

Biomechanical study on the acetabular cup stability using different screw fixations

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Background

Successful osseointegration of an uncemented acetabular cup requires stable fixation. This can be particularly challenging in cases with distorted anatomy or bony defects, such as in revision total hip replacement. Complimentary screw fixation can be used to provide additional stability in these cases.

Aim

To determine the effect of screw utilization, using different bony corridors, on cup fixation stability.

Method

A biomechanical testing set-up was developed in which a 68-mm acetabular cup (Stryker) was fixated in polyurethane blocks (SikaBlock® M440) mimicking cortical bone using either 1) no screws, 2) 2 screws in the ilium, 3) 2 screws in the ilium + one screw in the anterior column and 4) 2 screws in the ilium + 1 anterior column + 1 screw in posterior column. The ilium, anterior column and posterior column were defined based on the screw distribution in the cup (see Attachment). A T-shape bar was used to push the acetabular cup in the blocks and as a lever for testing the effect of load on micromotion.

Results

The use of additional screws substantially improved cup stability under loading conditions. Adding 2,3, or 4 screws increased the peak load by 16.7, 20.1 and 22.2 times that sustained in the no-screw condition (Attachment).

Conclusion

In cases where adequate press-fit stability is uncertain the use of additional screws improves cup fixation substantially. Moreover, additional screws in opposite directions like the anterior and posterior bony column provide an additional improved stability compared to only ilium directed screws