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EFFECTIVENESS OF DIFFERENT QUADRICEPS STRENGTHENING PROTOCOLS IN IMPROVEMENT OF EXTENSOR LAG IN OSTEOARTHRITIC KNEE JOINT

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ABSTRACT

Introduction: *Osteoarthritis of knee is a widespread, slowly developing disease with a high prevalence with age, with greater body weight and in post menopausal women. The main causes of functional dysfunction in osteoarthritic knee are pain and quadriceps muscle weakness. Physical rehabilitation usually includes quadriceps exercises i.e. isometric and isotonic exercises for the maintenance of joint range of motion and muscle strength. Biofeedback is a process that can be combined with it to increase the awareness about the extent of muscle work done by quadriceps muscle. The aim of the study was to compare the effectiveness of different quadriceps strengthening protocols with or without biofeedback in improvement of extensor lag in osteoarthritic knee joint.* ***Materials & Methods:*** *Sixty osteoarthritic knee patients with twenty patients each in three groups were randomly selected from Guru Harkrishan Hospital, Sarai Kale khan and Physical rehabilitation clinics in Delhi. Patients were randomly divided into three groups A, B and C. Research Design was Experimental study. Dependent Variables were Quardiceps Lag and Knee ROM .Independent Variables were Biofeedback and Modified Quadriceps Exercise which were introduced to the subjects. ANOVA test was applied to find out the statistical level of significance.* ***Results:*** *There was a great improvement of extensor lag in group C who had received Modified Quadriceps Sets with Biofeedback when compared with group B and group A. The percentage of reduction in pain was more and ROM was more increased in group C when compared with group B and A.* ***Discussion & Conclusion:*** *Modified quadriceps sets with biofeedback are better than the quadriceps sets and quadriceps sets with biofeedback in improvement of extensor lag in osteoarthric knee patients.*

Key Words: *Quadriceps Sets, Biofeedback, Extensor Lag, Osteoarthritis*

Introduction

Knee Osteoarthritis (OA) is a common condition which represents a major contribution to the burden of physical disability. Prevalence increases with age, so that about 11% of all women over the age of 60 yr have symptoms due to knee OA. Most knee OA is managed by conservative means rather than surgery [1]. The disease affects 33% of individuals over the age of 65 years. The rapid increase in the percentage of the people older than 55 rears of age in western countries means that OA is becoming a major public health problem, affecting approx. 40 million people [2].Knee osteoarthritis leads to muscle weakness and vice versa may also be true and we can say that they are two ends of a vicious cycle in elderly people [3].

A 'quadriceps lag' is present when a patient cannot fully 'actively' extend the knee (straighten the leg using muscle contraction), but it can be fully 'passively' extended by the therapist. This would mean that the quadriceps muscle is weak or inhibited, or may be that there are some adhesions present causing pain and inhibition. [4] Sheila C O' Reilly found that quadriceps strength is strongly associated with knee pain and disability in the community, even when activation and psychological factors are taken into account. Main objective was to determine the importance of quadriceps strength, structural change, and psychological status in terms of knee pain in the community and the relative importance of quadriceps function, structural

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change, and psychological status with respect to disability in subjects with knee pain[5] Weakness of quadriceps has also been suggested to be either the result of disuse atrophy secondary to knee pain and muscle inhibition from joint pain dysfunction leading to inactivity and functional weakness from disuse atrophy[6].

Isometric contractions produce low articular pressure and are well tolerated by OA patients with swollen, painful joints. These exercises can improve muscle strength static endurance. They prepare the joints for more dynamic movements and are, therefore, typical starting point for most strengthening programs [7].

The Vastus Medialis Oblique (VMO) originates from the adductor longus and magnus tendons and the medial intramuscular septum majority of fibers arising from the tendon of the adductor magnus[8]. Based on the anatomical findings, Browstein Et Al[9] and others[10,11] have suggested that simultaneous activation of the knee extensors and the hip adductors might provide the VMO with more the quadriceps, it has also been observed that the lowermost fibers of the VMO attach to the anteromedial aspect of tibia through the medial extensor aponeurosis and may act to resist external rotation of tibia[12]. Given this attachment and action, it has been suggested that the VMO can be preferentially recruited through active medial rotation of tibia [10, 12].

Investigation of the relative activity of VMO and vastus lateralis (VL) during knee extension has been conducted by several researchers [13-17]. Both of these components have been shown to be throughout the full range of knee extension, with VMO: VL EMG proportion value ranging from 1 to 1.2 in healthy subjects [13-18]. Hodge and Rechardson found a greater increase in VMO activity compared with VL, activity when hip adduction was added to an isometric knee extension exercise in both weight bearing and non weight bearing conditions [19]. Judi Laprade Et Al compared five commonly used isometric exercises to determine which gives best elicited activity in VMO when compared with VL. The five exercises examined were knee extension, hip adduction, hip adduction with knee extension, medial tibial rotation and knee extension and concluded that VMO:VL proportion was highest when medial rotation and knee extension were resisted simultaneously [20]. Considering all these predisposing factors, the aim of the present study was compare the effectiveness of different quadriceps strengthening protocols in improvement of extensor lag in osteoarthritic knee.

Materials & Methods:

Subject: Sixty osteoarthritis knee patients were randomly assigned in the study. They were randomly divided into three groups A, B and C. Patients were selected on the basis inclusion criteria. The details of the procedure were explained to each subjects and their written consent were taken. Pain was measured by VAS and knee range of motion (ROM) by goniometre.

Inclusion criteria:

- Male/female patients between the age group of 50-75 yrs.
- Confirmatory x-rays showing osteophytes, joint space narrowing (grade ii, iii) or subchondral bone sclerosis.
- Patients with complain of knee pain, stiffness, difficulty climbing stairs, in walking and sitting crossed leg.
- Patient complains of knee pain since 6 months.
- Bilateral knee pain
- Occupation-sedentary job, housewife, sitting job.

- Patients currently receiving tens.

Exclusion criteria:

- Patients with knee OA surgery, recent knee injury.
- Patients who had mental, neurological, cardiac, vascular and sensory problems.
- Patients on nsaids, mao inhibitors, tri-cyclic anti depressants, neuroleptics etc.

Settings

1. Guru harkrishan hospital, Sarai kale khan
2. Physical rehabilitation clinics in Delhi

Design: Experimental model

Equipments

1. ISI marked sphygmomanometer
2. Goniometer (speedway-Ludhiana)

Variables

Dependent: Visual Analogue Scale, knee ROM and Extensor Lag

Independent: Biofeedback, Modified Quadriceps Exercise

Procedure

- Informed consent form filled by the patients.
- 60 patients randomly divided into 3 groups:

In the present study, subjects suffering with bilateral osteoarthritis of knee were divided into 3 groups and three different types of exercises were introduced: group A (quadriceps sets), group B (quadriceps sets with biofeedback) and group C (modified quadriceps sets with biofeedback). The treatment protocol was followed for 2 weeks. After first 3days of treatment one day rest was given and again the treatment was given for another two days and one day rest to avoid the exertion to the patients. Then the same treatment protocol was followed for the second week.

Group A: Ask patient to sit on the plinth, with the knees flexed to few degrees. Ask the patient to push his/her knees back and tighten the front thigh muscle. Have the patient dorsiflex the ankle without letting the foot to clear the floor, and then hold an isometric contraction of the quadriceps.

Group B: Ask patient to sit on the plinth, place an inflated sphygmomanometer cuff below the distal end of femur. Then ask the patient to push his/her knees back and tighten the front thigh muscle. Then patient is asked to maintain the mercury level by holding an isometric contraction of the quadriceps.

Group C: Ask patient to sit on the plinth, with the knees flexed to few degrees. Place an inflated sphygmomanometer cuff in between the thighs. Firstly the patient is instructed to press on the cuff from both thighs and then asked to perform isometric contraction of quadriceps.

Duration

- 2 weeks
- 5 times/wk
- Rest after 3 days of exercise
- 1 session: 3 sets(1set x 15repetitions)

Techniques of exercises

1. Group A (Quadriceps Sets)

2. Group B (Quadriceps Sets with Biofeedback)

3. Group C (Modified Quadriceps Sets with Biofeedback)

Statistical Analysis:

The data were analyzed using student's t- test. The level of significance was set at $p<0.05$. ANOVA - test was applied to find out the level of significance between the groups and within groups.

Results

Table 1. Showing F –values between groups and within groups and their level of significance by applying ANOVA test

Variables		"F" Value	P - value
EL - Pre	B/W GROUPS	0.049	0.953
	WITHIN GROUPS		
EL- Post	B/W GROUPS	5.679	0.009
	WITHIN GROUPS		
VAS- Pre	B/W GROUPS	0.604	0.554
	WITHIN GROUPS		
VAS-Post	B/W GROUPS	3.209	0.056
	WITHIN GROUPS		
FLXN-Pre	B/W GROUPS	0.464	0.634
	WITHIN GROUPS		
FLXN-Post	B/W GROUPS	1.119	0.341
	WITHIN GROUPS		

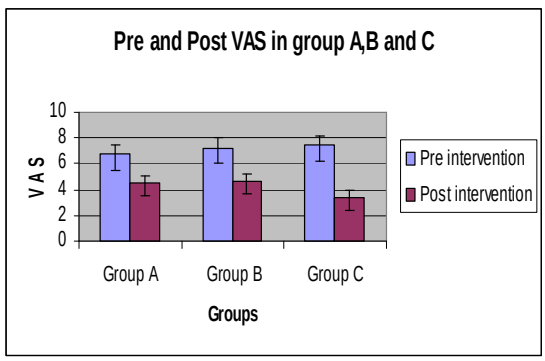

Figure 1: Comparison of Pre and Post VAS in Groups A, B and C

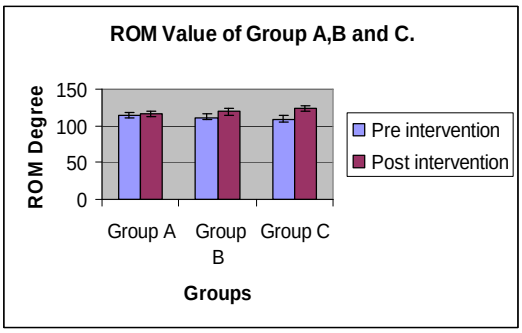

Figure 2: Comparison of pre and Post Values of ROM in Group A, B and C

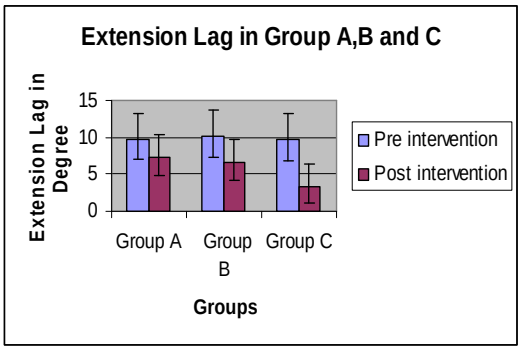

Figure 3: Comparison of Pre and Post Values of Extension Lag in Groups A, B and C

It was observed from the fig 3 that there was a great improvement of extensor lag in group C who had received Modified Quadriceps Sets with Biofeedback when compared with group B and group A. The mean± standard deviation in post-test analysis for group C came out to be 3.4± 2.4 as compared to 6.6±2.503 and 7.2±3.1 for groups B and groups A respectively (Lag in Degrees). Thus group C showed greater improvement in extensor lag as compared to other two groups due to greater effect on the activation of VMO component of the quadriceps. The level of significance was $p< 0.001$. It was shown in fig 1 that pain was reduced more in the knee joint in group C patients as compared with group B & A . Even it was found that in group C patient's knee flexion was raised more as observed from fig 2.

Discussion

Browstein et al[9] and others[10,11] have suggested that simultaneous activation of the knee extensors

and the hip adductors might provide the VMO with more of the force of quadriceps, it has also been observed that the lowermost fibers of the VMO attach to the anteromedial aspect of tibia through the medial extensor aponeurosis and may act to resist external rotation of tibia[12]. It could be suggested that the VMO can be preferentially recruited through active medial rotation of tibia [10, 12].

Investigation of the relative activity of VMO and vastus lateralis (VL) during knee extension has been conducted by several researchers [13-16]. Hanten and Schuthier reported proportionally greater VMO activity of VL muscle during a maximal hip adduction effort with knee extended [10] and Hodge and Rechardson found a greater increase in VMO activity compared with VL, activity when hip adduction was added to an isometric knee extension exercise in both weight bearing and non weight bearing conditions [19].

In the present study , it was observed that percentage of decrease in Extension Lag in group C was 64.9% which was highly significant where as in group B and group A , it was 34.6% and 26.5% respectively . It showed that Modified Quadriceps Sets with Biofeedback had more beneficial effects than other two Quadriceps exercises .T. J. Antich and Clive E. Brewster reviewed some techniques that were found to be effective for decreasing or eliminating knee pain in patients performing quadriceps femoris exercises. Specific modifications of standard quadriceps femoris muscle exercises often allow completely pain-free exercise, thus providing a faster progression of treatment and a subsequently shorter rehabilitation period. Patients with Patellofemoral jonint (PFJ) symptoms may achieve pain relief by performing isometric hip adduction exercises before performing knee-extension exercises. Although isometrically adducting the hips (2 sets of 10 repetitions, each of 10 seconds' duration) does not elicit a VMO muscle contraction automatically, performing hip adduction exercises before knee-extension exercises has been observed to result in decreased pain [21].

We observed from this study that ROM for flexion was raised by 13.7 % ($p< 0.05$) in group C where as in group B & A , it were 7.2 % ($p< 0.05$) and 1.7% ($p>0.10$) respectively. Pain was measured by VAS. It was found that in group C , pain was reduced by 54.0% ($p<0.001$) whereas it were reduced by 36.1% ($p<0.05$) and 32.8%($p> 0.10$) in group B & C respectively.

Conclusion

In the present study, group C had shown significant effect in improvement of extensor lag as compared to group B and A. Hence modified quadriceps sets with biofeedback are better than the quadriceps sets and quadriceps sets with biofeedback in the improvement of extensor lag in osteoarthritic knee patients.

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