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Augmented Reality Guided Periacetabular Osteotomy – Proof Of Concept

Orthopaedics / Pelvis, Hip & Femur / Joint Preserving Surgery

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Background

The Ganz' periacetabular osteotomy (PAO) consists of four technically challenging osteotomies (OT), namely the supra-acetabular (saOT), the pubic (pOT), the ischial (iOT) and the retroacetabular OT (raOT).

Objectives

We performed a proof of concept study to test 1) the feasibility of augmented reality (AR) guidance for PAO, 2) precision of the OTs guided by AR compared to freehand technique performed by an experienced PAO surgeon and 3) effect of AR on performance depending on experience.

Study Design & Methods

A 3D preoperative plan of a PAO was created from segmented CT data of an anatomic plastic pelvis model (PPM). The plan was then embedded in a software application for a AR head-mounted device. Soft tissue coverage was imitated using foam rubber. The 3D plan was then registered onto the PPM using an anatomical landmark registration. Two surgeons (1 experienced and 1 novice PAO surgeon) performed each 15 FH and 15 AR-guided PAO's. The starting point distances and angulation between planned and executed OT-planes for the FH and the AR-guided PAOs were compared in post-intervention CTs.

Results

AR guidance had no effect on performance of the expert surgeon regarding the mean differences between planned and executed starting points but the raOT angle was more accurate if compared to FH PAO ($p=0.0027$). AR guidance increased accuracy of performance by the novice surgeon for iOT ($p=0.03$). An intraarticular osteotomy could be observed only once performed by the novice surgeon with the FH technique.

Conclusions

AR guidance of osteotomies for PAOs is feasible and seems to increase accuracy, most accentuated for less experienced surgeons.