Letter to the Editor

A valuable technique for femoral stem revision in total hip replacement: The in-cement revision – A case series and technical note

A B S T R A C T

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Revision of a cemented femoral stem can be a challenging procedure. We present a series of cases utilising the “In-cement” revision, whereby the same size stem is introduced into the original cement mantle, without additional cementing. It requires a stable cement mantle in the correct version.

We describe the technique and present a review of 23 revision total hip replacements performed over a 5 year period. At average follow-up of 67 months (12–128 months), the overall survivorship was 91.3% with no patient requiring re-revision for stem loosening or mechanical failure. Two patients required re-revision for infection and one of those patients is now deceased. No further operations were required in 21 patients.

The “In-cement” revision can be a valuable technique for the revision arthroplasty surgeon. Early results suggest this is a safe and effective technique in the appropriate patient.

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1. Introduction

Revision of a cemented femoral stem can be a challenging procedure. Removing the cement mantle requires time and patience with a risk of further bone damage and possible fracture.^{1–4} Retention of the old cement mantle and insertion of a smaller or shorter stem – the cement-in-cement revision – described for taper stems – provides a good alternative if the cement mantle is stable, but is limited if a smaller size or offset stem is already in situ. We present a newly described technique, the “In-cement” revision – the introduction of a stem, the same size as the original implant, into the previous cement mantle, without additional cement or downsizing. This has not been previously described or investigated in the literature. We present the technique and a series of 23 cases.

In-cement revision requires an intact and stable cement mantle in the correct version. The benefits include improved view of the acetabulum, time efficiency, the ability to use the same size stem and utilisation of the previous distal centralised spacer plug to facilitate subsidence.

2. Technique

After either general or spinal anaesthetic, the patient is positioned laterally. An incision is made through the previous scar and the hip is exposed through a posterior approach. After appropriate dissection and debridement, the hip is dislocated, the head tapped off and the cemented, polished, tapered stem is removed (Fig. 1).

There are three primary keys in the technique:

1. Inspection of the cement mantle for stability and version (Fig. 2).

Inspect the cement mantle for cracks and coverage. Forceps or a pituitary rongeur are used to attempt to mobilise the cement and therefore determine if it is stable. Version is assessed and is deemed either appropriate or not appropriate. If the version of the previous stem is not appropriate or the cement mantle is not stable, an in-cement revision should not be pursued.

2. Protection of the cement mantle (Fig. 3).

Place a moist swab in the canal to prevent debris from the acetabular revision dropping into the cement mantle.

The acetabulum is then exposed and revised as appropriate.

3. Reinsertion of the same size stem without a centraliser (Fig. 4).

No centraliser is used to facilitate subsidence. Tap in the stem until it re-engages with the taper. Double check the length of the

Fig. 1. Removal of stem.

Fig. 2. Inspection of cement mantle for version and stability.

Fig. 4. Insertion of new stem without centraliser.

Fig. 3. Protect the canal.

stem with the greater trochanter and normal anatomical markers and the stem is assumed to be stable.

The head is then applied, the hip reduced (**Fig. 5**) and layered soft tissue closure completed.

Fig. 5. Reduction and confirm stability.

Fig. 6. Survivorship: in-cement revision.

3. Methods

We retrospectively reviewed 250 patients undergoing revision by a single surgeon, at one institution over a 5 year period between 2004 and 2009.

Twenty-three patients were identified as having undergone “In-cement” revisions. We recorded demographic data, the reason for revision, and length of follow-up at last review. The primary outcome measure was requirement of re-revision.

4. Results

The twenty-three patients included 13 females and 10 males with an average age of 65 years (43–84). The reasons for initial revision (**Table 1**) were recurrent dislocation 13 (56.6%) (11 for wear in cemented cups over 10 years old and 2 thought to be

secondary to malposition of acetabulum), aseptic loosening acetabulum 9 (39.1%) and infection 1 (4.3%).

The average patient follow-up was 67 months with a range from 12 months to 128 months. The overall survivorship was 91.3% (**Fig. 6**), with no patient requiring re-revision for stem loosening or mechanical failure. Two patients required re-revision for infection

Table 1
Reason for revision.

Reason for revision	No. 23
1. Recurrent dislocation	13
2. Aseptic loosening acetabulum	9
3. Infection	1

Table 2
Demographic data.

Demographic data		Date of OT	Age	Reason for revision	Re-revision required	Reason for re-revision	Length of follow-up (months)
Patient 1	F	19/08/2008	50	1	No		74
Patient 2	F	19/03/2004	53	1	No		128
Patient 3	M	13/12/2010	49	1	No		36
Patient 4	M	8/12/2008	69	1	No		71
Patient 5	F	26/10/2009	43	1	No		61
Patient 6	F	24/09/2004	46	1	No		104
Patient 7	F	3/11/2000	61	1	No		137
Patient 8	F	7/07/2006	67	1	No		100
Patient 9	F	27/09/2006	72	1	Yes	Infection	83
Patient 10	M	19/05/2007	84	3	Yes	Infection	Deceased
Patient 11	M	27/08/2005	80	5	No		12
Patient 12	F	11/01/2005	74	5	No		118
Patient 13	M	9/08/2010	71	5	No		48
Patient 14	M	2/03/2007	75	5	No		104
Patient 15	F	21/07/2009	77	5	No		67
Patient 16	M	10/07/2007	72	5	No		62
Patient 17	F	4/12/2005	48	5	No		96
Patient 18	F	18/05/2006	71	5	No		54
Patient 19	F	12/07/2009	80	5	No		12
Patient 20	M	8/03/2010	47	5	No		12
Patient 21	M	19/05/2006	78	5	No		12
Patient 22	F	15/11/2005	71	5	No		39
Patient 23	M	25/07/2005	64	5	No		48

and one of those patients is now deceased. One other patient had died at the time of chart review of unrelated causes. No further operations were required in 21 patients (Table 2).

5. Discussion

In total hip arthroplasty, initial stability is imperative to allow long-term bony ingrowth. Initial stability depends upon the establishment of a mechanical interlock between the implant and the bone of the host.⁵ Cement around a metallic stem has two functions, to provide stability and to assist in load transmission.⁵ In a cemented stem if initial stability is not achieved, fibrous junctional tissue forms between the bone and the cement resulting in increased load and predisposing to migration and loosening. In cemented revisions, initial stability can be difficult to achieve.

In the polished taper loaded stem used in these cases (Exeter/Stryker), the stem becomes a wedge within the cement mantle. It initially subsides within the cement until radial compressive forces are transferred to the bone as hoop stresses.⁶ A centraliser is imperative to initially allow subsidence of the stem, but then protects the distal cement mantle. Stability is maintained by a balance of forces across the stem–cement interface as well as by perfectly matched surface contours of the stem and the cement that's applied to it.⁵ By definition a taper can be removed by applying traction to the metal taper without interfering with the cement surface.

Removal of a cement mantle as part of revision of a femoral stem can be technically demanding.^{1,3} There is a risk of femoral fracture^{2,4} and creating excess bone loss, adding to the operating time which has the potential to increase infection rates, thrombosis and general anaesthetic complications.

In a well fixed cement mantle, several centres have published data on the technique of a cement-in-cement revision, whereby the original cement mantle is maintained and a new, smaller stem is cemented into the old mantle. First described by Greenwald⁷ several studies now exist investigating its success.^{8–10} In a large study from Exeter, Duncan et al.¹¹ followed 136 revision hips for a mean of 8 years and monitored the patients clinically and radiographically using the Barrack cement mantle grading system,¹² and had a 100% survival rate for femoral loosening

and stem subsidence. Goto et al.¹³ from Japan also had good survivorship in their series of 44 revision hips using this technique, although they reported a 20% femoral fracture rate. Mandziak et al.¹⁴ reported similar subsidence rates to primary hip arthroplasty and good long-term results.

The technique of cement-in-cement revision certainly has many advantages. It also has the option of subtly altering the femoral version, by removing some proximal cement and down-sizing the stem. A potential limitation relates to the requirement of a smaller stem, particularly in larger patients when the design limit of the implant may be exceeded. The Exeter system has a 44 mm offset short (125 mm) stem, which is 25 mm shorter than the standard, however if a smaller offset, or smaller stem width is required, this technique may not be suitable. There are also some clinical concerns about the risk of stem fracture if a smaller stem is required.¹⁵

An in-cement revision has all the benefits of a cement-in-cement revision with the added incentive of using the same size primary stem. In regions with economic pressures, provided the original stem is in good condition, it could also potentially be re-used, saving the cost of a new stem. We found it to be a safe technique with predictable outcomes for double taper stems in select patients.

It is simple to learn and perform and does not require extra time to re-cement the femur. It requires the cement mantle to be stable and to be in the correct version, as this cannot be altered.

In our study, both the patients who failed required re-revision for infection. They had different primary indications for incement revision – aseptic loosening and infection. Utilisation of this technique in primary infection cases may not be ideal. Because no other studies currently exist on the “In-cement revision”, the determination of the correct indication for this surgery is still under investigation. However, the use of the cement-in-cement revision for infection cases has been studied. Morley et al.¹⁶ have reported using the cement-in-cement technique for 15 infection cases as part of a two-stage revision. They achieved successful eradication of 14 out of 15 infections, but notably did not implant spacer prosthesis in the first stage of the revision. Potentially, the inability to provide more antibiotic with new cementing and the difficulty in determining absolutely that the cement–bone

interface is completely sealed, may lead to the in-cement revision technique not being indicated in infection cases.

Another possible concern in the in-cement revision is the reality that no two stems are exactly the same. Manufacturing differences within the same sized stem may result in the new stem not being perfectly contoured to the previous cement mantle. This may result in differences in length in the order of a few millimetres, which we suggest would not be relevant clinically.

Other limitations of this study include small numbers and our sole outcome measure being requirement for re-revision. Future investigation with larger numbers and functional and radiographical outcome measures will be useful in determining the full value of this technique. However, in our series of 23 patients with an average of greater than 5½ years follow-up, no patient required re-revision for femoral loosening, fracture or other mechanical failure. The senior author continues to use this technique frequently and follow-up of these patients is ongoing. We believe it can be a valuable technique in an appropriate patient.

In-cement revision is a useful technique in a highly select group of patients, who are not infected, with a good cement mantle at the time of revision surgery. The theory of a taper fix is such that re-inserting an identical taper is mechanically acceptable. This series confirms that it is clinically acceptable.

Conflicts of interest

The authors have none to declare.

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