There is a North Atlantic divide in the philosophy of femoral fixation in total hip replacement (THR). In the United States, the majority of THR femoral stems are cementless, whereas in many countries in Europe, particularly in Scandinavia, the majority are cemented.1 Slightly more cemented than cementless stems are used in the United Kingdom.2

The reason for this North Atlantic divide is historical. The original Charnley cemented stems, which were developed in the 1960s, were tapered and polished in design and had no features to pressurise the cement; these performed very well. An independent series from North America has shown that the 35-year survival of the early Charnley femoral stems was 93%, using aseptic loosening as the endpoint.3 Based on this evidence it is a shame that we can no longer use these stems today as they are not available.

There have always been cases of loosening of cemented femoral stems. These were usually associated with marked subsidence of the stem within the cement mantle. It was therefore assumed that in order to prevent loosening, it was necessary to strengthen the bond between the implant and the cement to prevent subsidence. ‘Improved’ designs of stem were introduced predominantly in the United States. These stems had matt or rough surfaces with collared and some were pre-coated with polymethylmethacrylate (PMMA). With these supposed improvements the results paradoxically progressively deteriorated. The reason for this, which was not initially appreciated, is that all stems de-bond from the cement with consequent and inevitable movement between the stem and the cement mantle. If the stem is rough it will wear away the inside of the cement mantle, releasing cement debris and leading to loosening. Furthermore, the rougher the surface the more rapidly loosening occurs. As a result of these poor outcomes the use of cemented stems declined in the United States, along with the associated skills required for cementing. The situation in England was different as other polished tapered stems, for example the Exeter, were being used. The Exeter stem (Stryker, Newbury, UK), which was introduced in 1970, like the early Charnley, did exceptionally well. In the designers series after 33 years, the Exeter stem had a 97% survival based on aseptic loosening as the endpoint.4 Charnley himself gained an insight into why these polished tapered stems worked well in that he observed patients sometimes had pain after THR, but the pain went when the femoral stem subsided. An understanding of subsidence is necessary to appreciate why polished tapered cemented stems maintain fixation in the long term.

The best way to study subsidence of stems is with radiostereometric analysis (RSA). RSA studies have shown that the Exeter stem subsides within the cement mantle and that there is no subsidence of the cement relative to the bone5. During the first year after implantation the stem subsides by approximately 1 mm and then it continues to subside slowly for at least ten years.5 Other polished tapered stems subside similar amounts. As they are polished they do not damage the cement mantle when they subside and, because of the tapered morphology of the stem, the cement is compressed.6 Cement performs well in compression and does not fracture. More importantly, the
cement-bone interface is also compressed, so this interface will also remain secure even in young, active patients. There are other designs of cemented stems that perform well, but our preference is to use polished tapered designs.

Data from the national joint registries gives insight into the relative merits of cemented and cementless stems. In the National Joint Registry for England and Wales, the revision rates of cemented stems, whether in combination with cementless or cemented acetabular components, are substantially lower than those of cementless stems. This data has to be interpreted with caution, particularly because cementless stems tend to be used in younger patients. Furthermore the overall data consists of pooled results of many different stems, some of which perform well and some badly. At five years the mean revision rate of all the cemented stems is about half that of all the cementless stems. Also, the revision rate of the most commonly used cemented stem is about half that of the most commonly used cementless stem. Similarly the revision rate of the best performing cemented stem is about half that of the best performing cementless stem. However, most importantly, the revision rate of the worst performing cemented stem is similar to that of the best performing cementless stem.

Data from the national registries gives an insight into the revision burden in different countries. (Revision burden is the proportion of hip replacements that are revisions). In the United States, where the vast majority of femoral stems are cemented, about 18% of THRs are revisions. In Sweden, where the vast majority of stems are cemented, about 6% of THRs are revisions. In the United Kingdom, where there a slightly more cemented than cementless stems the revision burden is about 11%. The reason why polished tapered cemented stems work well is that they are very forgiving in practice. In a large multicentre study, the failure rate was found to be independent of alignment and quality of cementing. With cement it is simple to achieve accurate leg length, anteversion and neck offset. There is a concern about cement in young patients, but polished tapered stems perform very well in young patients with a series aged less than 50 years from Exeter, achieving 99% survival of the stem at 15 years. A cemented stem can be considered to be customised for the patient and can be used in almost all situations: it works well whatever the bone quality, and almost with femoral deformity. A cemented stem therefore has no virtually no complications. Cementless stems are in many ways not as forgiving. Surgical error can lead to peri-prosthetic fractures. There are contraindications such as very poor quality bone or very abnormal morphology, and there is a significant risk of thigh pain. Cement has other advantages. It provides a seal that will prevent ingress of wear debris or joint fluid under pressure, thus decreasing the risk of osteolysis. It can be used to deliver local antibiotics and its cost is low. Revision is relatively straightforward for problems with the acetabular component or articulation as the stem can easily be knocked out of the cement mantle to gain access to the acetabulum. Then, after addressing the problem, a new stem can be put back into the old cement mantle. In addition it is possible to do a cement-in-cement revision. In summary, a polished tapered collarless cemented stem works well in every patient. It is relatively easy to achieve optimal orientation, offset and leg length, and is we believe well worth five minutes extra operating time.

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References