If a surgeon is faced with altered lesser trochanter anatomy when revising the femoral component in revision total hip replacement, a peri-prosthetic fracture, or Paprosky type IIIb or type IV femoral bone loss, a modular tapered stem offers the advantages of accurately controlling femoral version and length. The splines of the taper allow rotational control, and improve the fit in femoral canals with diaphyseal bone loss. In general, two centimetres of diaphyseal contact is all that is needed to gain stability with modular tapered stems. By allowing the proximal body trial to rotate on a well-fixed distal segment during trial reduction, appropriate anteverision can be obtained in order to improve intra-operative stability, and decrease the dislocation risk. However, modular stems should not be used for all femoral revisions, as implant fracture and corrosion at modular junctions can still occur.

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Advantages and disadvantages of modular tapered stems

Wagner was the first to describe the use of a distal tapered, fluted stem in the late 1980s. As it was difficult to control when the stem engaged the diaphysis and component undersizing, subsidence occurred in about 20% of patients, which altered leg lengths and/or led to instability in up to 25% of patients. As a result many implant companies and surgeons moved to modular tapered, fluted stems.

In type III deficiencies, the metaphysis and diaphysis are compromised, therefore a modular tapered stem is beneficial; particularly in type IIIb femurs, where less than 4 cm of isthmus remains for fixation. A minimum of 2 cm of diaphyseal contact is generally all that is needed to gain stability with modular tapered stems. In type IIIa bone defects, a fully porous coated, cylindrical stem can be used. However, when this type of stem is used for more severe cases such as type IIIb bone loss, failure rates have been reported to be as high as 21%.

One of the advantages of using a modular tapered stem in patients with poor bone quality is that the splines on the taper provide rotational control, and the taper engaged in the diaphysis provides axial stability. The proximal body then facilitates independent control of anteversion, offset and length. During surgery, the distal taper is placed first, so the surgeon knows exactly where the taper will engage the diaphysis. Subsequently the proximal body is built off a stable distal tapered...
stem in order that length can be restored accurately. By allowing the proximal body trial to rotate on a well-fixed distal segment during trial reduction, it becomes easier to obtain appropriate anteverision, which in turn improves intra-operative stability and decreases the risk of dislocation. The end result is an implant that minimises leg length discrepancies and increases stability.

In cases of severe femoral bone loss, a monoblock stem, which is the alternative to modular stems, can be a problem. Loose stem femoral remodeling often results in varus and retroversion and as a result, the lesser trochanter anatomy becomes altered, which makes judging femoral version more difficult. In cases of severe varus remodeling in which a curved stem is necessary, modularity prevents anteverision mismatch that would occur with a monoblock stem, as the distal curved portion of the stem can be inserted independent from the version of the proximal body. Ultimately modularity decreases the risk both of femoral cortex perforation and of erroneously anteverting the stem. However, the disadvantages of using a modular stem include implant fracture and corrosion at the modular junctions can still occur. Newer implant designs have lower rates of fractured implants, but there are currently few reports of severe corrosion of modular revision implants that cause the surgeon to revise the components.

Results
In our initial series of 16 patients who had type IIIb and IV femoral defects and underwent a femoral revision using a modular tapered fluted stem, there were no failures and underwent femoral revision using a modular tapered fluted stem. In cases of severe varus remodeling in which a curved stem is necessary, modularity prevents anteverision mismatch that would occur with a monoblock stem, as the distal curved portion of the stem can be inserted independent from the version of the proximal body. Ultimately modularity decreases the risk both of femoral cortex perforation and of erroneously anteverting the stem. However, the disadvantages of using a modular stem include implant fracture and corrosion at the modular tapers. Newer implant designs have had lower rates of fractured implants, but there are currently few reports of severe corrosion of modular revision implants that cause the surgeon to revise the components.

Table I. Paprosky classification of femoral deficiency in revision total hip replacement

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Minimal metaphyseal bone loss, intact diaphysis</td>
</tr>
<tr>
<td>II</td>
<td>Extensive metaphyseal bone loss, intact diaphysis</td>
</tr>
<tr>
<td>IIIa</td>
<td>Extensive metaphyseal bone loss, diaphyseal bone loss with &gt; 4 cm of scratch fit at the isthmus</td>
</tr>
<tr>
<td>IIIb</td>
<td>Extensive metaphyseal bone loss, diaphyseal bone loss with &lt; 4 cm of scratch fit at the isthmus</td>
</tr>
<tr>
<td>IV</td>
<td>Extensive metaphyseal bone loss and non-supportive diaphysis</td>
</tr>
</tbody>
</table>

Pain scores were less in the modular tapered group, and dislocation rates were lower than that reported in the monoblock revision stems.\textsuperscript{4,7,10,11} However despite early reports of failures, clearly there remains a role for monoblock tapered fluted stems. In fact, Bohn and Bischel recently reported a 95.2\% survival rate in 129 consecutive femoral revisions using the Wagner SL revision stem.\textsuperscript{13}

Conclusion
In femoral revisions with altered lesser trochanter anatomy, a periprosthetic fracture, or Paprosky type IIIb and type IV femoral bone loss, a modular tapered stem offers the advantages of controlling femoral version and length accurately. As a general rule, a minimum of 2 cm of diaphyseal contact is required to gain stability with these stems. By allowing the trial proximal body to rotate on a well-fixed distal segment, appropriate anteverision can be obtained more easily, thus resulting in improved stability. However, modular stems should not be used for all femoral revisions as implant fracture and corrosion at modular junctions can still occur.

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References


