International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979; Impact Factor: RJIF 5.72
Received: 11-01-2019; Accepted: 13-02-2019
www.allsubjectjournal.com
Volume 6; Issue 3; March 2019; Page No. 121-124

Effectiveness of Pilates on strength of quadriceps muscles in healthy individuals

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Abstract
Background: The aim of the current study was to check the effectiveness of Pilates on strength of quadricep muscle in healthy individuals.
Methodology: A convenient sample of 40 people consists of college students including 20 males and 20 females from Dr. A. P. J. Abdul Kalam College of physiotherapy, PIMS, Loni. The participants included were between age group of 18-24 years and having knowledge about both in English and Marathi. Illiterate individuals were excluded.
Results: The data was analyzed using z test. Pre-intervention score for MMT was 2.95±0.7493 and post-intervention for MMT was 4.17±0.7472. Result showed that z value was -7.439 which is considered as extremely significant.
Conclusion: The study concluded that the strength of quadriceps muscle significantly increased after performing Pilates exercise as expressed by increase in Manual Muscle Testing grade.

Keywords: quadricep weakness, Pilates, muscle strength, core stability

Introduction

Human knee joint is one of the three-dimensional complex structure whose geometry is difficult to execute by solid model [1]. The biggest joint in the human body is knee joint and it is more susceptible to degenerative changes and injuries. Its localization between femur and tibia is important in everyday activities such as kneeling, rising from seated chair and walking. It is a type of modified hinge joint. The articular surfaces created by medial femoral and lateral femoral, tibial condyles and articular surfaces of patella. Articular cartilage covers the knee joint. Articular cartilage is composed of 4 layers. Articular cartilage is anural, avascular and is made up of connective tissue. The smooth and painless movements are created by the articular cartilage. Knee joint is divided into two joints: tibiofemoral and patellofemoral joints. Patella is one of the largest sesamoid bone which is concave articular surface. Tibiofemoral joint – articulates condyles of femur and tibia. It is classified as modified hinge joint where sliding occurs [2]. The quadriceps femoris insertion into the patella is through a common tendon which is three-layered arrangement: rectus femoris (RF) most superficially, vastus medialis (VM) and lateralis (VL) in the intermediate layer, and vastus intermedius (VI) which is situated most deeply [3]. Out of all 4 muscles every muscle has different contribution in total strength of quadriceps.35%of the quadriceps strength is contributed by the vastus intermedius and rectus femoris together, 40% is contributed by vastus lateralis and 25% is from the vastus medialis [4]. Quadriceps muscle weakness also known as "Arthrogenous muscle weakness" is weakness of muscles acting or occurring on an inflamed or injured joint. This weakness might occur due to loss of muscle or the inability to activate the muscle. The weakness of the quadriceps muscle, and of the thigh muscle is a common and important cause of knee trauma, surgery or an arthritis, Muscle weakness results in disability and renders the joint thus leading to further damage of the muscle. This contributes to atrophy further leading 3 to weakness. Several studies concentrate on inhibition of quadriceps activation. It is most commonly believed that vastus medialis muscle wasting is more than the other three heads of the quadriceps [5]. Pilates exercise was created by Joseph Pilates in 1920.He was a German physical trainer. These exercises are used to increase muscle strength, endurance, flexibility, posture and balance. These exercises are easy to perform and maintain. Initial methods of muscle conditioning involved maximum voluntary contraction of a muscle group but in Pilates, emphasis is on the recruitment of motor units [6]. Pilates exercise is divided into two approaches 1) Reparatory and 2) Modern approach. The traditional reparatory approach uses a set of exercise repetition and exercise sequence and modifying them according to different type of problems. On the other hand, in modern approach focus is mainly on understanding and improving body awareness and giving exercise according to the client weakness or strength [7]. Pilates exercise involves activation of specific muscle in a particular sequence with controlled speed, precision and control of movement with emphasis on breathing and proprioception. Pilates exercise is suitable for all age groups and all body types due to modifiable nature of movements [8].

Methodology

Source of data: The data was collected from the students with quadriceps weakness in Dr A.P.J Abdul Kalam, college of Physiotherapy, loni, Taluka-Rahata, district Ahemadnagar- 413736, and Maharashtra. Method of collection of data: Primary

Type of Data: Primary
Study Design: Prospective interventional
Sample size: 40 Participants: Male and female of age group 18-24 years
Sampling Method: Convenient sampling. Study Duration: 3 weeks
Equipment's to be used: Mat

Materials to be used
1. Consent form
2. Data collection sheet
3. Recording Sheet
4. Pen
5. Pencil.

Selection Criteria
- **Inclusion criteria**
  1. Young individuals with less than grade 4 of quadriceps muscle strength on manual muscle testing
  2. Subjects willing to participate
  3. Both male and female
  4. Age group between 18-25 years
  5. Subjects with quadriceps muscle weakness

- **Exclusion criteria**
  1. History of any lower limb surgery in the last 12 months
  2. Physically challenged
  3. Any congenital abnormalities of lower limb
  4. Soft tissue injury of the lower limb

Procedure
The ethical clearance form registration no. BPT/INT/2018/19
The participants were screened and after finding suitability according to inclusion and exclusion criteria, they were requested to participate in the study. They were explained about the study. The participants were briefed about the intervention. They were explained about the effect of Pilates such as improve in strength, core stability, endurance and body mobility. An informed written consent obtained from the participants. The demographic data was obtained, and assessment was done. The sample size of the study was 40 participants. There was single group of 40 participants. The participants included were young students from Dr A.P.J Abdul Kalam college of physiotherapy. There were 20 males and 20 females included in the study. The participants were in supine position on mat. Before starting with Pilates exercise each and every individual was educated about the stretching of whole body. The participants were instructed to focus more on lower limb muscle stretching and also, they were instructed about the breathing control, concentric muscles contraction. Every individual participant was explained about the Pilates methods 6 basic principles: i.e. 1. cantering 2. breathing 3. control 4. concentration 5. flow (fluidity) 6. Precision.
Pilates Principles: Cantering: Pilates is often described as "movement flowing out from a strong centre." This centre is the foundation for all movement. Our priority is to create a strong and dynamic centre which is essential for functional movement. Breathing: This essential link between the body and the mind is the foundation of all life. Full, conscious breath will not only have many physical and mental advantages, but also keep the mind focused. The Pilates breath is unique and helps in core stabilization and mobilization. Control: Pilates named his method "Contrology" as his aim was to control the movement and focus on quality. In order to be in control, we need to understand and be able to perform movements with the correct form and flow. 15 Concentration: Concentration cannot be achieved without intentional and informed focus. "It is the mind itself which controls the body" said Joseph Pilates. It is the internal focus and being in the moment that will make the difference. Flow: Pilates exercises are performed with flow and smoothness. This brings grace to the movements and lessens the pressure on the joints. Precision: In order to achieve precision, there must be a combination of concentration and control. In Pilates it is quality and efficiency that counts. Proper alignment, form and breathing will create precision6. Therapist will demonstrate participants with all four Pilates exercises (MAT) basis. Pilates Exercise. The hundreds Level 1 Neutral spine Transverse abdominis and Multifidus co-contraction. Palpation of transverse abdominis and multifidus Slow exhalation while initiating 30% of contraction Hold position and focus on up to 10 breath cycles. LEVEL 2 Inhalation to prepare. Exhalation and raise right knee over right heel. Hold position pulse arm up and down in small arc of movement. Inhale for 5 arm movements and exhale for 5 arm movements for up to 100 arm movements. On fifth breath out lower the right leg to the mat Repeat on left leg Repeat 1-2 times on both legs. 16 One leg stretch LEVEL-1 Inhale to prepare Exhale, slide the left heel forward along the floor away from the sitting bone Inhale. Slide the left heel back along the floor towards the sitting bone to resume neutral spine. I.e. starting position Repeat 8-10 times alternating legs Level-2 Inhale to prepare Exhale, float the left leg in to table top position Inhale and hold this position Exhale extend the left leg forward and upward on a diagonal line Inhale, hold the left leg back in to the table top position Exhale, lower the left leg to the mat to resume neutral spine starting position Repeat 8-10 times alternating legs Double leg stretch LEVEL 1 Inhale to prepare. Exhale, lift both arms to 90 degrees, placing hands over shoulders, palms facing away from the face. Inhale and hold this position. Exhale, lower both arms overhead as far as control can be maintained, ensuring that the ribcage remains soft. Inhale, circling the arm outward and downward in a „D" shape, finishing the „D" shape with hands above the shoulders. Repeat 8 – 10 times 17 Repeat 8-10 times in the opposite direction. LEVEL 2 Inhale to prepare. Exhale, lift both arms to 90 degrees, placing hands over shoulders, palms facing away from the face Inhale and hold this position Exhale, lowering arms overhead and simultaneously sliding the left heel forward along mat away from the sitting bone Repeat 8-10 times alternating legs One leg kick/Double leg kick LEVEL 1 Inhale to prepare Exhale, bend left knee, gently pulse the knee further towards your left hip three times, firstly with a pointed ankle, secondly with a flexed ankle and lastly with a pointed ankle. Inhale, extend the knee to rest the leg on to the mat keeping the ankle plantar flexed Repeat 8-10 times alternating legs LEVEL 2 Inhale to prepare Exhale, bend left knee, gently pulse the knee further towards the left hip three times, firstly with a pointed ankle secondly with a flexed ankle and lastly with a pointed ankle Inhale and commence extending the knee towards the floor. Just prior to the leg lowering completely to the mat, reach and then lift the leg

approximately 1 inch off the mat and lower to the floor, keeping the ankle plantar flexed Repeat 8-10 times alternating legs 18 Fig 1 The hundreds Fig 2 One leg stretch Fig 3 Double leg stretch One leg kick/Double leg kick

Fig 1: The hundreds

Fig 2: One leg stretch

Fig 3: Double leg stretch

Fig 4: One leg kick/Double leg kick

Result

The objective of study was to find the effect of pilates on strength of quadriceps muscles in healthy individual which analyzed on the basis of MMT.

The statistical analysis was done using Microsoft Excel. Various statistical measures such as mean, standard deviation (S.D) and test of significance such as student's z test were analyzing the data. The result was concluded to be extremely significant with the p value is <0.0001.

Discussion

The present study "Effectiveness of Pilates on strength of Quadriceps Muscle in Healthy Young Individuals. In Dr. APJ Abdul Kalam College of Physiotherapy; Loni, Taluka Rahata, District Ahmednagar, Maharashtra, India. Forty (40) participants with age above 18 years were included in this study and Manual Muscle Strength was taken as outcome measure. The purpose of this study was to find out the effectiveness of Pilates on the strength of Quadriceps muscle in the healthy young individuals. The participants were given Pilates training for 3 days per week for 3 weeks. The effectiveness was then assessed using the outcome measure Manual Muscle Strength at the end of training. Then the data was evaluated using „". The result was that Pilates training was effective way to improve the strength of Quadriceps muscle in the healthy young individuals.

Pilates exercise focus on neutral alignment of pelvis, scapula and spine. The joints are stacked: shoulders over hips, hips over knees, and knees over ankle. Progression is made by manipulating the effects of gravity, length of levers, centre of gravity and base of support. The muscles are exercised dynamically in concentric and eccentric mode by spring tension. The lumbar stabilization multifidi are mainly composed of type one fibres which require low loads to improve performance. The muscle activation levels when combined with longer tension times and low movement velocities, provide and ideal stimulus for improving muscular strength.

The study was carried out by Lisa Marie Bernardo, Ph.D., M.P.H., R.N., and H.F.I. on The effectiveness of Pilates training in healthy adults: An appraisal of the research literature concluded that Pilates finds support for the effectiveness of Pilates in healthy adults to improve flexibility, lumbar pelvic stability, transversus abdominis activation, and muscular activity.

Another study was carried out by Gönül Babayġggt Ġrez on Pilates Exercise Positively Affects Balance, Reaction Time, Muscle Strength, Number of Falls and psychological parameter in 65+ years old women concluded that this study supports the following points: 1) The Pilates Method improves dynamic balance, muscle strength, reaction time, flexibility. 2) It decreases number of falls and increases quality of life, 3) and moreover, Pilates exercise may increase bone mineral density, 4) there is relationship with balance, muscle strength and reaction time and anxiety.

Conclusion

The study concluded that the strength of quadriceps muscle significantly increased after performing Pilates exercise as expressed by increase in Manual Muscle Testing grade.

Acknowledgement

Indeed, I am very glad to present this project as a part of my B.PT. Internship. I take this opportunity to thank all the hands that have joined together to make this project a success.

It is indeed my privilege to express my sincere gratitude to Principal Dr. A.P.J. Abdul Kalam College of Physiotherapy, Loni for his valuable advice and permitting me to carry out the project in this institution.

I wish to express my deep gratitude to my project in-charge Dr. Keerthi Rao and all the teaching staff and non-teaching staff who have helped me to choose this project and provide me with constant guidance and support throughout the completion of this project.

I wish to thank all the participants for their cooperation and tolerance towards this project.

References

1. Quilty B, Tucker M, Campbell R, Dieppe P. Physiotherapy, including quadriceps exercises and patellar taping, for knee osteoarthritis with predominant patello-femoral joint involvement: randomized controlled trial. The Journal of rheumatology. 2003; 30(6):1311-7.
2. Donahue TL, Hull ML, Rashid MM, Jacobs CR. A finite element model of the human knee joint for the study of tibio-femoral contact. Journal of biomechanical engineering. 2002; 124(3):273-80.
3. Waligora AC, Johanson NA, Hirsch BE. Clinical anatomy of the quadriceps femoris and extensor apparatus of the knee. Clinical Orthopaedics and Related Research®. 2009; 467(12):3297-306.
4. Farahmand F, Sejiavongse W, Amis AA. Quantitative study of the quadriceps muscles and trochlear groove geometry related to instability of the patellofemoral joint. Journal of Orthopaedic Research. 1998; 16(1):136-43.

5. Stokes M, Young A. The contribution of reflex inhibition to arthrogenous muscle weakness. Clinical Science. 1984; 67(1):7-14.
6. Kloubec Pilates J. How does it work and who needs it ?. Muscles, ligaments and tendons journal. 2011; 1(2):61-27.
7. Sekendiz B, Altun Ö, Korkusuz F, Akın S. Effects of Pilates exercise on trunk strength, endurance and flexibility in sedentary adult females. Journal of bodywork and movement therapies. 2007; 11(4):318-26.
8. Mohammadi M, Kaldırımcı M, Kazemi SE, Mızrak O, Tuğrulhanşam C. The effect of Pilates exercise on gait speed and strength of lower limb in elderly male. Advances in Applied Science Research. 2015; 6(7):1-6.