

The Effect of Stem Fit on the Radiocapitellar Contact Mechanics of a Metallic Axisymmetric Radial Head Hemiarthroplasty: Is Loose Fit better than Rigidly Fixed?

Background/Methods: Radial head hemiarthroplasty is commonly employed to manage comminuted displaced fractures. With regards to implant fixation, current designs vary with some prostheses aiming to achieve a tight 'fixed' fit, and others utilizing a smooth stem with an over reamed 'loose' fit. The purpose of the present study was to evaluate the effect of radial head hemiarthroplasty stem fit on radiocapitellar contact using a finite element model which simulated both fixed (size-for-size) and loose (1, 2 & 3mm over reamed) stem fits.

Hypothesis: It was hypothesized that a loose stem fit would improve radiocapitellar contact mechanics, with increased contact area and decreased contact stress, by allowing the implant to find its 'optimal' position with respect to the capitellum.

Results/Discussion: This data suggests that the loose smooth stem radial head implant may be functioning like a bipolar implant in optimizing radiocapitellar contact. The 'loose' over reamed stem provided optimal contact mechanics of the metallic axisymmetric radial head implant compared to the 'fixed' stem. The 1mm over reamed stem reduced maximum contact stress without affecting contact area. Over reaming of 2mm provided the greatest decrease in maximum contact stress, albeit with a significant reduction in contact area. Over reaming of 3mm produced a larger amount of stress concentrations on the capitellum suggesting there may be a limit to how loose a smooth stem implant should be implanted.