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A study on effectiveness of Diadynamic current with Vastus Medialis oblique training in Patellofemoral pain syndrome

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Abstract
Background and Purpose: Patellofemoral pain syndrome (PFPS) is a common knee disorder characterized by anterior or retro patellar pain associated with activities that load the patellofemoral joint. Diadynamic current and VMO training was effective treatment in patients with PFPS.
Objective: To find out the effect of Diadynamic current and Vastus Medialis Oblique training to reducing pain and improving function in subjects with Patellofemoral Pain Syndrome
Study Design: Experimental design
Methods: 30 subjects with patellofemoral pain syndrome with age between 20-50 were recruited for the study and then randomly assigned to either one training group. 10 cm- Visual Analogue Scale of pain (VAS), Anterior Knee Pain Scale (AKPS) and Lower Extremity Functional Scale (LEFS) were the assessment tools used. The scores were measured before, after exercise training.
Results: The values were statistically analyzed using paired 't' test and independent 't' test. There was statistically significant improvement both within the groups and in between the groups on all the 3 outcome measures. Group- A had greater improvement than Group-B.
Conclusion: This study shows that Diadynamic current with VMO Training will be more beneficial effect in patients with patellofemoral pain syndrome.

Keywords: Patellofemoral pain syndrome (PFPS), Vastus Medialis Obliquus (VMO), Diadynamic current

Introduction
Patello femoral Pain Syndrome is one of the most frequent musculoskeletal disorders of the knee joint, [1-3] including approximately 25% of the orthopaedic diagnosis [2] It is defined as an anterior and/or retro patellar knee pain as a result of structural and biomechanical alterations of the joint [4-6]. It is one of the most prevalent knee conditions in adolescents and young adults [7, 8]. The etiology of Patello femoral Pain Syndrome is likely to be multifactorial [9]. Among the most frequent biomechanical factors related to the Patello femoral Pain Syndrome development, the static and dynamic unbalance stands out [5]. Among the alterations on the static unbalance, some authors assure that abnormalities such as excessive subtalar pronation, increase on the Q angle, external tibial torsion, retraction of the lateral retinaculum and improper patellar behavior can cause anterior knee pain [10, 11]. Along with an evolving understanding of the pathomechanics of patellofemoral joint, came novel intervention approaches geared toward addressing flexibility and strength deficits of the knee structures, or structures immediately adjacent to the knee. Physical therapy plays an important role in the conservative management of Patello femoral Pain Syndrome, with treatment frequently advocated for pain control and muscle strengthening [14]. However other authors relate Patellofemoral Pain Syndrome with the unbalance on the dynamic stabilizer muscles, especially among the medialis and lateralis components [5, 10-13] Diadynamic current and Strengthening the VMO was believed to be the key to "proper tracking of the patella". The purpose of this study was therefore to investigate the effectiveness of Diadynamic current and VMO training in reducing pain and improving function in individuals with Patellofemoral Pain Syndrome.

Objective
To find out the effect of Diadynamic current and Vastus medialis Oblique training to reducing pain and improving function in subjects with Patellofemoral Pain Syndrome.

Methods
30 subjects with patellofemoral pain syndrome with age between 20-50 were recruited for the study and then randomly assigned to either one training group. 10 cm- Visual Analogue Scale of pain (VAS), Anterior Knee Pain Scale (AKPS) and Lower Extremity Functional Scale (LEFS) were the assessment tools used. The scores were measured before, after 2 weeks of exercise training.30 subjects with unilateral or bilateral Patellofemoral Pain Syndrome were selected and randomly assigned into two experimental groups A and B. Subjects of Group A were taught Knee Extension Exercises Quadriceps sets: 3 sets of 10 repetitions at a time (1 minute rest between each set). It can be done several times throughout the day. Subjects of Group B were Diadynamic current is a monophasic pulsed current that was sine wave, operating at 50Hz (or 60Hz USA) which is then rectified (full wave or half wave). The resulting monophasic pulses have a duration of 10 milliseconds. MF is a half wave rectification which will deliver 50 pulses per second, delivering 10ms pulses with a 10ms interval given for 15 minutes.

VMO training
The subject is seated in a chair with back supported, the knees flexed to 90 degrees and the affected foot fully on the ground (compression through a joint enhances activity in the stabilizing muscles like the VMO). By pushing the foot forward along the floor very gently and tightening the Quadriceps with the knee in 90 degrees of flexion, the subject simultaneously squeezes a towel placed between the knees and holds it for 10 seconds. Hips should not be internally rotated when trying to perform adduction. Different flexion angles can be used on subsequent visits. 90 degrees is the usual starting position as the VMO comes in more readily in this position. It is repeated 10 times, twice or thrice daily. The total treatment duration was 2 weeks. For the first week the subjects were supervised in the Physiotherapy department for atleast twice a week. After two weeks they were instructed to continue the exercises in their home itself and asked to come after 3weeks. Pain and functional outcome scores were taken at the first visit, two weeks after exercise and finally 6 weeks after exercise.
Treatment for Group B: Quadriceps sets: 3 sets of 10 repetitions at a time (1 minute rest between each set). It can be done several times throughout the day.

Study Design
Experimental Design

Population
Individuals with unilateral or bilateral Patellofemoral Pain Syndrome who were referred to the Department of Physiotherapy Saveetha Medical college Hospital, Chennai.

Sampling Method
Purposive Random Sampling, Subjects were selected in accordance to a predetermined inclusion and exclusion criteria to ensure homogeneity of the subjects. The subjects were then randomly assigned into two groups, Group A and Group B.

Sample Size
Total: 30 Subjects.
Group A: 15 Subjects (Diadynamic currents and VMO training).
Group B: 15 Subjects (Traditional Knee Extension Exercises alone).

Inclusion Criteria
- Age: 20-50 Years
- Sex: Both Males and Females
- Subjects with unilateral or bilateral Patello Femoral Pain Syndrome
- Subjects having Anterior or Retro patellar Knee pain on at least two of the following activities
  - Prolonged sitting
  - Squatting
  - Climbing up or down stairs
  - Running
  - Kneeling
  - Jumping / Hopping
- Pain on at least two of the following evaluations
  - Palpation
  - Patellar compression
  - Resisted knee extension
- Subjects having symptoms for at least 1 month and pain level >3 and <8 on Visual Analogue Scale (VAS).

Exclusion Criteria
- Severe knee pain >8 on Visual Analogue Scale (VAS)
- Referred pain from back or hip
- Recent history of medications for pain relief (within 3 months)
- Recent knee surgeries
- Central or Peripheral neurologic pain
- Severe knee deformities or malalignment of lower extremities

Outcomes Measured
- Pain
- Lower extremity functional outcome

Measurement Tools
- Visual Analogue Scale (VAS)
- Anterior Knee Pain Scale (AKPS)
- Lower Extremity Functional Scale (LEFS)

Results
The values were statistically analyzed using paired‘t’ test and independent ‘t’ test. There was statistically significant improvement both within the groups and in between the groups on all the 3 outcome measures. Group- A had greater improvement than Group-B.

Table 1: Pre Score

S. No	Statistical Measurement	VAS		AKPS		LEFS	
		Group A	Group B	Group A	Group B	Group A	Group B
1.	Mean	8.13	8.2	73.7	74.5	59.8	60.4
2	Standard Deviation	0.74	0.67	7.1	7.2	13.9	14.8

Table 2: Post Score

S. No	Statistical Measurement	VAS		AKPS		LEFS	
		Group A	Group B	Group A	Group B	Group A	Group B
1.	Mean	5.2	0.93	61.2	36.0	62.9	84.0
2	Standard Deviation	1.62	0.45	10.4	8.7	8.7	7.58

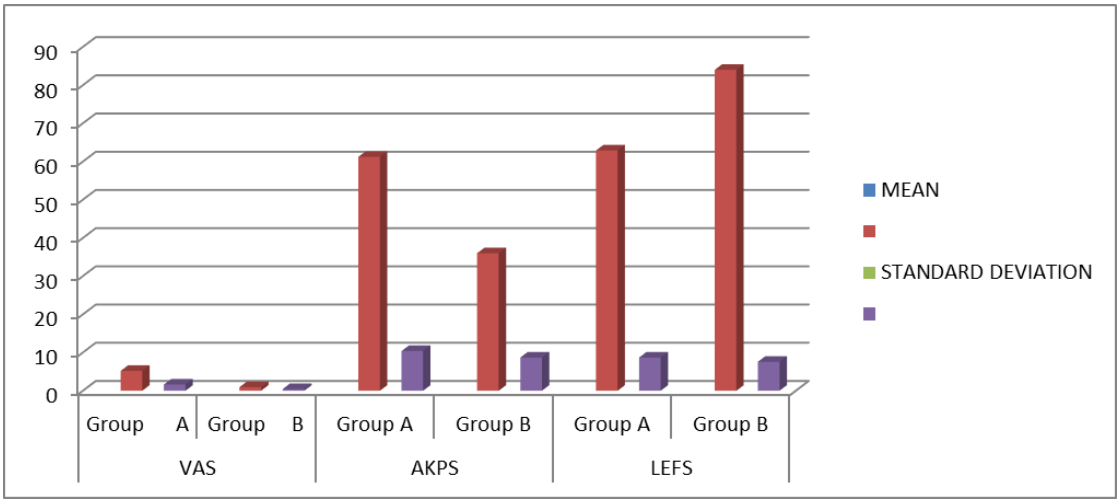

Fig 1: Pre Score

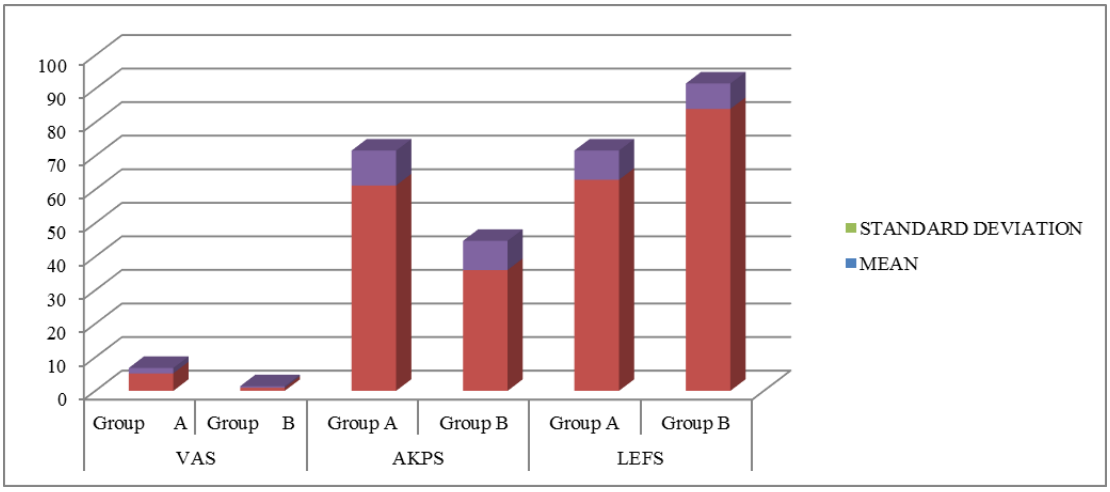

Fig 2: Post Score

The Results shows that the unpaired t Test will be used to find out the outcome measures following:

In VAS measurements are the two-tailed P value is less than 0.0001 by conventional criteria, The mean of Group One minus Group Two equals 4.2700, 95% confidence interval of this difference: From 3.3807 to 5.1593, t = 9.8360, df = 2, standard error of difference = 0.434.In anterior knee pain scale results for the two-tailed P value is less than 0.0001 by conventional criteria, this difference is considered to be extremely statistically significant. The mean of Group One minus Group Two equals 25.200, 95% confidence interval of this difference: From 18.029 to 32.371, t = 7.1980, df = 28, standard error of difference = 3.501, the lower extremity functional scale compare to both groups are the two-tailed P value is less than 0.0001 by conventional criteria, this difference is considered to be extremely statistically significant. The mean of Group One minus Group Two equals -21.100, 95% confidence interval of this difference: From -27.175 to -15.025, t = 7.1144, df = 28, standard error of difference = 2.966. The results of this study concur with the findings that individuals symptomatic for PFPS may benefit by Diadynamic current with VMO training.

Discussion

Patellofemoral pain syndrome is a common condition presenting to physiotherapy practices. Despite its prevalence, the aetiology remains unclear and there is a limited consensus on the efficacy of selected exercises focusing on VMO retraining. The current debate when rehabilitating the patellofemoral joint is over the type of strengthening of the Quadriceps muscle. Rehabilitation that included selective strengthening of the vastus medialis portion of the Quadriceps muscle has been shown to be an effective treatment option for patellofemoral pain. Two portions of the vastus medialis muscle have been identified, the superior or longitudinal component and the oblique or inferior component (VMO). The VMO originates partially from the adductor longus and the adductor magnus and has an orientation that is either oblique or transverse, with the insertion of the inferior or oblique section occupying half or more of the medial border of the patella. Lieb and Perry [16] determined that the VMO was a significant stabilizer of the patella, as well as a knee extensor which is frequently innervated independently from the rest of the quadriceps by a branch from the femoral nerve. Diadynamic current applied to the quadriceps muscle in the anterior aspect of the knee to given. It is very effective pain relief of Patello femoral pain syndrome. VMO, when compared with the other vastus components, could easily be inhibited by pain, effusion and atrophies. Training the VMO should be regarded as a motor skill acquisition rather than a strengthening procedure. Appropriate training allows the motor control

system to acquire information necessary to change the length-tension properties of the agonist, in this case the VMO and its antagonist the vastus lateralis.

In patellofemoral pain sufferers, the vastus medialis activity decreases significantly; and instead of being tonically active, the VMO becomes phasic in action, which may explain the onset of pain further into, rather than at the beginning of an activity.

The subjects of both the groups in our study improved significantly on all the three outcome measures. Group-A subjects showed significantly better improvement than Group-B particularly at the end of second week. This suggests that immediate effects of pain reduction, and functional ability improvement occurred following hip adduction combination with knee extension exercise. The results of this study concur with the findings that individuals symptomatic for PFPS may benefit by adding isometric hip adduction with knee extension in weight bearing positions. The results presented here must be viewed with caution, as the number of subjects in each group was less. While classification of PFPS was carefully controlled, no attempt was made to quantify the degree of pathology beyond the subject's description of pain. However, the duration of symptoms and reported severity of pain was similar across subjects. In addition, all of the subjects were active and relatively close in age.

Suggestions and Limitations

1. This study was done in a short-time period with a small number of subjects. Therefore to make the results more valid, long-term study with a larger sample size is recommended.
2. This study does not include EMG analysis or Biofeedback training. So further studies utilizing EMG analysis of muscle activity, EMG Biofeedback training can be carried out.
3. Inclusion of a control group would be helpful in validating the results.
4. Further studies are recommended to analyze the effect some other modified exercise regimen.
5. This study does not include muscle morphology measurement. So, further studies with muscle morphology as an outcome measure are recommended.

Conclusion

Patellofemoral pain syndrome (PFPS) is a common knee disorder characterized by anterior or retro patellar pain associated with activities that load the patellofemoral joint. Even though the traditional knee extension exercise training seems to be effective, the results suggest that immediate effects of pain reduction and functional ability improvement occurred following Diadynamic current and VMO Training.

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