Radial center-edge angle calculated by acetabular coverage analysis software “ACX dynamics” in pincer type femoroacetabular impingement

Shoichi Nishikino, Hironobu Hoshino, Hiroshi Koyama, Yukihiro Matsuyama

Department of Orthopaedic Surgery Hamamatsu University School of Medicine, Shizuoka, Japan
Shoichi Nishikino, MD

I have no financial relationships to disclose.
ACX

ACX software enables evaluation of three dimensional acetabular coverage on a plain antero-posterior (AP) radiograph of pelvis.

Konishi N.  
ACX dynamics

ACX dynamic (ACX) software enables evaluation of three dimensional acetabular coverage as radial center angle (RCE) using a plain antero-posterior (AP) radiograph of pelvis.

6 Anatomical landmarks plotting was necessary.

We import Bitmap format radiograph in ACX and just plot 6 anatomical landmark, sacroccygeal joint, pubic symphysis, tear drop, femoral head, joint line of acetabulum, anterior and posterior wall of acetabulum.
RCE is defined by the angle formed by two lines connecting the femoral head center to the acetabular edge and the vertical line through the center of the femoral head on various radial planes. **RCE was semi-automatically evaluated by ACX** and measured on each radial planes (every 15 degrees, from anterior border expressed as 0° to posterior border expressed as 180°).
**Validation of RCE calculated by ACX**

(S.Nishikino  EHS 2016)

**30 hips CT with no OA change**

**RCE : ACX vs CT images**

**RCE : A45° – P75°**

The average differences : <5°
Standard deviation : <3°
Correlation coefficient(r) : ≥0.90

The diagram shows the validation of RCE calculated by ACX on radial planes from A45° to P75°, which is clinically important for evaluating acetabular morphology in patients with pincer type FAI.

Fujii et.al (CORR 2012)

A:Anterior, P:Posterior

RCE calculated by ACX showed the reasonable values on the radial planes from A45° to P75°, which was clinically important to evaluate acetabular morphology of the patients with pincer type FAI.
To evaluate the anterosuperior acetabular coverage quantitatively in pincer type FAI using RCE calculated by ACX.
Materials & Methods

Pincer (P) group

30 hips
(16 males, 14 females, average 37.1 years old) undergoing hip arthroscopic surgery for pincer type FAI (CE angle $\geq 40^\circ$, or CE angle $\geq 30^\circ$ and ARO $\leq 0^\circ$, or CE angle $\geq 25^\circ$ and COS positive)

Control (C) group

30 hips
(15 males, 15 females, average 39.4 years old) who had asymptomatic hip joints with no osteoarthritic change ($\leq$ Tönnis grade 1), no pincer type FAI and no dysplasia (CE angle $\geq 25^\circ$).

RCE : A $45^\circ \sim P75^\circ$

P group vs C group
There were significant statistical differences between two groups in **A45°-A75°** RCE (P<0.01). In those regions, RCEs in pincer type FAI group were significantly greater than those in control group.
Discussions

**ACX dynamics**

**Pincer** type FAI

New parameter to describe anterior acetabular rim trimming during hip arthroscopy

☞ **RCE** calculated by ACX
**Rim trimming using RCE**

<table>
<thead>
<tr>
<th></th>
<th>Preoperative RCE</th>
<th>Simulation RCE</th>
<th>Postoperative RCE</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 45°</td>
<td>15.8°</td>
<td>5.2°</td>
<td>3.2°</td>
<td>4.0±6.6°</td>
</tr>
<tr>
<td>A 60°</td>
<td>23.6°</td>
<td>19.9°</td>
<td>19.6°</td>
<td>16.6±3.9°</td>
</tr>
<tr>
<td>A 75°</td>
<td>29.1°</td>
<td>27.5°</td>
<td>26.0°</td>
<td>24.6±2.8°</td>
</tr>
<tr>
<td>A (P) 90°</td>
<td>32.5°</td>
<td>32.3°</td>
<td>31.3°</td>
<td>30.6±2.9°</td>
</tr>
</tbody>
</table>

RCE calculated by ACX can prevent insufficiency of rim trimming and iatrogenic dysplastic hip after anterior acetabular rim trimming during hip arthroscopy.
Conclusions

✔ ACX dynamics software enables evaluation of three dimensional acetabular coverage as RCE on a plain antero-posterior (AP) radiograph of pelvis easily.

✔ RCEs from 45° to 75° calculated by ACX in pincer type FAI were approximately 10° greater than those in control group on the radial planes.

✔ For the treatment of the patients with pincer type FAI, RCE calculated by ACX might be a useful tool to evaluate the acetabular morphology followed by pincer resection in hip arthroscopic surgery.
References


