

Radius of Curvature of the Radial Head Matches the Capitellum

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Disclosure

**I (and/or my co-authors) have
something to disclose.**

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Background

- Prior studies have identified anatomical similarities between the radial head and capitellum
 - Vanhees et al demonstrated a correlation between the long outer diameter of radial head and the vertical height and anterior width of the capitellum
 - Leclerc et al demonstrated capitellar dimensions could predict radial head diameter
- These studies correlated the **bony anatomy** of the radial head and capitellum
 - **no studies include the articular cartilage**

Background

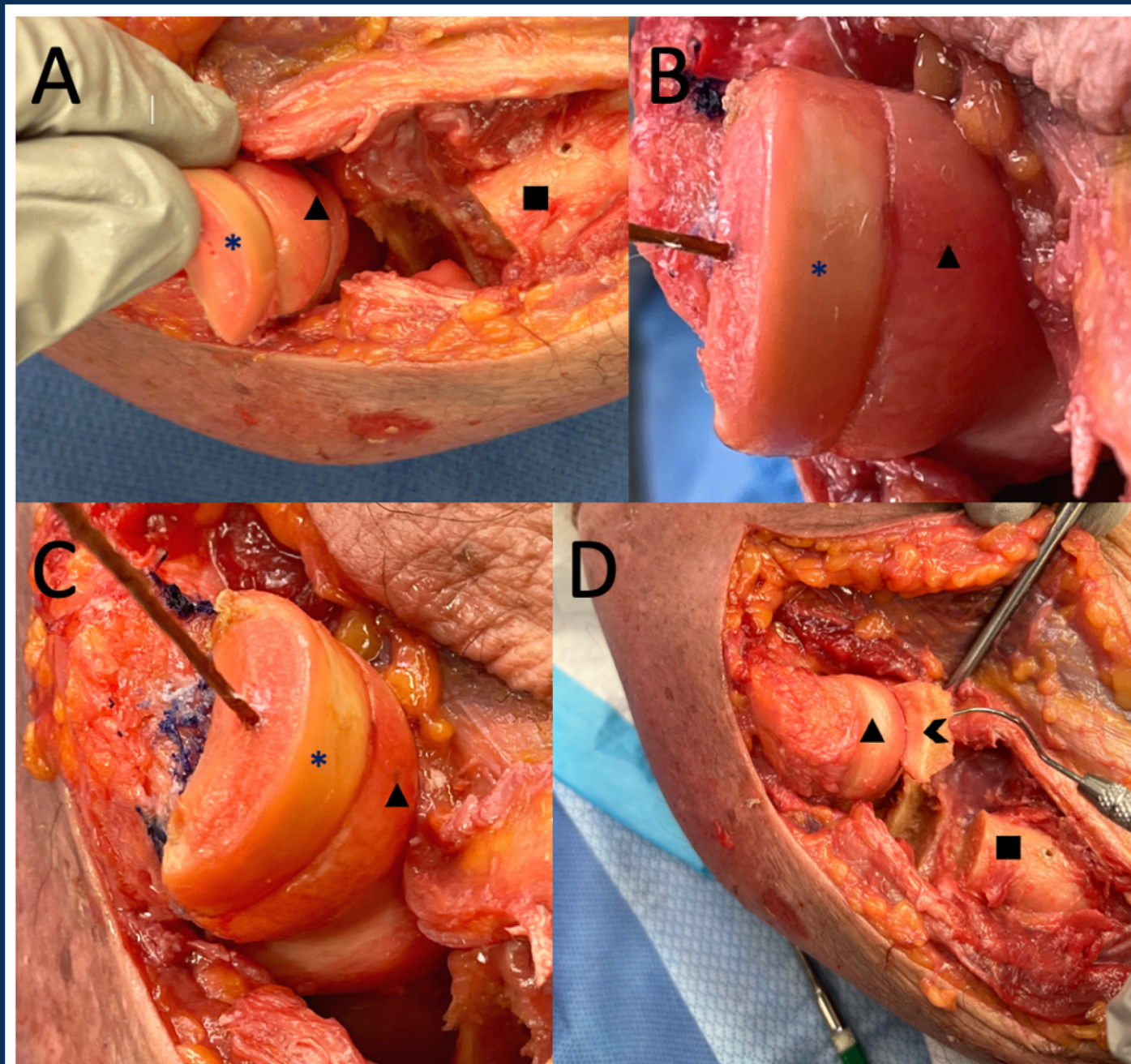


Figure 2. (A-C) Cadaveric dissection demonstrating the similar radius of curvature of the radial head (*) to the capitellum (▲) with the radial neck depicted (■). (D) Resected Sigmoid notch (◀) of the ulna articulation with the capitellum.

Clinical Application

- Comminuted distal humerus fractures with non-reconstructable capitellar osteoarticular injury
- Osteochondral “kissing lesions” of the radiocapitellar joint where a radial head arthroplasty is performed and the resected radial head is available as a local osteochondral autograft
- Osteochondral autograft transfer procedure from the safe zone of the radial head to the capitellum
- Local osteochondral graft from the peripheral cartilaginous rim would minimize the morbidity associated with ipsilateral knee graft harvest

Purpose

- To compare the radius of curvature (ROC) of the radial head peripheral cartilaginous rim and the cartilage contour of the capitellum utilizing MRI

Hypothesis

- The radius of curvature of the radial head and capitellum would be similar on MRI, and thus the radial head could serve as a potential local osteochondral autograft for the treatment of complex radiocapitellar pathology

Methods

- Retrospective study at a single institution over 3 years
 - **Inclusion criteria:** Patients undergoing MRI of the elbow with complete imaging
 - **Exclusion criteria:** Incomplete imaging or a diagnosis of osteochondritis dissecans, osteomyelitis, tumor, fracture, or osteoarthritis
- MRI was obtained using a standardized protocol

MRI Protocol

- Elbow coil
 - Supine, elbow in full extension with supination of the forearm
- 3mm slice thickness



Measurements

- ROC of the radial head and long outer diameter of the radial head
 - Axial oblique sequence centered on the proximal radioulnar joint at the sigmoid notch
- ROC of the capitellum (centered on sigmoid notch), capitellar vertical height, and radial head height
 - Sagittal oblique sequence centered at the midpoint of the radiocapitellar joint
- Width of the articular surface of the capitellum
 - Coronal sequence

Measurements

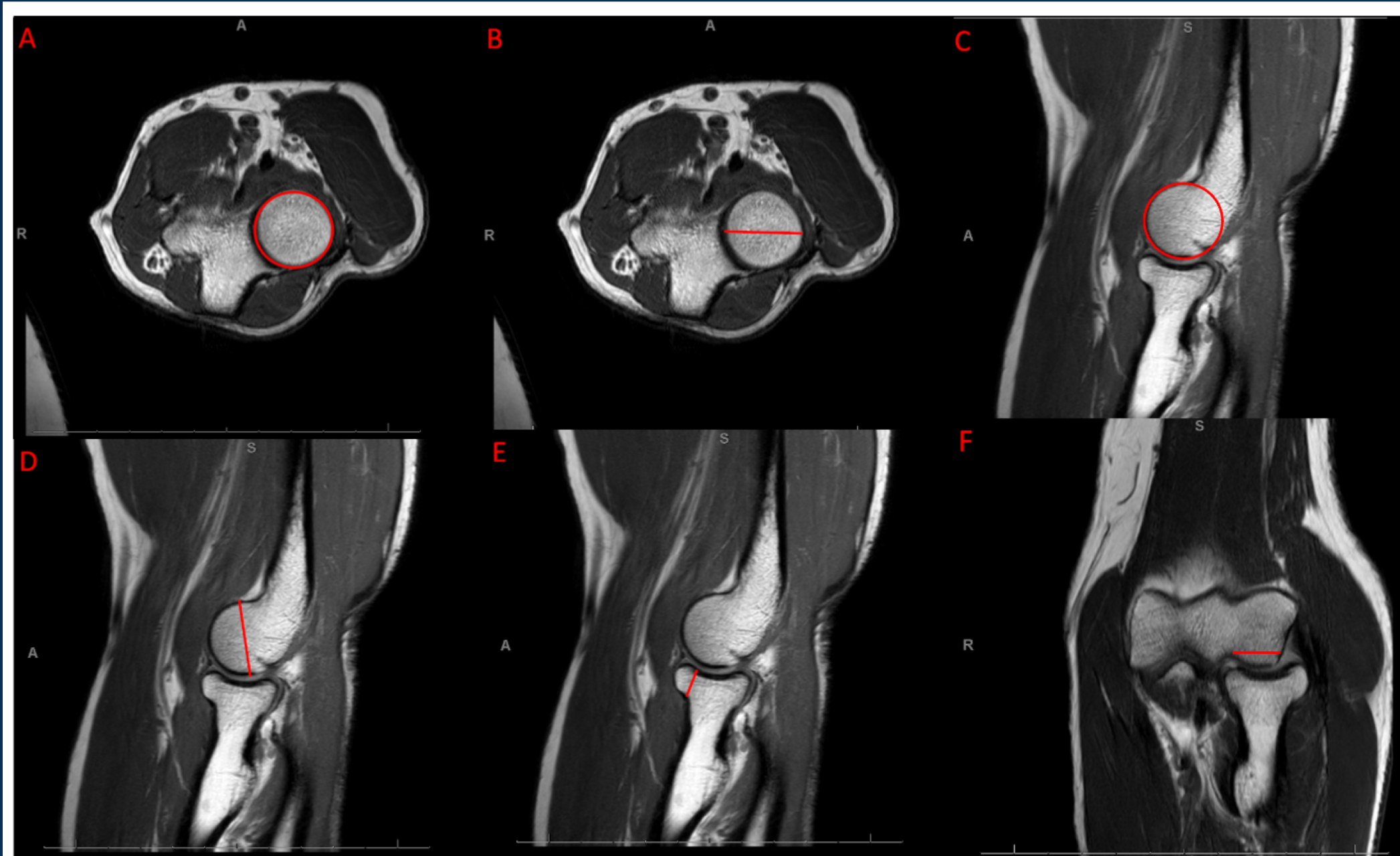


Figure 1A. Radius of curvature of the radial head; Figure 1B. Long outer diameter of the radial head; Figure 1C. Radius of curvature of the capitellum; Figure 1D. Capitellar vertical height; Figure 1E. Radial head height; Figure 1F. Width of the articular surface of the capitellum.

Results

Demographics	
<i>Variable</i>	n=83
<i>Age (mean)</i>	43 (SD 17)
<i>Male</i>	57
<i>Female</i>	26
<i>Caucasian</i>	57
<i>African American</i>	18
<i>Hispanic</i>	5
<i>Unspecified</i>	2
<i>Multiracial</i>	1
<i>Right (Laterality)</i>	51
<i>Left (Laterality)</i>	32
<i>Height (cm, mean)</i>	174.6 (SD 9.9)
<i>Weight (kg, mean)</i>	86.9 (SD 17.9)
<i>BMI (kg/m², mean)</i>	28.5 (SD 5.3)

Results

Radius of Curvature (ROC) Measurements				
Variable	<i>n</i>	<i>Median</i>	<i>IQR</i>	<i>95% CI</i>
Radial Head ROC	83	12.3	1.6	11.9; 12.4
Capitellum ROC	83	11.9	1.7	11.6; 12.0
Delta ROC	83	0.3	0.6	0.24; 0.46

Results

Measurements		
Variable	<i>n</i>	<i>Mean (SD)</i>
Capitellum Width	83	13.8 (1.6)
Capitellum Vertical Height	83	23.3 (2.2)
Radial Head Outer Diameter	83	24.3 (2.1)
Radial Head Height	83	10.6 (1.3)
		<i>Percent</i>
Radial Head Height/ Capitellum Width	83	77.7%
Radial Head Diameter/ Capitellum Vertical Height	83	104.0%

Results

- **94% (78/83) had a median difference ROC of <1mm**
 - **63% (52/83) were within 0.5mm**
- Radial head height was $10.6 \pm 1.3\text{mm}$, and the capitellar width was found to be $13.8 \pm 1.6\text{mm}$
- Inter- and intra-rater reliability were strong to very strong

Discussion

- The ROC of the convex peripheral cartilaginous rim of the radial head is similar to the ROC of the capitellum **to within 1mm**
- The radial head height was approximately 78% of the capitellar articular width
- The average size defect an ipsilateral radial head could potentially reconstruct is approximately 24x10mm (radial head diameter x radial head height)

Limitations

- Image-based study
- Further cadaver-based studies are needed to confirm these findings and the operative feasibility of using the radial head as an osteoarticular autograft

Conclusion

- The radial head may be a useful osteochondral autograft for reconstruction of the capitellum
 - Complex intraarticular distal humerus fractures with associated radial head fractures
 - “Kissing lesions”
 - Osteochondral autograft transfer from the “safe zone” of the radial head to the capitellum