

“Effectiveness of General Quadriceps strengthening versus selective Vastus Medialis Obliquus strengthening in Patellofemoral Pain Syndrome.”

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Abstract: The aim of this study was to determine whether general quadriceps strengthening is effective as compared to selective Vastus medialis obliquus (VMO) strengthening in Patellofemoral pain syndrome (PFPS) . Ten subjects who had suffered from patellofemoral pain syndrome resulting in difficulty during activity of daily living like squatting, cross leg sitting, jumping, walking, stair climbing and pain which worsens with descending stairs were chosen. Their Pain on VAS, Strength by Pressure biofeedback(Stabilizer), Range Of Motion(Universal Goniometer) and functional activities with (Knee functional score) were considered before and after intervention. The subjects were divided into Group A and B and intervention was given for six days a week for six weeks which included 3 sets of general quadriceps strengthening and selective VMO strengthening respectively while Ultrasound was common for both the groups. Strength and Functional activities improved significantly with VMO strengthening ($p < 0.05$), but no significant difference was seen in Pain and Range of motion between the groups though significant difference was seen in pre and post values of both groups concluding that VMO strengthening is effective in case of PFPS.

Key words: VMO, PFPS, Pressure biofeedback.

INTRODUCTION:

Patellofemoral pain syndrome (PFPS) is a highly prevalent musculoskeletal overuse condition that has a significant impact on participation in daily and physical activities¹. Though it is a common musculoskeletal condition it is difficult to manage². A recent retrospective view of running

injuries found PFPS to be the most common presentation to a sports medicine clinic in both females (19.2% of injuries) and males (13.4% of injuries)³. The etiology of patellofemoral pain syndrome may be multifactorial. Causes include overuse/overload, biomechanical problems and muscular dysfunction.

PFPS is often used interchangeably with other terms, such as patellofemoral pain (or stress) syndrome, patellofemoral dysfunction or anterior knee pain. PFPS here describes patients who have pain over the anterior aspect of the knee that typically occurs with activity like stair climbing, squatting, walking, running which often worsens when they are descending steps or hills⁴.

Generally strengthening the quadriceps musculature is the widely used treatment for PFPS⁵, but one theory states that, if the force generated by the VMO is essential for proper patella tracking, then general quadriceps femoris strengthening, especially closed chain exercises⁶, will bring the VMO up to a 'threshold' necessary for optimal tracking⁷. Hence there is debate as to whether rehabilitation should be based on exercises strengthening the quadriceps femoris muscle group or specifically targeting the vastus medialis oblique (VMO).

The study presented here aims to compare the general quadriceps strengthening approach with a selective VMO strengthening approach in the management of PFPS.

Method:

Ten subjects including both males and females were selected between age group of 18 to 60 years who are willing to participate in the study. They met the criteria that at least three diagnostic tests are positive out of five on clinical examination⁸. The subjects were briefed about the study, the intervention and a written consent was obtained. Before and after the intervention, Pain (Visual analogue scale), Range of motion (Universal Goniometer), Function (Knee Functional score), Strength (Pressure Biofeedback) were measured. Subjects were divided into group A and B which consisted of 5 patients each by convenient sampling.

Group A was given general quadriceps strengthening (subjects were instructed to keep a shoulder-width distance between feet and then bend both the knees and go down smoothly and come back up. They could increase the intensity of this exercise by carrying dumbbells in hands in according to Delorme Regimen (1945)⁹ by calculating 10 RM for each subject. 1RM is the greatest amount of weight a subject could lift throughout the full ROM just 1 time and amount of weight that could be lifted and lowered just 10 times is 10 RM. Delorme proposed and studied the use of 3 sets of 10 RM with progressive loading during each set¹⁰ (**Photograph no.1**)

Group B was given selective VMO strengthening (subjects were instructed to do double

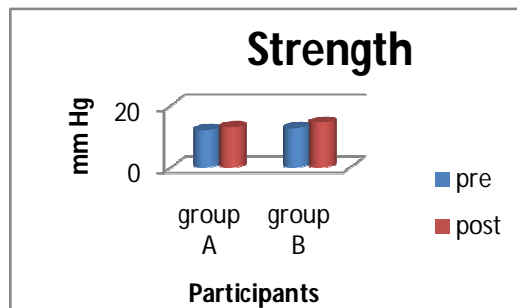
leg squat with isometric hip adduction exercise by placing one ball between both the knees to maintain hip adduction and distance between both the knees and another ball between wall and back of the patient for smooth movement. Then the subject was instructed to bend both the knees and go down smoothly and come back up. The subject could increase the intensity of this exercise by carrying dumbbells in hands in accordance to Delorme Regimen (1945) by calculating 10 RM for each patient. **(Photograph no.2)**

Ultrasound Therapy was common for both the groups (Subjects were in supine lying position, knee slightly flexed with support below the knee, continuous ultrasonic waves of 1 MHz frequency and 1.5 W/cm² power was applied with a 5-cm diameter applicator (Sonopulse 434; Enraf Nonius, Delft, The Netherlands) for 5 min per session¹⁰ over the anterior knee after the exercises were administered.

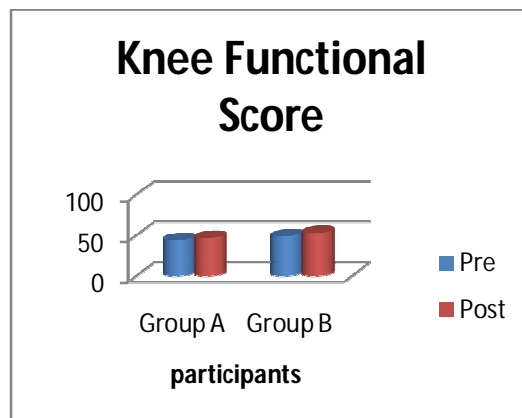
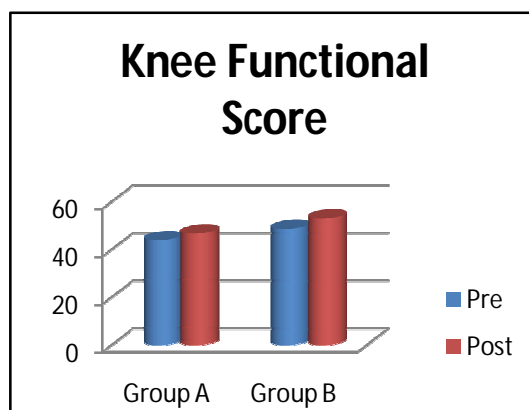
Pre and post treatment strength was measured with Stabilizer™ (Pressure Biofeedback, Chattanooga Group, Inc., USA), Pain on Visual Analogue Scale, Range of Motion with Universal Goniometer, Functional activity with Knee Functional Scale. (Reliability and Validity of all instruments are evaluated.) **(Photograph no.3)**

DATA ANALYSIS:

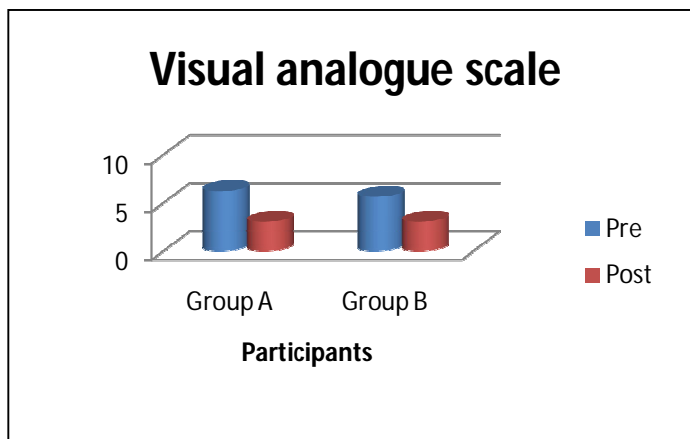
(Graph no.1)



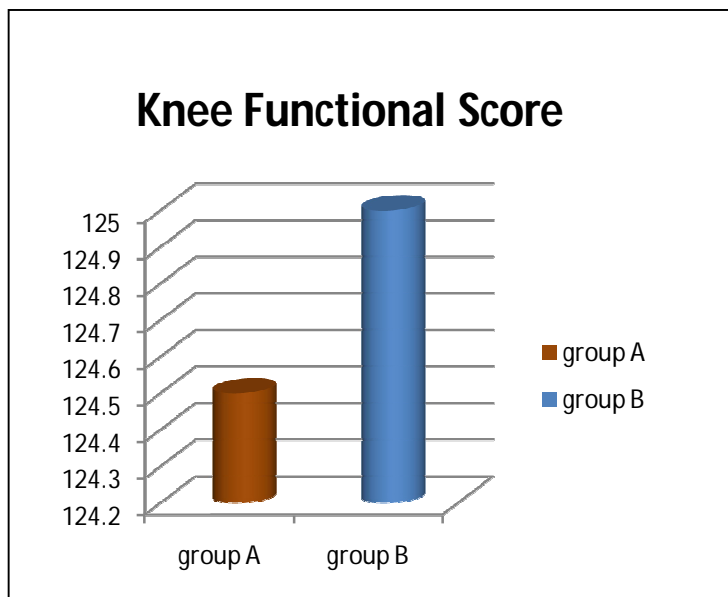
(Graph no.2)



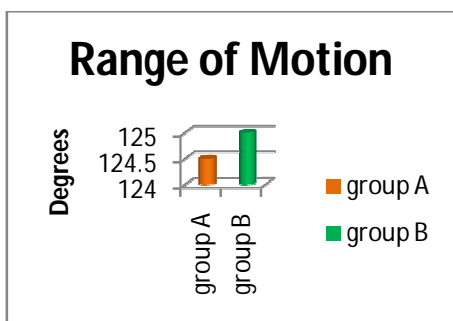
(Graph no.3)



(Graph no.4)



(Graph no.6)



(Graph no.5)

RESULTS:

Graph 1 shows that VMO strengthening demonstrated statistically significant increase in strength of Group B ($p < 0.05$) as compared group A. Graph 2 states that Group B shows statistically significant difference as compared to Group A ($p < 0.05$) in terms of Knee functional score. While there was no statistically significant dif terms of Range of motion.

(Graph 3), yet a statistically significant difference between pre and post intervention ranges was noticed. However, it revealed that there was reduction in pain on Visual analogue scale of Pre and post intervention scores.

(Graph 4)

DISCUSSION:

This study demonstrated that both general quadriceps strengthening and VMO strengthening reduced pain and improved range of motion, but that there was no difference between the approaches while VMO strengthening plays significant role in improvement of strength and functional activities and participation. The conclusions supported previous work, which demonstrated minimal added value of selective VMO training in improving pain and function .

Several RCTs investigating PFPS have examined the benefit of selective activation of the VMO by comparing conventional open and closed kinetic chain exercise programs with and without electromyography biofeedback have reported no additional clinical improvement between the groups at three-month follow-up¹¹

The inclusion of VMO strengthening exercises in the initial stages of the rehabilitation process merely reflects first stage of a program of 'quadriceps femoris' strengthening¹⁰. Furthermore, Powers¹² suggested that optimising lower limb alignment of the femur relative to the patella, by enhancing pelvic and femoral control, may be as pertinent as focusing on rehabilitating muscles that directly control the patella.

CONCLUSION:

The study demonstrated that physiotherapy involving either selective VMO strengthening exercises or a general quadriceps femoris strengthening program reduced pain, improved Range of motion, but selective VMO strengthening is most likely to be given to improve strength and functional activities of day today life in PFPS patients.

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REFERENCES:

1. Bill Vicenzino, Natalie Collins, Kay Crossley, Elaine Beller, Ross Darnell and Thomas McPoil: Foot orthoses and physiotherapy in the treatment of patellofemoral pain syndrome: A randomized clinical trial.
2. Biedert RM. Pathogenesis of patellofemoral pain. In: Biedert RM, editor. Patellofemoral disorders diagnosis and treatment. Chichester, England: John Wiley & Sons, Inc.; 2004. p. 55-69.
3. Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR, Zumbo BD: A retrospective case-control analysis of 2002 running injuries. *Br J Sports Med* 2002, **36(2)**:95-101.
4. Fox TA. Dysplasia of the Quadriceps Mechanism: Hypoplasia of the Vastus Medialis Muscle as Related to the Hypermobility Patella Syndrome. *Surg Clin North Am*, 1975; 55:199-226.
5. Bolgia L, Malone T. Exercise prescription and patellofemoral pain: evidence for rehabilitation. *Journal of Sport Rehabilitation* 2005;14:72e88
6. Boling MC, Bolgia LA, Mattacola CG, Uhl TL, Hosey RG. Outcome of a weight-bearing rehabilitation program for patients diagnosed with patellofemoral pain syndrome. *Archives of Physical Medicine and Rehabilitation* 2006;87:1428e35.

9. Grabiner MD, Koh TJ, Dragnich LF. Neuromechanics of the Patellofemoral Joint. *Med Sci Sports Exerc*, 1994; 26:10-21.
10. Jo Nijsa,b,_, Catherine Van Geela, Cindy Van der auweraa, Bart Van de Veldea Diagnostic value of five clinical tests in patellofemoral pain syndrome *Manual Therapy* 11 (2006) 69–77
11. DeLorme T. Restoration of muscle power by heavy resistance exercise. *Journal of Bone and Joint Surgery* 1945;27:645e67.
12. G. Syme , P. Rowe , D. Martin , G. Daly Disability in patients with chronic patellofemoral pain syndrome:A randomised controlled trial of VMO selective training versus general quadriceps strengthening,*Manual Therapy* 14 (2009) 252e263.
7. Selfe J, Harper L, Pedersen I, Breen-Turner J, Waring J. Four outcome measures for patellofemoral joint problems: part 2. Reliability and clinical sensitivity. *Physiotherapy* 2001b;87:516e22.
8. Powers CM, Landel R, Perry J. Timing and Intensity of Vastus Muscle Activity during Functional Activities in Subjects with and without Patellofemoral Pain. *Phys Ther*, 1996; 76: 946-955 .



Photograph no.1



Photograph no.2



Photograph no.3

This original research work was conducted in college of Physiotherapy, PIMS,Loni, Tal .Rahata, Dist.Ahmednager, Maharastra, India, Pin-413736 by Dr.Leena Choudhari with Dr.Kirthi Rao.

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