How I do a Maquet Osteotomy?

Philippe Landreau, MD
Paris, France

Which treatment?

Maquet: 1963

- Anterior displacement of the tibial tuberosity design to reduce the joint reactive force in the patellofemoral joint

Maquet: 1963

- Biomechanically, this is achieved by increasing the level arm of the quadriceps muscle and by increasing the angle $\beta$ formed by the vectors of the quadriceps muscle and the patella tendon

Maquet: 1963

- Recommendation of a 2.0 to 2.5 cm advancement based on geometrical calculations that suggested a 50% of reduction in the compressive patellofemoral force could be achieved

Biomechanics

Ferguson 1979

- Implantation of stress transducers in the retropatellar of amputation specimens.

- A point of diminishing returns is encountered after 1.25 cm of elevation.

- He recognized some potentially deleterious effects of increasing elevation due to the transfer of stress to the proximal pole of the patella
Ferrandez et al: elevation of the tibial tuberosity can paradoxically increase stresses on the proximal portion of the patella, particularly when it is elevated >1 cm. Using in vitro measurements, both Nakamura et al. and Ferrandez et al. found an elevation of >1 cm to be counterproductive with regard to patellofemoral stresses.

Lateral parapatellar incision extended past to the tubercle. A 2.5 cm by 5 cm section of iliac crest is then harvested.

Osteotomy performed with use of a thin oscillating saw blade 8 cm from the superior aspect of the tubercle distally in the coronal plane. Once mobilized, the proximal segment is displaced anteriorly, allowing plastic deformation of the bone at the distal attachment. The iliac crest graft is then fashioned to allow anteriorization at the tubercle.
Technique of Maquet O.

- A cancellous screw can be utilized for supplemental fixation through the tubercle and the graft, into the metaphyseal aspect of the tibia.

Technique of Maquet O.

- Full weight-bearing is allowed with protection of a rigid sling.
- Sling during 6 weeks.

Question

- Why I don’t perform Maquet Osteotomy anymore?!!

Results?

- Maquet reported data (average follow-up period, 4.7 years) on 39 patients who had undergone his procedure. Thirty-seven of the 39 patients had good to excellent results, this implied relief of pain and a functional knee.

Results?

- Jenny et al. evaluated sixty-five patients who had undergone a Maquet procedure for a variety of conditions and found that the forty-eight patients with patellofemoral arthritis had the best results at an average of eleven years.

Results?

- Engebretsen et al. reported on thirty-eight patients treated with the Maquet procedure. Of thirty-three patients who were available for follow-up at a mean of five years, ten had improvement, seventeen had no change, and six were worse off. The patients with improvement were noted to have “Grade III and IV” cartilage changes primarily involving the lateral facet.

Numerous articles reporting poor long-term outcome and an alarming incidence of serious complications.
Complications

- Complication rates of 10% to 40%
- Including tibial nonunion, tibial fracture, loss of fixation, skin necrosis, wound complication, infection, compartment syndrome, deep venous thrombosis

Wound complications

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>No. of cases</th>
<th>Wound complication rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maquet [8]</td>
<td>1976</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td>Helfet et al. [9]</td>
<td>1982</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Mescher et al. [9]</td>
<td>1986</td>
<td>27</td>
<td>37</td>
</tr>
<tr>
<td>Segal [10]</td>
<td>1987</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

Anatomical considerations

- The cutaneous vascular supply of the lower leg is derived chiefly from the anterior tibial, the posterior tibial and the peroneal arteries
- Tension of the bone on the skin

Anatomical considerations

- Colombe et al. showed an increased risk of infection due to oedema consequent on disturbed lymph drainage in long anteromedial incisions

Anatomical considerations

- "an anterolateral incision avoids major damage to the lymphatic drainage of the leg and offers the potential for reduced oedema and skin edge compromise by comparison with an anteromedial incision".

So, which technique?

- Fulkerson (1983) combined the theoretical advantages of both the Maquet anteriorization procedure (to decrease patellofemoral forces) and medialization (to improve joint congruity = AMZ (anteromedialization) achieved this by an oblique cut between the sagittal and coronal planes
Advantages

- The procedure had fewer complications than the Maquet and did not require iliac bone graft harvest.
- Reports have described satisfactory results in more than two-thirds of patients at five years after the surgery.

Advantages

- The most common areas involved in patients are the lateral and distal articular regions.
- Anterior and medial transfer of the tibial tubercle would thus be appropriate in these patients.

Advantages

- Using similar logic, with reversal of the oblique cut, it is possible to perform an anterolateralization in case of iatrogenic medial pain and degeneration.

Thank you