INTRODUCTION:
Cementless acetabular components with modular polyethylene liners have been commonly implanted for many years. It is not uncommon for the revision hip surgeon to encounter problems of mechanical wear of the liner whilst the metal acetabular shell remains secure to the pelvis.

The problem is more pronounced in cups of smaller diameter (<50mm). In these cases the polyethylene thickness is reduced and wear rates become proportionally higher. As well as the mechanical problems this poses, there are also associated inflammatory reactions due to the bioactive wear particles released. If left unchecked this can cause severe osteolytic reactions, which often progresses to aseptic loosening of the prosthesis.

Young active patients with higher demands may wear out a number of liners over their lifetime.

Options for revision surgery of worn polyethylene liners in well-fixed acetabular components include:

1. Replacing the worn liner with a new liner of the same design. Although this is probably the simplest option, all too frequently this is not possible due to damage to the liner locking mechanism, unavailability of the liner or because the original liner has been discontinued from the manufacturer.

2. Removing and replacing the complete construct. However, in the osseo-integrated cup this is often a destructive process, which may cause significant bone loss.

3. Removing the worn liner and cementing a new polyethylene liner into the metal-backed shell. This is an attractive and successful option. However, the drawback of this option is that an undersized liner has to be used to give a sufficient cement mantle thickness to allow adequate purchase. Often this means that the polyethylene thickness is reduced compounding the original problem of excessive wear and the associated debris osteolysis.

We performed a laboratory study investigating a modification of this last option. Whereby a chrome cobalt (CrCo) metal liner is cemented into an acetabular shell. The advantage being that, the metal liner provides a harder wearing surface than the polyethylene equivalent whilst having a smaller overall diameter thus allowing for a thicker cement mantle.

The purpose of this study was to determine the minimum cement mantle required for a metal liner to remain secure within a hemispherical metal shell.

METHODS:

In all, six mechanical tests were performed using a six-station computer controlled hydraulic hip joint simulator (Stanmore). 35 mm external diameter CrCo liners (Corin Medical Group, Cirenceter, England) were used. The liners were all scored on the reverse side with 2 concentric circles and a cross to a depth of 1 mm to increase the cement mantle. The metal liners were cemented using Simplex-P polymethylmethacrylate cement (Howmedica Int. S. de R.L Limmerick, Ireland) into custom made titanium shells to give cement mantle thickness. The cemented metal liner and shell was then sealed box at room temperature. Following testing the metal liner and custom shell were removed from their holder and each of the 6 liners cross-sectioned. The cut surfaces were ground to achieve a smooth finish. Crack penetration dye was applied to the ground surface and the degree of cracking was observed using light and scanning electron microscopy.

RESULTS:

After 10 million cycles the equivalent of 10 years of use none of the liners exhibited gross failure. The quantity of cracking was recorded for each cement mantle thickness and is shown in Figure 2.

Comparing the quantity of cracks found in the 1 mm cement mantles to the ½ mm mantles there was no statistical significance. However, on analysis of the 2 mm mantles, very few cracks were identified. The degree of cracking was significantly less than that observed in the ½ mm mantle (p<0.05) using student’s t-test. The majority of cracks observed were found around the polar bearing area in all cement mantles. In this mechanical test no gross failure of any of the liners was observed. On analysis of the cement mantles the 2 mm mantle had the fewest cracks and therefore was probably least likely to fail over the longer term.

DISCUSSION AND CONCLUSION:
Cementing a polyethylene liner in to a metal backed shell for the revision of a worn liner is novel method to overcome the problems of polyethylene wear when simple liner exchange is not an option. This method has been previously described. However, this solution does not address the problems of polyethylene wear and the associated debris osteolysis. To our knowledge no one has previously described the use of a metal liner in the revision of a worn polyethylene liner with a well-fixed shell.

Cementing a metal liner in the revision of a worn polyethylene liner within a well-fixed shell is a useful alternative. Not only does it provide a harder wearing bearing with lower wear rates it allows for a thicker cement mantle which as we have shown has fewer cracks and thus less likely to fail in the longer term. However, it is important to note that in clinical practice one would have to make certain that the metal liner used was compatible to the femoral head to avoid problems of metal disparity.

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