Cemented Femoral Fixation: The North Atlantic Divide

DAVID W. MURRAY, MD, FRCS

abstract

In the United Kingdom, more cemented than cementless stems are implanted, whereas in North America, few cemented stems are implanted. This is primarily because cemented stems have not performed well in North America, whereas they have in the United Kingdom, as different designs have been used.

The majority of cemented stems used in the United Kingdom are polished, collarless, and tapered. These are forgiving, as they subside within the cement mantle and compress the cement and stabilize the interface. They perform well in both young and active patients and elderly patients. They also do well in osteoporotic bone, with deformity, or with suboptimal cementing techniques. As the position of the stem can be varied, it is simple to achieve appropriate leg length, offset, and version. Cement can be used to deliver antibiotics locally. If revision is necessary, it is relatively straightforward. Cement has numerous advantages that outweigh the main disadvantage of an extended operating time.
There is a North Atlantic divide in femoral fixation. In the United Kingdom, more cemented than cementless stems are implanted, whereas in the United States, almost every stem is cementless. The reason for this is primarily historical.

The original Charnley cemented stems, developed in the 1960s, were tapered and polished and performed well. For example, an independent series from North America showed that the 35-year survival of the stem was 93% for aseptic loosening. We can no longer use these stems today, as they are no longer available.

There have always been cases of stem loosening, which are usually associated with marked subsidence of the stem within the cement mantle. It was therefore assumed that to prevent loosening, it was necessary to strengthen the bond between the implant and the cement to prevent this subsidence. Improved stem designs were introduced in the United States to prevent subsidence. Initially these were matte, then they became collared and rough, very rough, and finally precoated. Surprisingly, with these supposed improvements, the results progressively deteriorated. The reason for this, which was not appreciated initially, is that all stems debond from the cement. Once the stem debonds, there is movement between the stem and the cement. If the stem is rough, it will wear away the inside of the cement mantle, releasing cement debris and leading to loosening. The rougher the surface, the more rapidly loosening occurs. As a result of these deteriorating results, the use of cemented stems decreased in the United States.

The situation in England was different, as other polished, tapered stems were being used, such as the Exeter stem (Stryker, Mahwah, New Jersey), which was introduced in 1970. Like the early Charnley, the Exeter stem did exceptionally well, with 97% survival for aseptic loosening at 33 years. Interestingly, Charnley gained insight into why these stems worked well: He observed that patients sometimes had pain after hip replacement, but the pain went when the hip replacement subsided. An understanding of subsidence is necessary to understand how cemented stems function.

The best method to study subsidence of stems is with radiostereometric analysis. Radiostereometric analysis studies have shown that the Exeter stem subsides within the cement mantle and that there is no subsidence of the cement relative to the bone. During the first year after implantation, the stem subsides approximately 1 mm, and then it continues to subside slowly out to at least 10 years. Other polished tapered stems subside similar amounts. As they are polished, they do not damage the cement mantle. As a result of the subsidence of the tapered stem, the cement is compressed. Cement performs well in compression and does not fracture. More importantly, the cement–bone interface is also compressed, and under compression this interface will also remain secure even in young, active patients.

The concept of a polished, tapered, cemented stem is theoretically forgiving. It is also forgiving in practice. In a large multicenter study, the failure rate was found to be independent of alignment and quality of cementing. In addition, a cemented stem can be considered to be customized and can be used in all situations. A cemented stem therefore has no contraindication, whereas cementless stems do. For example, it would be risky implanting a cementless stem into a patient with gross osteoporosis or gross deformity.

Cement has many other advantages. The cement 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 antibiotics locally. It is low cost. Importantly, revision is relatively straightforward. It is easy to knock a polished, tapered stem out of the cement mantle, and, after revising an acetabular component, a new stem can be put back into the old cement mantle. In addition, it is possible to do a cement-in-cement revision.

Data from National Joint Registries gives insight into the relative merits of cemented and cementless stems. The data must be interpreted with caution, particularly because cementless stems tend to be used in younger patients, and also cemented stems are perhaps easier to revise. Overall, the cemented stems give better results than cementless. In the National Joint Registry for England and Wales, cemented stems are doing better than cementless, whether comparing all of the cemented stems with all cementless or looking at the commonly used devices or the best or worst device. The most interesting comparison is that the best performing cementless stem has a similar revision rate to the worst performing cemented.

Data from the National Joint Registries give insight into the revision burden in different countries. (The revision burden is the proportion of revision hips compared to primary hips.) The revision burden is low in Sweden, high in the United States, and somewhere in the middle in the United Kingdom. This is probably related to the use of cemented stems.

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 well worth 5 minutes’ extra operating time.

REFERENCES