Quadriceps Muscle Mechanical Simulator for Training of Vastus Medialis Obliquus and Vastus Lateralis Obliquus Mechanical Properties

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Objectives: In classical anatomy quadriceps muscle has four heads. Clinical studies have demostrated 6 heads of this muscle. These heads were demostrated seperately not only by their functional properties,but also by innervation and kinesiological properties. In our previous study we have developed and demostrated electrophysiological properties of vastus medialis obliquus by an electronic patient simulator. The purpose of this study is to develop a mechanical simulator which can be used to demostrate mechanical properties of 6 heads of quadriceps muscle and the screw home mechanism.
Methods: Quadriceps femoris muscle has 6 heads: rectus femoris, vastus intermedius, vastus medialis obliquus, vastus medialis longus, vastus lateralis obliquus and vastus lateralis longus. The fundamental mechanical properties of each head is seperated by insersio and angle of pull. Main design principle was to demostrate all heads with insersio and angle of pull properties. Second design principle was to demostrate the screw-home mechanism which is the result of difference in articular surfaces of medial and lateral of condyles of femur.
Results: Final design of the simulator consists of three planes for demostration of angle of pull and pulling forces (patellar plane, proximal and distal planes) of each heads. On each plane channels were graved as origo and insersio for demostration of angle of pull. Distal plane was movable for demostration of pulling forces in different angels of knee flexion and extention. Also proximal plane was adjustable to demostrate different sitting and standing positions. Srew home mechanism was demostrated by specially designed hingle mechanism. Left and right side hingle mechanisms have different radii as femoral condyles and this difference can cause rotation in terminal extension as in the screw home mechanism.
Conclusion: Vastus medialis obliquus, vastus lateralis obliquus and screw-home mechanism have clinical significance. We were not able to find any study which deals with training of screw home mechanism and vastus medialis obliqus and wastus lateralis obliquus muscles in the literature. The purpose of this study was to develop a simulator which can demostrate mechanical properties of vastus medialis obliquus and vastus lateralis muscles and screw home mechanism. As a result a traning simulator with stated properties was developed. In this simulator force measurement is acheived with analog dynamometers and future studies may focus on improvement of this simulator with digital force measurement.

The Orthopaedic Journal of Sports Medicine, 2(11)(suppl 3)
DOI: 10.1177/2325967114S00166
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