Relationship Between the Alpha and Beta Angle in Diagnosing CAM type Femoroacetabular Impingement on Frog-leg Lateral Radiographs

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Overview of Study

**Purpose:** To explore the relationship between alpha and beta angles on frog leg lateral hip radiographs.

**Method:** 50 frog-leg lateral hip radiographs were evaluated by 2 orthopaedic surgeons and 2 radiologists. Each reviewer measured the alpha and beta angles on 2 separate occasions.

**Results:** There was no significant association between positive alpha and beta angles, [kappa range −0.043 (95 % CI −0.17 to 0.086) to 0.54 (95 % CI 0.33–0.75)]. Intra-observer reliability was high.

**Conclusion:** There is no statistical or functional relationship between readings of positive alpha and beta angles. The radiographic measurements resulted in high intra-observer and fair-to-moderate inter-observer reliability.

**Level of Evidence:** III.
Background

- Femoroacetabular impingement (FAI) - common source of hip pain in the young adult
- Two different types of FAI: CAM and pincer
- FAI causes damage to the acetabular labrum and joint cartilage
- Alpha angles are used to assess the sphericity of the proximal femur
- Beta angles are used to assess the distance between the pathologic head-neck junction and the acetabular rim
Background

**Fig. 1** Diagram demonstrating measurement of alpha angle and beta angle in FAI hip (modified from Nepple et al.)

**Fig. 2** Diagram demonstrating measurement of alpha angle and beta angle in normal hip
The aim of this study was to explore the relationship between alpha and beta angles on frog-leg lateral hip radiographs.
Methods

50 frog-leg lateral view radiographs of the proximal femur were evaluated by 2 orthopaedic surgeons and 2 radiologists.

Each reviewer measured the alpha and beta angles on two separate occasions.

Determined the relationship between positive alpha and beta angles through the inter- and intra-observer reliability of these measurements.
Results

No significant association between positive alpha and beta angles
Kappa (k) range: -0.043 (95% CI: -0.17 - 0.086) to 0.54 (95% CI: 0.33 - 0.75)

Alpha angle ICC range: 0.74 (95% CI: 0.58 - 0.84) to 0.99 (95% CI: 0.98-0.99)

Beta angle ICC range: 0.86 (95% CI: 0.76- 0.92) to 0.97 (95% CI: 0.95-0.98)

High Intra-observer reliability
### Results

#### Table 1. Correlation Between Positive Alpha Angle and Positive Beta Angle

<table>
<thead>
<tr>
<th>Assessor</th>
<th>Kappa (95% CI)</th>
<th>Trial 1</th>
<th>Trial 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiologist 1</td>
<td>0.14 (−0.007 to 0.29)</td>
<td>0.14 (−0.036 to 0.32)</td>
<td></td>
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<tr>
<td>Radiologist 2</td>
<td>−0.040 (−0.17 to 0.091)</td>
<td>−0.043 (−0.17 to 0.086)</td>
<td></td>
</tr>
<tr>
<td>Orthopaedic surgeon 1</td>
<td>−0.008 (−0.17 to 0.16)</td>
<td>0.082 (−0.010 to 0.17)</td>
<td></td>
</tr>
<tr>
<td>Orthopaedic surgeon 2</td>
<td>0.54 (0.33 to 0.75)</td>
<td>0.53 (0.32 to 0.74)</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 2. Intra-Observer Reliability in Determining Alpha and Beta Angles

<table>
<thead>
<tr>
<th>Assessor</th>
<th>ICC (95% CI)</th>
<th>Alpha angle</th>
<th>Beta angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiologist 1</td>
<td>0.74 (0.58–0.84)</td>
<td>0.86 (0.76–0.92)</td>
<td></td>
</tr>
<tr>
<td>Radiologist 2</td>
<td>0.99 (0.98–0.99)</td>
<td>0.97 (0.95–0.98)</td>
<td></td>
</tr>
<tr>
<td>Orthopaedic surgeon 1</td>
<td>0.79 (0.66–0.88)</td>
<td>0.89 (0.81–0.93)</td>
<td></td>
</tr>
<tr>
<td>Orthopaedic surgeon 2</td>
<td>0.82 (0.70–0.89)</td>
<td>0.87 (0.77–0.92)</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

- No correlation between reading a positive alpha angle and positive beta angle from the same film.

- Presence of a CAM lesion does not necessarily imply that there is a decrease in the angular relationship between the head–neck junction and acetabular rim.

- Limitations exist for using radiographs to evaluate hip pathology.

- Planning acetabular rim recession is not necessarily required in the setting of findings of an increased alpha angle.
Conclusions

- No statistical or functional relationship between readings of positive alpha and beta angles.
- Radiographic measurements resulted in high intra-observer and fair-to-moderate inter-observer reliability.
- Presence of a CAM lesion on lateral radiographs does not necessitate a decrease in clearance between the femoral head and acetabular rim.
- Relationship between a positive alpha angle and a positive beta angle may not be the best measure of functional impingement.
- Further study is required to assess the relationship between alpha and beta angles.
References

References