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Accuracy Assessment of Hip Clinical Exam

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Introduction

Determining the hip range of motion (ROM) is one of the key points of its clinical examination. Unfortunately this process may lack precision since during hip movement there might be motion of other joints around the pelvis. It is also unknown if the examiner's clinical experience plays a role. We present the results of a preliminary study that aims to assess the accuracy of the hip ROM clinical exam executed by different examiners.

Methods

2 healthy volunteers (26 and 31 years) participated to the study. A hip clinical exam was performed successively by 2 orthopedists (2 and 12 years' experience), while the motion of the subjects was simultaneously recorded using optical motion capture. The following sequences were captured: 1) supine: maximal flexion, maximal IR/ER with hip flexed 90°, maximal abduction; 2) seated: maximal IR/ER with hip and knee flexed 90°. For all measurements, a hand held goniometer was used by clinicians to measure hip angles in those different positions.

Their results were compared to the internal hip joint kinematics computed from the recorded markers trajectories using a validated optimized fitting algorithm which accounted for skin motion artifacts (accuracy: translational error \approx 0.5mm, rotational error $<$ 3°). The resulting computed motions were applied to patient-specific hip joint 3D models reconstructed from their MRI data. Given the computed bone poses from motion capture data, hip angles were determined at each point of the motion independently of the major anatomical planes, thanks to two bone coordinate systems (1 for the femur and 1 for the pelvis).

Results

The error made by the clinicians varied in the range of \pm 10°, except for the flexion and abduction where the error was higher (flexion: mean 9.5°, range -7° – 22°; abduction: mean 19.5°, range: 8 – 32°). No significant differences between the errors made by the two examiners were noted (mean error for each examiner: 7.4° vs. 8.4°). 3D simulations of the process revealed interesting motion trends of other joints around the hip that could explain overestimation of flexion and abduction during the exams.

Conclusion

To our knowledge this is the first study of this kind assessing the accuracy of the hip clinical exam. The results seem to indicate that the clinical exam is a precise method for determining hip passive motion, if extra care is taken to stabilize the pelvis during flexion and abduction to prevent

overestimation of the ROM. The examiner's experience was not found to be a determining factor. Further studies including more subjects are required before validating the values of hip clinical exam as a gold standard.