Discrepancies in Measuring Acetabular Coverage: Revisiting the Lateral & Anterior Center Edge Angles

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- Consulting............................................Stryker/Pivot Medical
Introduction

- Hip dysplasia and pincer FAI are characterized by abnormal acetabular coverage of the femoral head.

- Two measures are used to assess acetabular coverage:
  - Wiberg’s lateral center edge angle (LCEA) evaluates lateral coverage on an anteroposterior (AP) radiograph
  - The anterior center edge angle (ACEA) evaluates anterior coverage on a false profile (FP) radiograph
Introduction

- Two distinct methods are commonly found in the literature to measure the LCEA and ACEA:
  - **Bone**: to the most lateral aspect of the bony acetabulum\(^3\text{-}^5\)
  - **Source**: to the lateral end of the sclerotic source\(^6\text{-}^8\)

- Differences between these methods may contribute to:
  - Inconsistent estimates of acetabular coverage
  - Clinical misdiagnosis
  - Treatment mismanagement

- For example, a difference > 5° between methods could change the classification of a hip from dysplastic (LCEA < 20°) to normal (LCEA > 25°)\(^1\)
Objectives

- Compare bone edge and sourcil edge measurements of the LCEA and ACEA in an adult population and evaluate:
  
  1. If the difference is clinically significant (> 5°)
  
  2. How the measurement method changes how a hip is classified (e.g., dysplastic, overcovered)
2 observers reviewed pre-op films from adult patients seen by the senior author for suspected hip pathology.

LCEA measured on AP film

ACEA measured on FP film

S = Sourcil
B = Bone
Interobserver repeatability was quantified by intraclass correlation coefficient (ICC) and interpreted as follows:

- Minimal: < 0.2
- Poor: 0.2 - < 0.4
- Moderate: 0.4 - < 0.6
- Strong: 0.6 - 0.8
- Almost perfect: > 0.8

Measurements averaged between observers.

Bone and sourcil measurements compared with:
- Bland Altman limits of agreement
- Paired t-test
Results

- **LCEA** measured on 188 pre-op AP radiographs
  - 109 female, 36.6 ± 11.4 years
- **ACEA** measured on 137 pre-op FP radiographs
  - 72 female, 35.9 ± 11.5 years
- Interobserver agreement was almost perfect:
  - Bone LCEA: 0.92
  - Sourcil LCEA: 0.92
  - Bone ACEA: 0.81
  - Sourcil ACEA: 0.89

- **Bone** and **sourcil** measurements of the LCEA and ACEA were significantly different (both p < 0.001)
Results

LCEA
- On average, bone LCEA was $3.6^\circ >$ sourcil LCEA
  - 95% limit of agreement = $-2.4^\circ$ to $9.6^\circ$
- 24% (46/188) subjects had a LCEA difference $> 5^\circ$ between methods

ACEA
- On average, bone ACEA was $9.7^\circ >$ sourcil ACEA
  - 95% limit of agreement = $-2.2^\circ$ to $21.5^\circ$
- 78% (107/137) subjects had an ACEA difference $> 5^\circ$ between methods
Results

- Of the 14 subjects with a sourcil LCEO < 20° (dysplastic), only four had a bone LCEO < 20°
- 6 subjects had a sourcil LCEO < 20° (dysplastic) but a bone LCEO > 25° (normal)

AP film of 42 yo male. The patient’s hip is classified as normal based on a bone (B) LCEO of 30°, but dysplastic based on a sourcil (S) LCEO of 19°
Results

- Of the 20 subjects with a **bone LCEA > 40°** (overcovered), only 9 had a **sourcil LCEA > 40°**

AP radiograph of 40 yo female. The patient’s hip is classified as normal based on a **sourcil (S)** LCEA of 28°, but overcovered based on a **bone (B)** LCEA of 43°
In the adult population, there is a statistically and clinically significant difference in bone edge and sourcil edge methods for measuring the LCEA and ACEA.

As we believe both Wiberg’s original description and subsequent literature support the use of the sourcil edge measurement method, we suggest that this measurement technique is preferred.

Nonetheless, when reporting the LCEA and ACEA, it is important to define and/or visualize the method used.
References