Subspine Decompression and its Influence on Proximal Rectus Femoris Integrity and Iliopsoas Excursion

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Disclosures

Brian Giordano, MD

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- Consultant for Arthrex
The purpose of this study was to determine the relative influence of anteroinferior iliac spine (AIIS) or subspine decompression on proximal rectus femoris integrity and iliopsoas excursion throughout a physiologic range of motion.
Introduction

• Femoroacetabular impingement (FAI) is described as an abnormal contact between the femoral head-neck junction and the anterior acetabular rim which typically manifests in hip pain and places patients at future risk for labral tearing and premature osteoarthritis [1].

• The importance of identifying and treating FAI has led to an increased focus on a subset of hip impingement syndromes described as extra-articular impingement, the most notable being **Anterior Inferior Iliac Spine (AIIS) Impingement**.
Introduction

• **AIIS Impingement**
  - Several studies have demonstrated that the femoral neck impinges on the AIIS at extremes of hip flexion leading to a focus on classifying AIIS morphology and its correlation to AIIS impingement [2,3]
    - Type I - smooth ilium wall between the AIIS and anterosuperior acetabular rim
    - Type II - AIIS prominence extends to the level of acetabulum rim
    - Type III - AIIS extends distal to the acetabular rim

• **Iliopsoas Snapping**
  - Described as an audible click that is heard with hip flexion that may be accompanied by hip pain and is secondary to tracking of the iliopsoas tendon
  - Commonly identified reasons for snapping include impingement of iliopsoas tendon with iliopectineal ridge including AIIS, femoral head, iliofemoral ligament.
Introduction

• Arthroscopic AIIS decompression in patients is shown to be beneficial [5, 6]

• However, there is limited knowledge of AIIS anatomy and its correlation with the direct head of the rectus femoris and iliopsoas tracking. Theoretically, extensive decompression may result in avulsion of the rectus femoris origin.

Study Focus:

1. Determine the anatomic footprint of the direct head of the rectus femoris on the AIIS in a more generalized population and correlate it with previous findings

2. Identify the extent of AIIS decompression that can be performed without significantly compromising the rectus femoris origin

3. Observe tracking of the iliopsoas and its change, if any, after AIIS decompression
Methods

• 19 cadaveric hips from 10 (4 female, 6 male) specimens were carefully dissected in order to retain the origin of the rectus femoris direct and indirect heads as well as the iliopsoas tendon insertion on the lesser trochanter

• The anatomic footprint of the rectus femoris origins were measured using calipers. Serial 5mm resections of the AIIS were made with osteotome and mallet. After each 5 mm increment of decompression, superior-inferior and medial-lateral measurements of the direct rectus origin were measured to assess any intrusion on the direct rectus footprint

Figure 1. Left cadaveric hip shown in a vice, held at the ischial tuberosity with the pubic ramus level to the table to maintain anatomic continuity between each specimen.

Figure 2. The total area of the rectus femoris direct head footprint was estimated by measuring 5mm tall rectangles within the footprint. The total area was on average 160.26 mm².
Methods

• Iliopsoas tendon tracking was also assessed after sequential AIIS decompression.

• Manual tension was maintained at the psoas origin while the hip was placed into flexion and internal rotation to the point of the lateral psoas contacting the inferior-medial point of the AIIS.

• Using a goniometer, the femoral flexion angle was measured when the psoas made contact with the inferior-medial point of the AIIS following each 5 mm decompression. By measuring the excursion of the medial border of the iliopsoas tendon as it traveled from its native resting position to the point where it first encountered bony impingement at the AIIS.

Figure 3. (A) Subspine decompression in cadaveric model. Note the 10mm subspine decompression performed and the proximity of IP tendon to the AIIS. (B) Iliopsoas tendon impingement on AIIS during physiologic ROM after 10 mm subspine decompression
### Results

<table>
<thead>
<tr>
<th></th>
<th>M/L</th>
<th>P/D</th>
<th>Area</th>
<th>% left after resection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>11.84</td>
<td>17.95</td>
<td>160.26</td>
<td>0</td>
</tr>
<tr>
<td>5 mm</td>
<td>12</td>
<td>17.47</td>
<td>155.26</td>
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<td>10 mm</td>
<td>10.58</td>
<td>12.74</td>
<td>105.79</td>
<td>64.64%</td>
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<td>7.684</td>
<td>59.05</td>
<td>34.66%</td>
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<tr>
<td>20 mm</td>
<td>8.250</td>
<td>4</td>
<td>25.42</td>
<td>14.46%</td>
</tr>
<tr>
<td>25 mm</td>
<td>8.500</td>
<td>2.250</td>
<td>9.00</td>
<td>10.75%</td>
</tr>
</tbody>
</table>

**Table 1.** Average rectus femoris direct head footprint measurements (mm) after each subsequent AIIS decompression. M/L (Medial to lateral distance). P/D (proximal to distal distance)
Results

- Consistent bare area at inferior margin of the AIIS devoid of rectus footprint. On average, the bare spot measured **4.84 mm with a range from 3-10 mm**.

- Range of motion before IP impingement, prior to any resection of the AIIS, was on average **14mm with a 70.28° arc ROM**.

<table>
<thead>
<tr>
<th>AIIS Resection</th>
<th>Percentage of total Iliopsoas Excursion</th>
</tr>
</thead>
<tbody>
<tr>
<td>5mm</td>
<td>18%</td>
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<tr>
<td>10mm</td>
<td>45%</td>
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<td>15mm</td>
<td>72%</td>
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<tr>
<td>20mm</td>
<td>95%</td>
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<tr>
<td>25mm</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Table 2. Percent of total excursion calculated for each specimen after each successive 5 mm of resection*

*Figure 3. Direct head of rectus footprint noted with bare area on the inferior aspect of AIIS.*
Results

• The average percentage of remaining footprint after each 5mm resection (5-25mm) was **statistical significance after resections larger than 5mm** (p=0.002).

• With each 5 mm resection the percentage of excursion before Iliopsoas impingement on the AIIS improved **and was statistically significance after all resections** (p=0.01)
Conclusion

- The direct head of the rectus tendon has a broad insertion over the AIIS with a relatively reproducible bare spot, or “safe zone” on the inferior border of the AIIS. In our study this bare spot measured 4.84mm on average. [7]

After 5-10 mm resection of the AIIS for sub-spine impingement:

- 96% and 65% of the anatomic footprint remaining, respectively
- Increases IP excursion distance by 18% and 45% of the total distance, respectively
- AIIS decompression up to 10mm from the anterior acetabular rim is likely safe without disrupting a significant portion of the rectus footprint and allowing significant improvement in IP excursion.
- Burr tip diameter (5mm) can be used to measure depth of decompression

- Although there are several potential etiologies for the internal snapping of the hip, we have presented one potential cause and how a sub-spine decompression can positively affect tracking of the iliopsoas tendon.
References


