A New Anatomically Contoured Large Diameter Femoral Head to Alleviate Soft-Tissue Impingement in Hip Arthroplasty

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INTRODUCTION

 Large heads increasingly used in THA to prevent dislocation e.g. Ceramic heads ≥ 36mm - 4% in 2003, 43% in 2013¹

 Large heads can impinge on soft-tissue such as iliopsoas causing groin pain²

  ▪ 15-18% groin pain incidence reported for large diameter metal-on-metal and hip resurfacing³

 Goal: Develop soft-tissue friendly large head THA

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METHODS:

1. Design Concept
   Contour peripheral region exposed to soft tissue

2. Identify Critical Design Parameters

3. Design Requirements
   - Minimize overhang beyond native articular margin
     - Compare against native anatomy
   - Maintain load bearing contact area
     - FEA with peak in vivo loads during daily activities
   - Maintain dislocation resistance
     - Dynamic dislocation simulations in MSC ADAMS
   - Maintain wear performance
     - Hip simulator wear tests
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RESULTS: Anatomically Contoured Head (ACH)

- Peripheral region below equator contoured to stay within native articular margin

\[ \beta_{ACH} = \phi \]

\[ \beta_{conv} = 0^\circ, 360^\circ, 180^\circ \]

\[ \phi = 0^\circ, 360^\circ, 180^\circ \]

\[ \text{ACH (}\beta_{ACH}\text{)} \quad \text{Conventional (}\beta_{conv}\text{)} \quad \text{Native femoral head}^5 \]

\[ \text{Angular extent} \quad \phi (\text{deg}) \]

\[ 0 \quad 30 \quad 60 \quad 90 \quad 120 \quad 150 \quad 180 \quad 210 \quad 240 \quad 270 \quad 300 \quad 330 \quad 360 \]

\[ 60 \quad 70 \quad 80 \quad 90 \quad 100 \quad 110 \quad 120 \quad 130 \]

\[ ^5\text{Cobb et al. JBJS Br 2011} \]
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CONCLUSION

- **Clinical Need**
  - Increased use of large diameter THA (10 fold in 10yrs)
  - Large heads impinging on soft tissue can cause groin pain

- **Solution - Anatomical Contoured Head (ACH)**
  - Peripheral region below equator contoured for soft tissue relief
  - Articular extent does not overhang native margin

- **Joint stability, Wear performance, Load bearing contact area maintained**