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Kinematic analysis of the Patella during the squat movement with and without weight-bearing.

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Abstract

The Patella is a small bone located anteriorly to the knee joint. It is articulated with the femur and works as a lever, transmitting the force produced by the quadriceps to the tibia and promoting knee extension. It is uncommon to study patellar movements in vivo and it is also usually applied expensive methods for doing this kind of analysis. The aim of this paper is to analyze the normal patellar kinematics (rotation and translation movements in relation to the femur) using a 3D kinematic analysis system, based on retro-reflective markers and digital cameras, which is a non invasive, radiation free and less expensive method.

Key words:

Biomechanics, Patella, Kinematics.

Introduction

The Patella is a small bone located anteriorly to the knee joint. It is articulated with the femur and works as a lever, transmitting the force produced by the quadriceps to the tibia and promoting knee extension. [1] The patellofemoral ligament is rarely studied in its normal conditions and it is not usual to apply non-invasive methods to analyze knee or patella movements.

Patel et al. [2], published in 2004 an article where they analyzed the patella kinematics with weight bearing in vivo and in a non-invasive way using magnetic resonance.

In 2014, Carmona et al. [3] utilized 3D kinematics to track the patella during vertical jumps performed by individuals that presented healthy knee joints or femoropatellar syndrome.

Having that in mind, our aim in this project is to capture and analyze the 3D kinematics of the patella (translation and rotation movements) during the squat movement with and without weight-bearing in individuals that present normal knees.

Results and Discussion

We collected anthropometric data and tracked the patella kinematics of 10 individuals from both genders without history of knee related pathologies or injuries. This data was collected during the squat movement with and without weight-bearing (15 kg). We positioned retro-reflective markers on the individuals' skins, recorded the movement using digital cameras and analyzed the data by the software RVideo.

With our future results, we will be able to compare if there is any variation within patellar movements of rotation and translation with and without weight-bearing during the squat movement. We will also be able to test the best data collection setup for smaller volumes, and test if it is possible to track precisely very subtle movements, such as the patellar ones.

Conclusions

It is necessary to study the movements under normal conditions in order to understand what happens in the human's body beyond the disorders. It is also important to apply inexpensive methods in order to make it more reproducible.

Using non-invasive methods will permit researchers to study movements in vivo more, which will permit us to better understand how movements actually happen in living beings.

Acknowledgement

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