CLINICAL PAPER /

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Development and evaluation of an image-free computer-assisted impingement detection technique for total hip arthroplasty.

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ABSTRACT

Purpose: Periprosthetic or bony impingement in total hip arthroplasty (THA) has been correlated to dislocation, increased wear, reduced postoperative functionality with pain and/or decreased range of motion (ROM).

We sought to study the accuracy and assess the reliability of measuring bony and periprosthetic impingement on a virtual bone model prior to the implantation of the acetabular cup with the help of image-free navigation technology in an experimental cadaver study.

Methode: Impingement-free ROM measurements were recorded during minimally invasive, computer-assisted THA on 14 hips of 7 cadaveric donors. Preoperatively and postoperatively the donors were scanned using computed tomography (CT). Impingement-free ROM on three-dimensional CT-based models was then compared with corresponding, intraoperative navigation models.

Results: Bony/ periprosthetic impingement can be detected with a mean accuracy limit of below 5 for motion angles, which should be reached after THA for activities of daily living with the help of image-free navigation technology.

SUMMARY

This study showed that it is possible to measure range of motion within a range of 5° on a cadaver. This impingement detection method may now be established in clinical use.

CONCLUSION

ROM Navigation reduce the risk of impingement

Based upon the virtual three-dimensional bone model incorporating the registration of the patients' individual bony anatomy, stem position, and knowledge on the implants geometries, the image-free impingement detection technique has the potential to calculate a ROM optimized cup position with a reduced risk for impingement prior to the implantation of the cup intraoperatively.