Effect of Capsulotomy on Hip Biomechanics: Should the Capsule Be Repaired After Hip Arthroscopy?

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Disclosure

• Non conflict with current study
• SJ : none
• AH : none
• KA: none
• RS : Biomet
• RT : Depuy

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Objective

• Validate the effect of various capsulotomy on the stability of hip joint with special interest in disruption of iliofemoral ligament (IFL) and zona orbicularis (ZO)
Materials and Methods

8 Pelvis

- Mean age 56.2 years (48-69 yrs)

Test set up

- 6 degree of freedom motion tracking sensor (Liberty, Polhemus)
- Maintain femoral head to acetabulum contact
- Torque applying adaptor
- Guiding construct
- ISB guideline used to define anatomical coordination system
- Center of rotation defined as functional approach
- Axial rotation applied manually with torque ranch with load cell

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Test conditions

Test I

A) Intact capsule
B) Interportal capsulotomy
C) T-shape capsulotomy

Test II

D) Reproduced interportal capsulotomy
E) Extended interportal capsulotomy (inf IFL resection)
F) Extended T capsulotomy (inf IFL + ZO resection)
Measurements

• IR and ER measured at 10° extension, neutral, 30° flexion

• Additional ER measured at 60°, 90°, and 110° of flexion

• Femoral head’s center of rotation coordinate monitored simultaneously when the hip was maximally rotated internally to externally at 10° extension, 0° flexion and 30° flexion
Statistics

• JMP software (SAS institute, Cary, NC)

• Repeated MANOVA performed independently for each hip flexion plane for the capsule of interest

• For significantly different conditions: a pairwise repeated measures analysis was performed with a Bonferroni correction of $\alpha$ value
Results I – Internal rotation

- No significance found among different capsulotomy conditions
Results II – External rotation in conventional capsulotomy conditions

- **Interportal capsulotomy**
  - Significant increase up to 60° flexion compared to intact capsule
  - Pronounced in 10° of extension: $6.1^\circ \pm 3.4^\circ$

- **T shape capsulotomy**
  - Significant increase up to 110° flexion compared to intact capsule
  - Pronounced in 10° of extension: $10.4^\circ \pm 6.4^\circ$
Results III – External rotation after IFL and ZO resection

- Significant increase in ER up to 110° flexion after entire IFL resection
  - Pronounced in 0° of flexion: 5.9° ± 4.3°

- Significant increase in ER up to 60° flexion after both IFL and ZO resection
  - Pronounced in 60° of flexion: 6.0° ± 6.3°

*Dim area represents result of intact capsule
**Result – Translation**  
(change in hip center of rotation at maximal internal rotation to maximal external rotation)

<table>
<thead>
<tr>
<th></th>
<th>10 extension</th>
<th>0 flexion</th>
<th>30 flexion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intact capsule</strong></td>
<td>0.8 ± 0.2</td>
<td>0.8 ± 0.2</td>
<td>1.0 ± 0.5</td>
</tr>
<tr>
<td><strong>Interportal capsulotomy</strong></td>
<td>1.2 ± 0.4</td>
<td>1.0 ± 0.1</td>
<td>1.5 ± 0.9</td>
</tr>
<tr>
<td><strong>T capsulotomy</strong></td>
<td>1.9 ± 0.3</td>
<td>2.1 ± 0.5</td>
<td>2.3 ± 0.8</td>
</tr>
<tr>
<td><strong>Reproduced Interportal capsulotomy</strong></td>
<td>1.2 ± 0.6</td>
<td>1.3 ± 0.4</td>
<td>1.2 ± 0.5</td>
</tr>
<tr>
<td><strong>Extended interportal capsulotomy</strong> (IFL resection)</td>
<td>1.6 ± 0.9</td>
<td>1.9 ± 0.8</td>
<td>2.0 ± 1.1</td>
</tr>
<tr>
<td><strong>Extended T capsulotomy</strong> (IFL and ZO resection)</td>
<td>2.9 ± 0.9</td>
<td>2.6 ± 1.0</td>
<td>2.7 ± 0.9</td>
</tr>
</tbody>
</table>

- No significant difference between intact and interportal capsulotomy condition
- Significant increase with T capsulotomy as compared to intact condition
- No significant difference after IFL resection
- Significant translation after ZO resection at 10° extension and at 10° flexion

Unit in mm
Conclusions

• Conventional capsulotomy resulted in increase of external rotation and resecting entire IFL result in further external rotation

• T shape capsulotomy can lead to significant translation

• ZO contribute significantly to prevent excessive external rotation and translation

• Clinical recommendation: Repair of the capsule would be beneficial especially when a T-capsulotomy is performed or when the routine interportal capsulotomy is extended to resect the entire inferior IFL or ZO
References


