that there was no significant difference between the group A and B before exercise. But there was significant difference between the group A and B after exercise ($P < 0.05$).

Group A – isometric Exercise

Group B – Straight Leg Raise

Table 1: Mean and Standard deviation of Age, Weight and Height for the subjects of Group A and Group B

Variable	Age Mean ± SD	Weight Mean ± SD	Height Mean ± SD
Group A	24.76±3.38	56.73±5.84	161.53±9.78
Group B	27.16±3.94	59.23±4.95	158.46±12.19
T-value	-2.59	-1.787	1.074
P-value	0.014	0.079	0.287

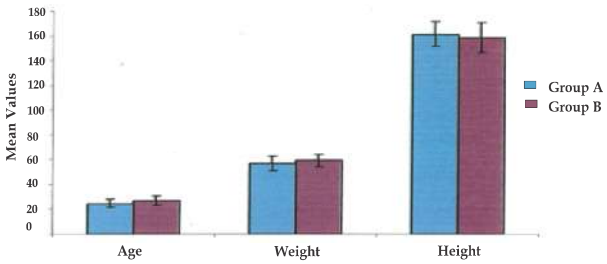

Fig. 3: Comparison of mean values of Age. Weight and Height for subjects of Group A and B

Table 2: Mean and Standard deviation of Active knee extension (AKE_), Passive Knee Extension (PKE), Quadricep lag (QL) and Quadricep lag after 21 days of treatment (QLA21) for the subjects of Group A and Group B

Group	AKE Mean ± SD	PKE Mean ± SD	QL Mean ± SD	AKE Mean ± SD	PKE Mean ± SD	QLA21 Mean ± SD	t-value	p-value
Group A	1.46 ± 0.49	3.78 ± 0.69	2.32 ± 0.57	1.76 ± 0.39	3.91 ± 0.67	1.42 ± 0.45	13.54	.00122
Group B	1.56 ± 0.37	3.65 ± 0.69	2.13 ± 0.74	3.45 ± 0.45	3.56 ± 0.52	1.75 ± 0.61	7.62	.0058

Table 3: Comparison of mean value for quadriceps lag and after 21 days (QLA21) for subjects between Group A and Group B

Variable	QLA Mean ± SD	QLA21 Mean ± SD
Group A	2.23±.576	1.42±.459
Group B	2.13±.741	1.75±.619
T-value	1.089	2.343
P-value	0.281	0.023

AKE = Active knee extension

PKE = Passive knee extension

QLA = Quadriceps lag

QLA21 = Quadriceps lag after 21 days exercise

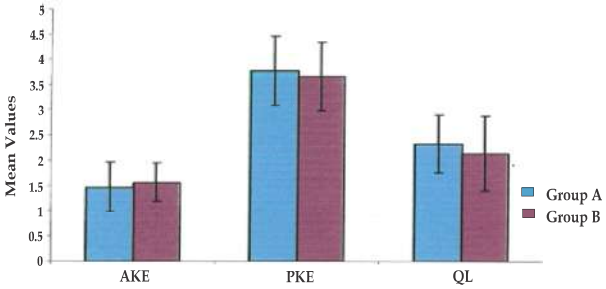

Fig. 4: Comparison of mean values of Active Knee Extension (AKE), Passive Knee Extension (PKE) and Quadricep Lag for Subjects of Group A and B

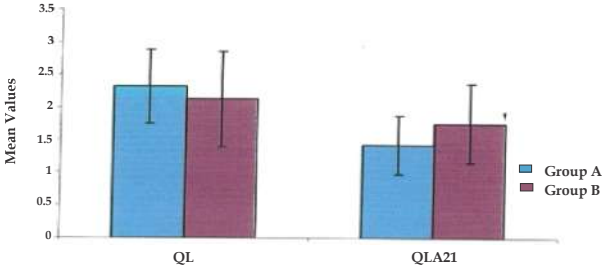

Fig. 5: Comparison of mean values of Quadricep Lag (QL) and Quadricep Lag after 21 days (QLA21) for Subjects of Group A and B

Discussion

The objective of the study was to determine the effect of SLR and isometric quadriceps exercise on quadriceps lag at normal healthy individual.

It was hypothesized that isometric exercise will reduce the affectively quadriceps lag compare to SLR exercise.

Edwards Grood et al. has shown that very large quadriceps forces are required to accomplish the last 15° of extension during leg raising exercises, typically twice those required to reach 30° of flexion. The large forces that are required to obtain full extension explain why an extensor lag occurs with quadriceps weakness even though a full passive range of motion in possible [21].

Krebs DE et al. results showed that motor unit activity depends not only upon joint angle, but also upon peripheral receptor feedback, which is altered in the post arthrotomy limits, producing the characteristic 'extensor lag' or inability to maintain the knee at 0 degree while flexing the hip [22].

Rafael F et al. suggests that SLR may be more effective in developing the rectus femoris while isometric may be more effective in developing the vasti muscles. Vasti muscles (VM) are the main muscle of knee extension. So the isometric is more effective compare to SLR [23].

Contraction is termed isometric (iso-constant, metric length), as no change takes place in the distance between the muscle's points of attachment (Rodgers and Cavanagh 1984) [46].

Although no motion is accomplished and no mechanical work is performed during an isometric contraction (Komi, 1986), muscle work (physiologic work) is performed energy is expended and is mostly dissipated on heat. This type of muscle work is called static work. The tension in a muscle varies with the type of contraction [46].

Isometric contractions produce greater tension than do concentric contractions. The longer contraction time of the isometric contractions allows greater cross-bridge formation by the contractile components, thus permitting greater tension to be generated (Kroll, 1987) [26,46].

Isometric quadriceps exercises in full knee extension may be effective in preventing or resolving a knee extensor lag, and most articular lesions will not be engaged with the knee in full extension [28,43].

Gregory M Karst et al. found in order to reduce the risk of exacerbating patellofemoral joint irritation, isometric QF exercises performed with the knee in full extension, such as the QS and SLR exercise used to reduce quadriceps lag, isometric quadriceps exercised is more effective to reduce lag. They also suggest in cases requiring QF strengthening in the fully extended knee position, isometric QS may be the treatment of choice on quadriceps lag [47].

Future Research

1. The present study was done on small sample size. So, future research on large sample population can be done.
2. Present study duration was 3 weeks, so a study of long duration can be done.
3. Present study can be done with other different knee joint exercise

Relevance to Clinical Practice

Extensor lag can disturb the knee stability. If lag is more it disturb the normal gait pattern and functional activities. Extensor lag is more means knee stability is less. It is very prone to knee injury on sports persons. Extensor lag can bring problems in case of sports persons.

Limitation of the Study

1. Since the study was conducted with healthy subject the results can not be readily generalized to a patient population without further research.
2. Since the instrumentation used is a universal protractor goniometer (360º) there are some probabilities of errors in the reading as compared to the method incorporating video imaging technique.
3. The sample size is small.

Conclusion

The study has shown that the quadriceps lag can be greater reduce on isometric exercise compare to SLR exercise. So, the study concluded that the Isometric exercise have more effect on quadriceps lag compare to SLR exercise.

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Original Article

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Effectiveness of Kinesio Taping in Improving the Functional Activity of Upper Limb in Hemiplegics

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Abstract

Introduction: Stroke is the leading cause of long-term disability among adults, and hemiparesis is the most common impairment after stroke. Longitudinal studies of recovery after suggest that only 50% of patients with significant arm paresis recover useful function [1]. Impaired or lack of sensation in the hemiplegic upper limb, its spasticity or flaccidity, and neglect of hemiplegic arm contribute equally to a non-functional upper extremity in the stroke victim [3]. The use of kinesio taping in conjunction with regular therapy program may assist with improving joint stability with subsequent improvement of voluntary control and coordination of the upper extremity [6]. *Need of the study:* As there is decreased functional activity of upper extremity among stroke subjects so this study being done to improve the functional activity of upper extremity and to improve the quality of life in hemiplegic subjects. *Aim of the Study:* To determine the effectiveness of kinesio taping in improving the functional activity of upper limb in hemiplegics. *Methodology:* Ten subjects were randomly divided into two groups. Five subjects in group A i.e. experimental group and five subject in group B i.e. placebo group. Group A –Kinesio taping was applied to shoulder, upper arm, elbow, forearm, wrist & hand of post stroke hemiplegic subjects. Pre and post tapping scoring was done via UEFI. *Group B:* In placebo group, one strap of shoulder, forearm tape and lumbrical taping were missed. Scoring was done in the same manner as done in group A. *Future Research:* 1. This study can be done on large sample. 2. Scapular component can also be included while taping. 3. Longer duration follow up under supervision can be done. *Limitation of Study:* 1. Some patients was drop out from the study due to three days follow up. 2. Lack of supervision for 3 days. *Conclusion:* The present study concluded that there is significant improvement in functional activity of upper extremity in hemiplegic subjects after kinesiotaping. On comparing group A and group B the results were significant in group A and there is not significant improvement was seen in group B when some components of taping were missed.

Kyewords: Cover Rolls Kinesio Tape; Scissor; Chair; Comb; Medium Size Ball; Jar & Small Suitcase.

Introduction

Stroke is the leading cause of long-term disability among adults, and hemiparesis is the most common impairment after stroke. Longitudinal studies of recovery after suggest that only 50% of patients with significant arm paresis recover useful function [1].

Analysis of community surveys from different regions of India shows a crude stroke prevalence rate of about 203 per 100,000 populations above 20 years of age, amounting to a total of about 1 million cases. The male to female ratio was estimated to be 1.7. WHO estimated that in 1990, out of a total of 9.4 million deaths in India, 619,000 were due to stroke. This gives a stroke mortality rate 73 per 100,000 (estimated total population 849 million). It is estimated that 600,000 Americans suffer a first stroke each year, and the nation's nearly 4 million stroke survivors are living with the consequences [2].

Patient diagnosed with stroke often present with a combination of muscle weakness or muscle imbalance, decreased postural control, muscle spasticity, poor voluntary control, and body mal-alignment [3].

In many patients with severe stroke, the affected upper limp (UL) never becomes useful, even after therapy. Only about 15 percent of those suffering from severe stroke recover hand function [4].

The paretic upper limb is a common and undesirable consequence of stroke that increases activity limitation. It has been reported that up to

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85% of stroke survivors experience hemiparesis and that 55% to 75% of stroke survivors have continued to have limitations in upper-extremity functioning. It has been estimated that 55% of stroke survivors have a nonfunctional upper extremity following initial therapy and 30% of stroke survivors have had some partial recovery of upper extremity function in terms of range of motion and strength, but are still unable to perform ADLs with the affected upper extremity, which negatively affects their independence and increases the burden of care [5].

Kinesio taping is a relatively new technique used in used in rehabilitation programs. It is commonly used in sports injuries; however, it is gradually becoming useful in treating other impairments [3].

Dr. Kenzo Kase designed the brand of tape kinesio Tex which is a flexible, thin, porous cotton fabric with adhesive backing. The tape is latex free and will only stretch longitudinally from 30 to 40% more than its original length. The intent of kinesio taping is to improve the dynamic stability of the weak muscle or the painful muscle by providing improved alignment and cutaneous stimulation to enhance muscle contraction. The elastic quality and proprioceptive input as well and subtle biomechanical factors may account for the functional changes observed (Kerr 1996). The principles and techniques of taping have been adapted to be used clinically in rehabilitation centers for patients who present with shoulder subluxation or shoulder pain. Taping can be used as an adjunct during the rehabilitation program for the patient to enhance functional recovery (Host 1995, Schmitt and Snyder-mackler 1996) [6].

The properties of kinesio tape do not constrict movement as 'conventional' rigid tape. kinesio taping allows immediate patient feedback regarding possible functional benefits. With the Kinesio Tape on the patient can report symptom relief, confort level or stability of the involved joint. The elastic property of kinesio tape conforms to the body, allowing for movement. The use of kinesio taping in conjunction with regular therapy program may assist with improving joint stability with subsequent improvement of voluntary control and coordination of the upper extremity [6].

The primary objective of this study is to determine the effectiveness of kinesiotaping in improving the functional activities in chronic hemiplegics.

Experimental hypothesis

kinesiotaping will show significant of functional activities of upper limp in hemiplegics.

Null hypothesis

Kinesiotaping may not show significant improvement of functional activities of upper limb in hemiplegics.

Need of the study

As there is decreased functional activity of upper extremity among stroke subjects so this study being done to improve the functional activity of upper extremity and to improve the quality of life in hemiplegic subjects

Aim of the Study

To determine the effectiveness of kinesio taping in improving the functional activity of upper limb in hemiplegics.

Review of Literation

Karatas N. et al; 2012; conduct a study on 'The effect of kinesiotape application on functional performance in surgeons who have musculoskeletal pain after performing surgey'. Concluded that kinesiotaping would be an effective method for reducing neck and back pain and improving functional performance [7].

Tulay Tarsulu et al; 2011; conduct a study on the 'Effects of kinesiotaping on sitting posture, functional independence and gross motor function in children with cerebral palsy'; concluded that kinesiotaping may be beneficial assistive treatment approach when combined with physiotherapy [8].

Chen-Yu Hang et al; 2011; conducted a study on 'Effect of kinesiotape to muscle activity and vertical jump performance in healthy inactive people'; concluded that kinesiotape implicate benefits for medical gastronemius muscle strength and push-off force [11].

Emidia Mikolajewka et al; 2011; conduct a study on 'Side effect of kinesiotaping-own observation'.; concluded that kinesiotape can cause allergies; there is need for caution s application of kinesiotape, particularly in neurological patient with possible sensory disorders and conscious disorders [12].

Marco losa et al; 2010; conducted a study on' Functional taping: a promising technique for children with cerebral palsy and concluded that functional taping seems to be a promising intervention for improving locomotor function in children with CP [13].

Spirtos M, O'Mahony, P. et al; 2010; conducted a study on 'The effect of kinesiotaping of the thumb and wrist on range of motion in children with cerebral palsy'. Stated that Kinesio tape impacts at the level of body functions and structures and significant change was greater at this level, studies which investigate kinesio taping combined with functional training would be usefu [14].

Francisco Garcia et al; 2009 September; Conduct a study on 'Treatment of myofascial pain in the shoulder with kinesio taping: a case report'. Concluded that treatment with kinesio taping contributed to the resolution of myofascial pain in shoulder producing an immediate treatment and resolving the problem in following days [16].

Hsu YH, Chen WY, et al; 2009 Dec; Conduct a study on 'Effect of taping on scapular kinematics and muscle performance in baseball players with shoulder impingement syndrome'. Found that the elastic taping resulted in positive changes in scapular motion and muscle performance [17].

Mark D. Thelen et al; 2008; Studied on 'The clinical efficacy of kinesio tape for shoulder pain: A randomized,double-blinded, clinical trial'. Concluded that KT may be some assistance to clinicians in improving pain-free active ROM immediately after tape application for patient with shoulder pain [18].

Zbigniew Sliwinski et al; 2007; conduct a study on 'Kinesiotaping application in children with scoliosis'. Conclused that kinesiotaping as a new method, using multiple forms and techniques, seems helpful in carrying out rehabilitation programme for children with scoliosis [19].

Subhash Kaul et al; 2007; conducted a study on 'Stroke in India: Are we different from world'. Concluded that India has been registering an upward trend in the last few decades, while the incidence of stroke in western countries has declined or plateaued [21].

Yasukawa A et al; 2006; conduct a study on 'Effect of kinesiotaping in an pediatric rehabilitation setting'; concluded that kinesiotaping may be a associated with improvement in upper extremity motor control and function in acute paediatric rehabilitation [6].

C. Philip Gabel et al; 2006; did a study on 'The upper limb functional Indix: Development and determination of reliability, validity and responsiveness. Concluded that ULFI demonstrated sound psychometric properties, practical characteristics and clinical utility there by making it a viable clinical outcome tool for determination of upper limb status and impairment [22].

Tapas Kumar Banerjee et al; 2006; studied on 'Epidemiology of stroke in India'. Concluded that there was higher prevalence of cerebral hemorrhage in the community compared to that in the western countries [2].

boudewijin Kollen et al; 2006; Conducted a study on 'Functional recovery after stroke: A review of current developments in stroke rehabilitation research'. Concluded that treatment strategies that incorperate compensation strategies with a strong emphasis on functional training, may hold the key to optimal stroke rehabilitation [23].

Leeanne M. Carey et al; 2005; did a study on 'Motor 4r impairment and recovery in the upper limb after stroke'. Stated that upper limb motor function and recovery are correlated with cerebral blood flow in cingulated, insula, highlighting the role of these are in the recovery process the dynamic nature of the relationship suggests ongoing adaptation within network [1].

John W. Krakauer et al; 2005; Conduct a study on 'Arm function after stroke; from physiology to Recovery'. Concluded that rehabilitation techniques enhance learning-related changes after stroke and contribute recovery [4].

Johanne higgins et al; 2005; conduct a study on' Upper limb function and recovery in the acute phase stroke'. concluded that extent of UL deficits assessed in the first week following a stroke with the use of a measure of activity limitation is a good prognostic indicator of UL function at 5 weeks post stroke and should be used for the planning of treatment strategies [5].

Kim KS, Seo HM et al; 2002; did a study on 'Effect of taping method of effect of taping method on ADL, ROM, hand function and quality of life in post-stroke patients for 5 weeks'. Stated that taping therapy was effective in improvement of physical aspects (hand function, upper extremity ROM) in post-stroke hemiplegic stroke [24].

M.C. Cirtea et al; 2000; Conduct a study on 'Compensatory strategies for reaching in stroke'. Concluded that use of compensatory strategies may be related to the degree of compensatory strategies may be related to the degree of motor impairment: severely and moderately impaired subjects recruited new degrees of freedom to compensate for motor deficit while mildly impaired subjects tended to employ healthy movement pattern [25].

Methodology

Sample

Ten subjects (10) were randomly divided into two groups. Five subjects in group A i.e. experimental group and five subject in group B i.e. placebo group. Group A –Kinesio taping was applied to shoulder, upper arm, elbow, forearm, wrist & hand of post stroke hemiplegic subjects. Pre and post tapping scoring was done via UEFI. Group B- In placebo group, one strap of shoulder, forearm tape and lumbrical taping were missed. Scoring was done in the same manner as done in group A. All the subjects participated in the study after signing the informed consent. The study was conducted in the Department of Physiotherapy, HIHT University, Jolly Grant. A sample of 10 subjects each in 2 groups were selected according to inclusion and exclusion criteria. Inclusion criteria Age 40-60 years, MMSE>23, Muscle power in upper limb > or = 2, Both gender male and female, Flexor synergy pattern in upper limb & 3 months to 6 months post stroke. Exclusion criteria subjects were excluded. Any fracture or dislocation on affected side, Tone (MAS) > or = 3, Any prior pathology to joint & Subluxated shoulder. Instrumentation for data collection includes Cover roll kinesio tape, Scissor, Chair, Comb, Medium size Ball, Jar & Small suitcase (Fig. 1).

Procedure

Ten subjects were randomly divided into two groups. Five subjects in group A i.e. experimental group and five subject in group B i.e. placebo group. Group A –Kinesio taping was applied to shoulder, upper arm, elbow, forearm, wrist & hand of post stroke hemiplegic subjects. Pre and post tapping scoring was done via UEFI.

Group B- In placebo group, one strap of shoulder, forearm tape and lumbrical taping were missed. Scoring was done in the same manner as done in group A. Taping area was prepared by removing the hair with the help of razor and cleaning the taping are with spirit. A pre taping scoring was done via upper extremity functional index (UEFI). After scoring kinesiotaping was applied over shoulder, elbow and wrist. (Fig. 2).

Subject was asked to do the following activities:

1. Opening the door
2. Grooming hair
3. Opening a jar
4. Carrying a small suitcase
5. Throwing a ball

After performing the activities we were asked the subject to score each activity himself or herself accordingly UEFI score.

0. = extreme difficulty or unable to do activity
1. = quite a bit of difficulty
2. = moderate difficulty
3. = little bit of difficulty
4. = no difficulty

Group A – In shoulder taping, arm was supported by elbow by a helper in 90 degree abducted position. 5cm wide tape was used. 1st strip of tape applied to shoulder ½ way along length of clavicle, continued across deltoid in diagonal direction, wrips around upper arm, terminates ¼ of the way along the scapula. 2nd strip applied in same direction but 2 cm below. An anchor tape was applied to secure the two ends. (Fig. 3).

In elbow and wrist taping, elbow was positioned in extended position, forearm in mid prone position and wrist in slightly extended position. 3cm wide tape was used. 1st strip of tape was applied from 5 cm above the olecranon process, spirally covering the lateral epicondyle, forearm and ending at ulnar border of wrist.

The a Y-shaped tape was applied over dorsal aspect of hand extending from midpoint of wrist to 1st and 5th metacarpals. Then tape was wrapped over lumbricals for palmer stability. An anchor tape was applied to secure the ends. Post taping score was taken to find out the immediate effect. After post taping immediate score, we ask the patient to practice these tasks at home and after 3 days one more scoring was done.(Fig. 4).

Group B- In placebo group, one strap of shoulder, forearm tape and lumbrical taping were missed. Scoring was done in the same manner as done in group A. (Fig. 5).

Results

Date of group A was analyzed by using ANOVA. The mean±standard deviation of pre taping was 8±1.41, post immediate taping was 12.2±1.48 and post 3 days was 13.8±1.09 with f value 24.92 and p value ≤ 0.05 which is significant. (Table 1).

In group B, the mean ± standard deviation of pre taping was 7.2±2.16, post immediate taping was 8.6±2.30 and post 3 days was 8.6±2.30 with f value 0.64 and p value ≥ 0.05 which shows non significant result. (Table 2).

Fig. 1: Showing instruments used in the study

Fig. 2: Showing preparation of the taping part

Fig. 3: Showing preparation of the taping part

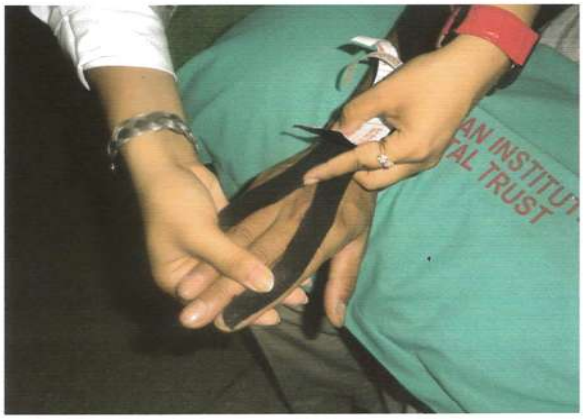


Fig. 4: Showing Y shape taping on dorsal aspect of hand

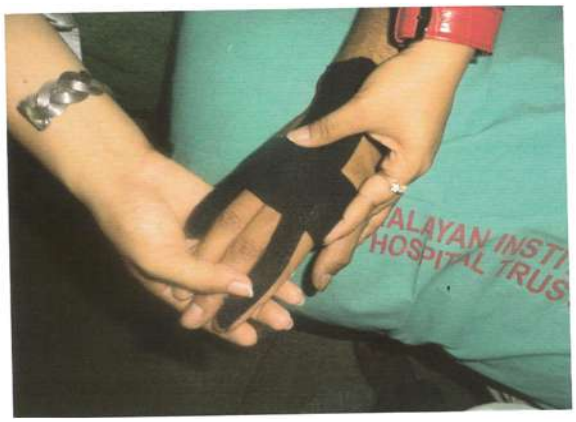


Fig. 5: Showing Y shape taping on dorsal aspect of hand

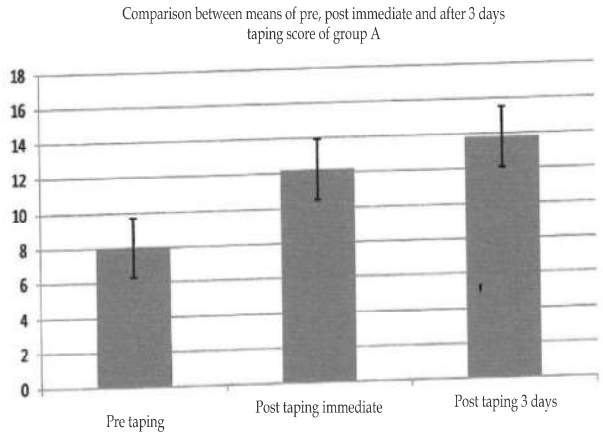
Inter group analysis i.e. between group A and group B was done by using unpaired t-test. The mean±standard deviation of pre taping of group A was 8±1.41 and group B 7.2±2.16 with t value 0.69 and p value ≥ 0.05. (Table 3).

The mean ±standard deviation of post immediate taping of group A was 12.2±1.48 and group B 8.96±2.3 with t value 2.93 and p value ≤0.05 *(Table-4)*

Which shows significant change. The mean±standard deviation of post 3 days taping of group A was 13.8±1.09 and group B was 8.6±2.3

Table 1: Comparison of mean, standard deviation, f value, p value for pre taping and post taping (immediate and 3 days) of group A.

Variable	Mean + St deviation	f value	p value
Pre taping	8±1.41		
Post taping immediate	12.2±1.48	24.92	≤0.05
Post taping 3 days	13.8±1.09		



Graph 1:

with t value 4.56 and p value ≤0.05 which shows significant result. (Table 5).

On comparison of pre taping score of mean and standard deviation 8±1.41 with post immediate score of mean and standard deviation 12.2±1.48 with post taping after 3 days of mean and standard deviation 13.8±1.09 with f value 24.92 and p value ≤ 0.05 which is significant. (Graph 1).

On comparison of pre taping score of mean and standard deviation 7.2±2.16 with post immediate score of mean and standard deviation 8.6±2.30 with post taping score after 3 days with f value 0.64 and p value ≥ 0.05 which is insignificant. (Graph 2).

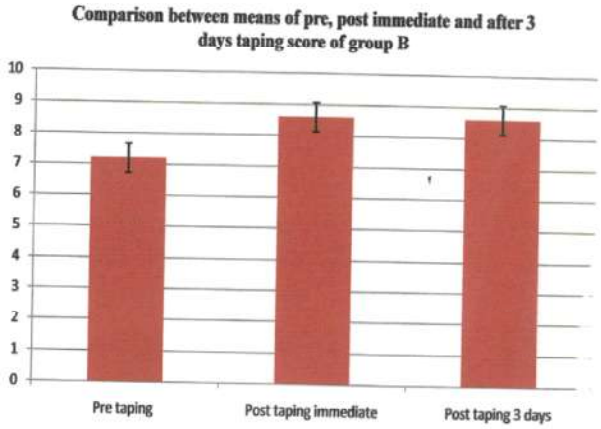
On comparison of pre taping score of group A of mean and standard deviation 8±1.41 with pre taping score of group B of mean and standard deviation 7.2±2.16 with t value 0.69 and p value ≥ 0.05 which is insignificant (Graph 3).

On comparison of post immediate taping of group A of mean and standard deviation 12.2±1.48 with post immediate taping score of group B of mean and standard deviation 8.6±2.3 with t value 2.93 and p value ≤ 0.05 which is significant. (Graph 4).

On comparison between post taping (3 days) score of group A of mean and standard deviation 13.8±1.09 with post taping (3 days) of group B of mean and standard deviation 8.6±2.3 with t value 4.56 and p value ≤ 0.05 which is significant (Graph 5).

Table 2: Comparison of mean, standard deviation, f value, p value for pre taping and post taping (immediate and 3 days) of group B

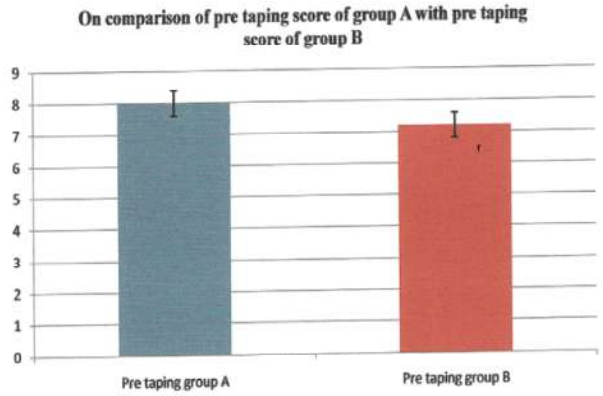
Variable	Mean + St deviation	f value	p value
Pre taping	7.2±2.16		
Post taping immediate	8.6±2.30	0.64	≥0.05
Post taping 3 days	8.6±2.30		



Graph 2:

Table 3: Comparison of mean, standard deviation, t value, p value for pre taping score of group A and group B

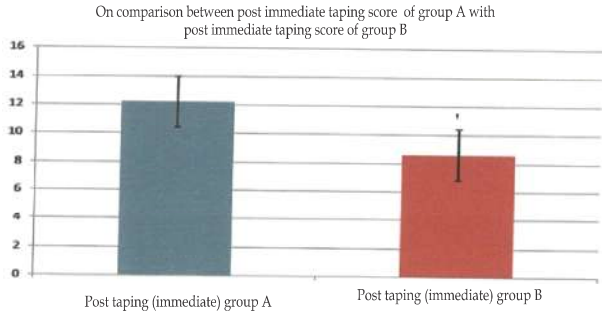
Variable	Mean + St deviation	t value	p value
Post taping group A	8±1.41	0.69	≥0.05
Post taping group B	7.2±2.16		



Graph 3:

Table 4: Comparison of mean, standard deviation, t value, p value for post taping (immediate) score of group A and group B

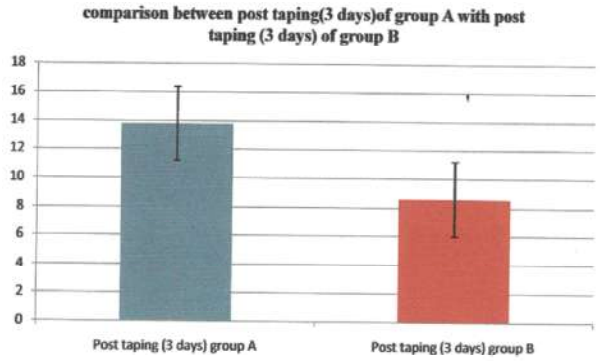
Variable	Mean ± St deviation	t value	p value
Post taping (immediate) group A	12.2±1.48	2.93	≤0.05
Post taping (immediate) group B	8.6±2.3		



Graph 4:

Table 5: Comparison of mean, standard deviation, t value, p value for post taping (3 days) of group A and group B

Variable	Mean±St deviation	t value	p value
Post taping (3 days) group A	13.8±1.09	4.56	≤0.05
Post taping (3 days) group B	8.6±2.3		



Graph 5:

Discussion

The paretic upper limb is a common and undesirable consequence of stroke that increase activity limitation. It has been reported that up to 85% of stroke survivors experience hemiparesis and that 55% to 75% of stroke survivors have limitations in upper-extremity functioning [5]. Many treatment are available to improve the upper limb function after stroke such as functional electrical stimulation, mirror therapy etc. Kinesiotaping relatively a new treatment technique. Few researches has been published regarding the effectiveness of kinesiotaping in improving the functional activity in stroke subjects.

The concept of kinesio taping was initiated in 1973 by Japanese chiropractor named Dr. Kenzo Kase. The four major functions suggested by Dr. Kase's theory on kinesio tape are: to relieve pain, remove congestion of lymphatic fluid or blood under the skin, support weak muscles and correct joint mal alignment [26].

In the present study aspect of 'supporting weak muscles' is taken as point of reference for kinesiotaping in hemiplegics with functional dependence on the basis of 'Upper extremity functional index'. UEFI is preferred upper limb regional tool due to its superior practical characteristics and clinical utility, and comparable psychometric properties [22].

The result of the study confirm that the effect of kinesiotaping has improved upper limb function as demonstrated with the UEFI. Although the sample size was small yet a statistical significant improvement was found when data was analyzed. Supported by 'Yasukawa A et al. in 2006'. This study demonstrated the clinical change in function can be measured supporting the use of kinesiotaping as an adjunct to treatment.

There is a significant change in port immediate taping score in group A $p \leq 0.05$ which approved a immediate improvement in functional activity according to UEFI. The use of kinesiotaping method appeared to have facilitated and improved movement provided needed stability and alignment to perform the task for reach, grasp, throwing etc.

The immediate change seen after the application of the tape can be attributed to the input provided by the kinesio tape. The continued improvement after 3 days was not found and need to be considered as lack of supervision for which patient has used upper extremity and quality of tape for duration of 3 days, resulting in loosening of tape or miss-placement from original attachment, which force or compel us to prefer study with larger sample size and duration with importance of features like supervision, days of application and quality of taping.

The placebo group showed non-significant result of $p \geq 0.05$. This states that beneficial effect of kinesiotaping "supporting weak muscles" does not act on these group as one of taping component was missed during taping procedure. This result also places stress on proper application and sequential procedure for kinesiotaping with proper preparation of the patient for expected outcome hence proving the experimental hypothesis.

Clinically this study demonstrated that by using kinesio tape as a treatment tool, the improvement was seen in upper extremity functional activity.

Clinical Relevance

Functional limitations of upper extremity are very common in stroke patients. Various researches have shown effect of physical therapy measures like mirror therapy, functional stimulation etc. in improving the functional activity of upper extremity in stroke subjects. Few researches have been published regarding the effectiveness of kinesiotaping in stroke subjects. Therefore this study aims at finding out the effectiveness of kinesiotaping in functional improvement of upper

extremity of stroke patients. Hence kinesiotaping should employ in upgrading rehabilitation protocol of hemiplegic subjects.

Future Research

1. This study can be done on large sample.
2. Scapular component can also be included while taping.
3. Longer duration follow up under supervision can be done.

Limitation of Study

1. Some patients was drop out from the study due to three days follow up.
2. Lack of supervision for 3 days.

Conclusion

The present study concluded that there is significant improvement in functional activity of upper extremity in hemiplegic subjects after kinesiotaping. On comparing group A and group B the results were significant in group A and there is not significant improvement was seen in group B when some components of taping were missed.

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Analyzing the Effects of Nutrients on Joints and Muscles in Human Beings: Systemic Review

Vaibhav Agarwal[1], Ravishankar Ravi[2], Tabassum Gani[3]

Abstract

Food is the most basic prerequisite of living organisms. Food builds the body, provides energy for living and working, and regulates the mechanisms essential for health and survival of life. It therefore constitutes the foundation of health of humans and animals. According to a report on health for all: an alternative Strategy [1]. human health is a function not any of medical care but of the overall integrated development of society, culture, economic, education, social, and political. It also depends on a number of supportive services, nutrition, improvements in environment, and health education. Food being the basic vehicle of satisfying man's hunger, it is intimately woven into the physical, economic, psychological, intellectual, and social life of human beings. Our food has several dimensions, the most obvious being the quantitative one. Insufficiency of food leads progressively from mild discomfort to severe hunger and ultimately to health hazards. There can be atrophy of joints, muscles and increase fatigue. Its qualitative dimension is equally important, because low-quality or improper diets lead to malnutrition and diseases. Food affects health, life span, physical fitness, body size, and mental development. Food also has a cultural dimension. The food habits of people are part of their cultural and emotional life, and preferences for food are ingrained [2]. People may cling for generation to their food habits, which may become rituals and patterns of daily routine life. A satisfying meal soothens both the body and mind and determines quality of human life.

Keywords: Nutrients; Muscles; Joints.

Introduction

According to the laws of thermodynamics, the human body exchanges both mass and energy from the environment: mass for growth and replacement of worn-out parts and for reproduction and energy to the biochemical processes taking place in the body and for various types work. Food provides both the mass and energy. The system operates under the steady-state conditions that is with a net gain or loss of mass or energy so that the expenditure is balanced by the intake meeting the demand by the supply. Too little intake leads to hunger and starvation, too much of it will result into obesity and other related disorders. Food and feeding, seems to be very simple and straight forward phenomena are indeed very complex and subjects of scientific studies invoice disciplines such as biology, biochemistry, medicine, nutrition, and psychology [2].

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Material and Method

Food nutrients when consumed in adequate amounts fulfill various functions of the body. The nutrients present in the foods may be classified into the following six broad categories

1. Carbohydrates
2. Proteins
3. Lipids (fats and oils)
4. Vitamins
5. Minerals
6. Water

The human body requires 17 vitamins and 24 mineral elements; it contains about 54% 62% water. 15% to 17% proteins, 14% to 25% fat, 5% to 6% mineral matte, and about 1% carbohydrates. Though

carbohydrates, broad groups of food nutrients, represent the smallest proportion in the human body (about 1%), they make up the bulk of our diet and constitute the chief source of energy (about 70%). Carbohydrates are burned in animal cells (biological) respirations using oxygen to produce energy. They help in the utilization of proteins and fats for more complex functions than production of energy. The carbohydrates consumed in excess of the body's needs are convened into fats (and glycogen) to be used when needed. Starches and sugars are the main sources of carbohydrates in our diet and are obtained from cereal grains such as wheat, rice, corn, sorghum, and millet as well as from tubers such as potato, sweet potato, and cassava. Sugarcane, beets and fruits provide sugars and sweetness to the diet.

Proteins are the major source of building material for the body and play an important role as structural constituents of the cellular membranes. Proteins function in the maintenance and repair of wont tissues. Enzymes, which are primarily proteins, are biological catalysts necessary for various biochemical reactions. The food value and quality of proteins is determined by the nature and amount of amino acids (essential amino acids). Proteins, if necessary, may he used to produce energy.

Body Composition

The weight of the human body increases about 20-fold during its growth and development from baby to adult. Barring the oxygen inhaled from the respired air, all the remaining mass enters the body through food and water, in addition to the material gained during intrauterine growth from the mother's diet. Thus, the human or animal body is literally what is consumed in the form of food or drinks that is one is what one eats.

Table 1: Composition of Human Body (%)

Nutrients	Man	Woman
Water	60-62	54
Protein	17	15
Fat	14	25
Minerals	6	5
Carbohydrates	1	1
Vitamins	Trace	Trace

Body Fat

Based on the assumption that the fat and the fat free tissues of the body have a fairly constant composition, efforts have been made to measure the energy stores of the individual indirectly through in vivo methods of determining fat and fat-free mass. Manay et al. [3] employed body specific gravity (density) as an index of obesity. Gamow [4] et al. also measured the density of human tissues. The excess weight of Football players may be due to their extra muscle and not fat; the latter tend to lower the body density. Human fat at body temperature has a density of 0.900g/cm and that of a-fat-free tissue is around 1.100g/cm. Thus, a person having body weight as fat will have an average body density of 1.00. Any mixture of fat and lean tissue will calculate the fat percentage of a body with an average density. Garrow et al. [6]. pointed out that very fatty or severely malnourished persons, the hydration of the fat-free body is altered, which may cause a small error m the estimation of body fat from density [5]. It is rather difficult to estimate accurately the volume of

Table 2: Composition of Human Body and Fat-Free Tissue as Influenced by Growth. Malnutrition and Obesity

Components	Fetus (20-25 wk)	Prematurebaby	Full-termbaby	Infant (1 year)	Adult man	Malnutrition infant	Object
Body weight (kg)	0.3	1.5	3.5	20	70	5	110
Water %	88	83	69	62	60	74	47
Protein %	9.5	11.5	12	14	17	14	13
Fat %	0.5	3.5	16	20	17	10	35
Remainder %	2.0	2.0	3	4	6	2	5
Fat-free weight (kg)	0.30	1.45	2.94	8	58	4.5	65
Water %	88	85	82	76	72	82	79
Protein %	9.4	11.9	14.4	18	21	15	21
Na (mmol/kg)	100	100	82	81	80	88	82
K (mmol/kg)	43	50	53	60	66	48	82
Ca (g/kg)	4.2	7.0	9.6	14.5	22.4	9.0	64
Mg (g/kg)	0.18	0.24	0.26	3.5	0.5	0.25	0.5
P (g/kg)	3.0	3.8	5.6	9.0	12.0	5.0	12.0

Age (years)	(g/kg) Water	Protein (g/kg)	Remainder (g/kg)	Potassium (mmol/kg)	K:N Ratio (mmol/kg)
Far free whole bodies					
25	728	195	77	71.5	2.29
35	775	165	60	--	--
42	733	192	75	73.0	2.35
46	674	234	92	66.5	1.78
48	7.30	206	64	--	--
60	704	238	58	66.0	1.75
Mean	725	205	71	69.0	2.05
Selected organs					
Skin	694	300	6	23.7	0.45
Heart	827	143	30	66.5	2.90
Liver	711	176	113	75.0	2.66
Kidneys	810	153	37	57.0	2.33
Brain	774	107	119	84.6	4.86
Muscle	792	192	16	91.2	2.99

the tissues of a living person. This is often done by submerging the subject in water and measuring the volume of water displaced or the apparent weight loss. a tank with a plastic cover in which the subject stands up to the neck in water, and the volume of air remaining under the cover is measured, by k1nowing the volume of water and of the whole tank, the volume of the subject can be calculated.

Water and protein Content. Potassium and potassium normality ratios (K:N) of the Fat-Free Bodies or Different Age and some Organs.

Body Potassium, Calcium, and Nitrogen

Potassium is labelled with the natural radioactive isotope [40] K, each gram of potassium emending about three gamma rays of high energy (1.46 MeV) each second.

Total body potassium can be estimated by detecting the gamma rays by suitable equipment. Having estimated total body potassium (TBK.), the fat free body mass (FFM) (kg) can be calculated for women and men from formulas, FFM TBK/60 and FFM=TBK/66 respectively, assuming that fat-free tissue of women and men tams 60 and 66 mmol K/g, respectively (1g K = 25.6 mmol).

Garrow [5] described a technique of neutron activation to estimate body Ca or N along with K. The subject is irradiated with a beam of fast neutrons whose energy is captured by the body, same of which become short-lived radioactive isotopes, notably [43] Ca and [15] N, emitting, radiation at characteristic energy bands.

Source of Food

In prehistoric time, humans lived as hunters and gatherers, obtaining their food from wild animal and plants. They expended on fruits, nuts, roots, and other plants foods as well as meat from animals and fish from seas and rivers gradually, humans learned to domesticate plants and animals to provide food. Plant domestication began in China around 10.000 B.C, followed by India, the eastern Mediterranean region, and Africa. Wheat and barley were among the first crops grown from the wild grasses, simultaneously. Livestock such as cows, sheep, and goats were domesticated, milk probably being the first animal product used as food. Small farming communities developed around the river basins, followed by the development of agricultural skills and resulting supply of sufficient food, its preservation, storage, and processing leading to the emergence of urban civilization on and bigger cities.

Food, Diet, Health, and Aging

Food, diet and nutritional factors have been known to influence host susceptibility, immune infections, and other defensive measures against several infection diseases. A complex interrelationship has been envisioned between infection and immune function [9]. Nutrias depletion weakened the host defense are being recognized as expected sequel of acute infections disorders, and conversely the presence or development of an infectious process is around pated in patients with malnutrition, both before and during nutritional rehabilitation.

Discussion

Well balanced diet is important to ensure that the joints receive a good supply of nutrients that actively sustain the cartilage and bones. It is particularly good for both the cartilage and the bones if your diet is rich in vitamin C, D, K and calcium. Vitamin C contributes to normal collagen formation for the normal functioning of the cartilage and bone. And calcium is required for the maintenance of the normal bones. Vitamin D and K and also Zinc and Manganese contribute to the maintenance of the normal bones.

Certain cartilage constituents are especially important; these are glucosamine sulphate, chondroitin sulphate, hyaluronic acid and collagen. They are found in the normal cartilages and tissue and in the joint fluids and are closely connected with each other in the cartilage metabolism.

Glucosamine is an amino sugar which is found in the body in hyaluronic acid for instance the important constituents of the cartilage matrix also includes chondroitin sulphate. The joint fluid contains a particularly large amount of haul.

Conclusion

Body nutrients like lipids, carbohydrates, proteins, vitamins, and minerals are essential for muscle and joints. In joints most of the bones and cartilages are being run up by vitamin C and D as well. Calcium plays an important role for normal functioning of cartilages and bones.

Bones, joints and muscles make up our muscular skeletal system. All these tissues allow for movement and sport, and active life style and also maintain our body posture. It keeps our bones, joints and muscles healthy. An upright posture, walking, standing, gripping and much more would not be possible without cartilages. Together they make our body's movement system which has to cope with a huge range of different responsibilities and enables us to move about easily.

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Case Report

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Occupational Therapy Intervention in Amyotrophic Lateral Sclerosis: A Case Report

Eshani Mallick[1], Pankaj Bajpai[2]

Abstract

Introduction: Amyotrophic lateral sclerosis (ALS) (the most common form of motor neuron disease) is a progressive and devastating disease involving both lower and upper motor neurons, typically following a relentless path towards death. Occupational therapists are involved in end of life care to improve the quality of life. Adaptive and assistive technology which is other wise a rehabilitative approach is always helpful in improving quality of life. *Case report:* We present cases of two 51-year-old women with amyotrophic lateral sclerosis and the use of assistive and adaptive devices to improve their quality of life. *Conclusion:* Assistive and adaptive devices prescribed and provided were effective in improving quality of life in patients with amyotrophic lateral sclerosis.

Keywords: Lateral Sclerosis; Occupational Therapy Case Report

Introduction

Amyotrophic lateral sclerosis (the most common form of motor neuron disease) is a progressive and devastating disease involving both lower and upper motor neurons, typically following a relentless path towards death [1]. The mean age of onset for sporadic ALS (SALS) varies between 55 and 65 years with a median age of onset of 64 years [2,3,4]. The lifetime risk of developing the condition is 1:400. On average, death results within 2–3 years from symptom onset [5,6,9]. Characterized by heterogeneous patterns of deterioration, presenting symptoms range from falls, limb weakness, communication, and swallowing difficulties to changes in mood, cognition, and behavior [5,7,8,9]. Motor neuron disease encompasses a group of progressive neurologic disorders that destroy cells responsible for the control of essential muscles [10]. Two female patients of 51 years with diagnosis of amyotrophic lateral sclerosis came to National Institute for Locomotor Disabilities for further rehabilitation. They were referred to Occupational Therapy department. Both the patients were dependent in majority of ADL activities. Being an occupational therapist our goal focused on independent ADL and thus improving quality of life.

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Case 1

A left handed, hypertensive lady with diagnosis of anterior horn cell disease from upper socioeconomic status of urban area came to Occupational Therapy department of National Institute for Locomotor disabilities. She was docter by profession. She presented with insidious onset, rapid progressive weakness leading to full dependency on wheelchair for mobility.

- EMG and NCV studies suggestive of anterior horn cell disease
- VEP study suggested bilateral retro optic pathway destruction
- Serum protein electrophoresis showed some increase of beta 1 globulin fraction
- Bone scan report showed increased osteoblastic activity in the bilateral sacroiliac joints and right L4/L5 facet joint.

After Occupational therapy assessment it was found that the patient was fully dependent on ADL activities, she was unable to move her lower extremity and had clumsy movements of upper extremity,

she had generalized wasting of muscles and was highly fatigued and depressed. The Functional Independence Measure (FIM) score was 65/126 and Fatigue Severity Scale (FSS) Score was 62/63.

We found the assets which consisted of the following:-

- She was able to communicate with people independently
- She was used to operate mobile phone with both the hands
- She was able to write slowly with left hand and the words were legible

After identifying the problems we prescribed and also provided adaptive and assistive devices which were required.

Occupational Therapy Intervention

Prescribed Assistive and Adaptive Device

- ✓ Adapted spoon, Fork, Tooth brush (preferably motorized), Hand shower, Handled glass/ Coffee Mug, Comb, Pen, Bath mitt, Bathing brush as demonstrated and suggested
- ✓ Higher level table for eating, washing, brushing as discussed
- ✓ Wheelchair with toilet seat, chest level lapboard and removable arm support
- ✓ Front open Velcro facilitated Modified dressing
- ✓ Use Lifter technology for transfer if possible

Home Care Program

- ✓ Proper positioning on wheelchair.
- ✓ Maintenance of strength and range of motion-active range of motion exercises for both extremities, and perform ADL. Perform ADL with the help of assistive device as far as possible.

Family Involvement in Therapy

- ✓ The family members should encourage the patient for performing the ADL independently.
- ✓ Continuous Psychological support by family member should be provided.

The patient was asked to come and report after 1 month for a follow up, but she did not report. A telephonic conversation with her family members clarified that she was hospitalized due to excessive respiratory distress.

Case 2

A 51 years old depressed housewife with diagnosis of diffuse anterior horn cell disease presented to us with severe slurring of speech with nasal intonation of voice along with difficulty in swallowing food. She had severe weakness of distal muscles of upper extremity initially and later it proceeded towards the proximal muscles but could ambulate independently under supervision. The patient was dependent in feeding, grooming, dressing, bathing. She was taken to the bathroom under supervision. She was unable to write which she used to do before the incident.she cannot even operate the mobile phone. The strength of upper extremity and lower extremity was poor along with endurance level of 50/63. There was impaired manipulation and prehension (FIM score of 49/126, FSS score of 55/63).

- MRI report is suggestive of mild cerebral and cerebrellar atropic changes.
- EMG report was suggestive of diffuse anterior horn cell involvements.

Occupational Therapy Intervention

Prescribed Assistive and Adaptive Device- Adapted spoon, Fork, Tooth brush (Fig. 3), tongue cleaner (Fig. 2), Hand shower, Handled glass/ Coffee Mug, Comb (Fig. 1), Pen, Bath mitt, long handed Bathing brush as demonstrated and suggested. Higher level workstation for eating, washing, brushing as discussed. Front open Velcro facilitated Modified dressing.

Home Exercise Program- Proper positioning, Maintenance of strength and range of motion-active range of motion exercises for both extremities, maintaining strength by making her perform ADL activities

Family Involvement in Therapy- The family members should encourage the patient for doing the ADL activities independently, Continuous Psychological support by family member should be provided.

Follow up

After one month follow up it was found that the FIM score increased from 49/126 to 71/126 that is increase in independency, FSS score was 50/63 from 55/63 which reveals decrease in fatiqueness and thus improved quality of life.

Conclusion

Adaptive and assistive devices are useful technique to increase independency in ADL and thus improving quality of life in patient with anterior horn cell disease or motor neuron disease.

Very few studies was found related to adaptive and assistive devices in ALS. The studies available are from different foreign countries but is not seen in Indian patient with ALS. The adaptive devices provided to the patient are cost effective but effective in increasing independency in ADL.

Acknowledgement

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