The influence of the Teres minor muscle integrity/atrophy on active external rotation in reverse total shoulder arthroplasty

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Disclosures

I Ofer Levy am the designer of the implant used in this study
Background

Reverse total shoulder arthroplasty (rTSA) gained popularity in the recent years. Despite the good outcome shown and the quick recovery compared to other implant designs, concerns were expressed about the poor results achieved in active external rotation (AER) postoperatively. This poor AER has been correlated with loss of integrity /atrophy of the posterior cuff, in particular with the teres minor (TM).

Aim of the Study

To assess whether there is a correlation between the integrity / atrophy of the TM and postoperative AER in patients following rTSA.
Materials & Methods

A retrospective review of a prospectively collected data:

- 109 shoulders in 97 patients
- Underwent Stemless metaphyseal rTSA (Verso, IDO)
- Between 2005 and 2015
- Cuff tear arthropathy or massive irreparable rotator cuff tear with glenohumeral joint degeneration
- Mean age 75.73 ± 8.94;
- 31 M / 66 F
- 12 months minimum follow-up
Materials & Methods

Patients were assessed clinically and radiographically:

- preoperatively, 3 weeks, 3, 6, 12 months and yearly postoperatively
- Constant Score (CS), Pain Score (VAS), Subjective Shoulder Value (SSV), Patient Satisfaction Score (PSS), ADLEIR score (Activities of Daily Living requiring External & Internal Rotation)

The TM integrity / atrophy was assessed on the preoperative CT scan by 2 observers:

- TM fatty infiltration was evaluated according to the Goutallier classification,
- TM muscular degeneration according to Walch morphological classification
Materials & Methods

The patients were divided into 2 groups according to the TM status:

Group A + A1 – Goutallier 0-2
Normal or hypertrophic muscle

Group B + B1 – Goutallier 3-4
Atrophic or absent muscle
## Materials & Methods

<table>
<thead>
<tr>
<th></th>
<th>Goutallier</th>
<th>Walch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Stage 0</strong> = completely normal muscle, without any fatty streak</td>
<td><strong>Group A1</strong></td>
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<tr>
<td></td>
<td><strong>Stage 1</strong> = the muscle contains some fatty streaks</td>
<td><strong>Normal</strong> = the thickness of the muscle is half of the anterior-posterior width of the glenoid</td>
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<td></td>
<td><strong>Stage 2</strong> = the fatty infiltration is important, but there is still more muscle than fat</td>
<td><strong>Hypertrophic</strong> = the thickness of the muscle is larger than the anterior-posterior width of the glenoid</td>
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<tr>
<td>Group B</td>
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<tr>
<td></td>
<td><strong>Stage 3</strong> = there is as much fat as muscle</td>
<td><strong>Group B1</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Stage 4</strong> = more fat than muscle is present</td>
<td><strong>Atrophic</strong> = the thickness of the muscle is less than half of the anterior-posterior width of the glenoid</td>
</tr>
<tr>
<td>68</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>41</td>
<td></td>
<td>73</td>
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</tbody>
</table>
Results

Last Follow-up

<table>
<thead>
<tr>
<th>ROM</th>
<th>Group A-A1</th>
<th>Group B-B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>157</td>
<td>154</td>
</tr>
<tr>
<td>AABD</td>
<td>150</td>
<td>144</td>
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<tr>
<td>AIR</td>
<td>73</td>
<td>77</td>
</tr>
<tr>
<td>AER</td>
<td>46</td>
<td>36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Group A-A1</th>
<th>Group B-B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADLEIR</td>
<td>27/36</td>
<td>30/36</td>
</tr>
<tr>
<td>CS</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>Pain (VAS)</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>SSV</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

CS, ADLEIR, SSV & Pain Score significantly improved at 12-months in all the patients (p <0.001)
There were no statistically significant differences of these scores between the groups (A-B and A1-B1) (p=0.91, 0.15)

Mean AER improved from $22.4^\circ \pm 21.6^\circ$ preoperatively to $40.6^\circ \pm 17.5^\circ$ postoperatively with no statistically significant difference between the groups (p = 0.43 A/B; p = 0.85 A1/B1).
Results

ROM @Last Follow-up

Group A-A1

Group B-B1

AE  AABD  AIR  AER
Discussion

Our results showed no difference in AER & function related to TM degeneration in patients following stemless metaphyseal rTSA.

Are these results due to surgical technique? due to implant specific design features?

Simovitch et al. suggested that increasing fatty infiltration of the TM (3-4 stage) is associated with less postoperative AER and worse clinical outcome after rTSA. In their study the implant used was a Grammont style (Delta III) with 155° neck shaft angle and medialised COR.

All rTSA in our study were performed using an anterosuperior approach. The implant used in our study has 145° neck-shaft angle and +3mm lateralised COR. The +3mm lateralisation of the COR may recruit more of the posterior and anterior fibres of the deltoid muscle to act as external and internal rotators respectively.

A specific design feature of the implant with the 10° oblique dial-able liner, allows fine adjustments of the optimal version in each patient to achieve the optimal rotational movements without impingement on the glenoid bone. The surgeon attempted to approximate any remnants of TM and SSC to the tuberosities, even if the quality of the tendons was very poor. This was possible in 84 cases (77%). It may be possible that the approximation and re-tensioning of the remnant of the TM, regardless of its atrophy and fatty infiltration, improves the AER and restores the force couple assisting the posterior fibres of the deltoid to AER.
Discussion

3y and 4y po bilateral triple-finned stemless rTSA

Limitations

No control group with medialised COR
No control CT scans to assess the TM status post operatively

Conclusion

TM degeneration does not influence AER in patients following stemless metaphyseal rTSA.