Original Article

Midterm results following uncemented, modular, fully porous coated stem used in revision total hip arthroplasty: Comparison of two stem systems

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ABSTRACT

Background: Aim of this study was to evaluate stem subsidence and survivorship of implant following implantation of Revitan (Zimmer) and MP (Waldemar Link) stems.

Methods: Retrospective case series with clinical and radiological follow-up of 1–10 years.

Results: 47 Revitan and 57 MP stems were analyzed. In 12 cases there was subsidence of the stem present. Two Revitan stems and one MP stem were revised as a result of subsidence. Failure rate was 4.3% for Revitan, 1.8% for MP stem and difference was not statistically significant.

Conclusion: There is no significant difference in subsidence or survivorship between Revitan and MP stems.

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1. Introduction

A modular, uncemented, fully porous coated stem is commonly used in revision total hip arthroplasty.^{1,2} It is versatile, allows accurate positioning and balancing of the hip, use of various bearing surfaces and leads to satisfactory results.^{1–5} Mid-term results were reported previously.^{3–5} Since first introduction of the concept of the modular, fully porous stem, many companies produced stems of their own design based on same principle, but manufactured differently. The results of Revitan (Zimmer, Warsaw, Indiana, US) and MP (Waldemar Link, Hamburg, Germany) stems have been reported separately,^{6,7} but no direct comparison was made to the best of our knowledge.

2. Objectives

Aim of this study was to evaluate the outcome and survivorship of implant following uncemented modular fully porous coated femoral stem use in revision hip arthroplasty in series of single surgeon. We compared results following Revitan (Zimmer) and MP (Link) stem implantation.

3. Methods

We performed a retrospective case series of all patients who had revision total hip replacement surgery with implantation of either Revitan or MP stem, performed by the senior author between 2003 and 2012, with clinical and radiological follow-up between 1 and 10 years. This was part of larger review of revision practice of senior author, the outcomes of extended trochanteric osteotomy were reported in separate paper. The senior author is experienced hip revision surgeon, undertaking above 40 hip revisions per year. Due to the nature of supply in the hospital, he uses uncemented, modular, fully porous coated stem from two companies interchangeably, based on availability. During research period, he used MP and Revitan stems in significant numbers when performing revision hip arthroplasty with use of uncemented stem. Patients who had implanted either Revitan or MP stems were included in the study. Only patients with radiological and clinical follow-up till full osteo-integration of the stem were included in the analysis.

Clinical notes and radiographs were reviewed by independent observer. Subsidence was measured using direct radiographic method, measuring distance of the top of the stem to fixed point of the femur, lesser trochanter if well visualized. This method was proven to be sufficient to detect migration above 1 mm.⁸ Femoral deficiency was classified according to Paprosky.⁹

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4. Stems

Both MP and Revitan are uncemented, modular stems. They are designed to be used in revision hip arthroplasty. Revitan stem is made of titanium–aluminum–niobium alloy (Protasul®-100), MP stem is made of titanium aluminum vanadium alloy (Tilastan®). Both stems have flutes, and primary fixation relies on press-fit. Both stems are highly porous and the bone in-growth leads to biological fixation. Both MP and Revitan stems are available in various sizes in terms of length and radius. Once stem is implanted, the modular body with a neck is connected to the stem using locking mechanism, which is different in each stem. The body is available in various sizes (length and radius). MP system offers different offsets and neck angle of 126 and 135°. Revitan system is available with neck angle of 135° only and offset of 44 mm only.

5. Results

We identified 104 revision hip arthroplasty cases when an uncemented modular fully porous coated femoral stem was used – MP (Link) modular stem was used in 57 cases, and Revitan (Zimmer) modular stem was implanted in 47 cases. All patients had sufficient follow-up. Femoral deficiency varied from type I to type IIIb according to Paprosky classification (Table 1). Indications for revision surgery are shown in Table 2, and patients' characteristics in Table 3. There was no statistical difference in patients' age, ASA and femoral deficiency amongst groups.

In 81 cases extended trochanteric osteotomy (ETO) was performed. All procedures were performed through posterior approach. Following exposure of the hip and proximal femur, osteotomy line was marked with diathermy. Distal end of osteotomy was created using 2.5 mm drill. Osteotomy was performed using oscillating saw reaching 12–14 cm from tip of greater trochanter. The attempt was made to keep anterior soft tissue attachment to osteotomised fragment. Before stem implantation, the Dall Miles (Stryker) cable was applied distal to osteotomy site to prevent femoral shaft fracture. Following stem implantation, the osteotomy was reconstructed using 2 or 3 Dall-Miles (Stryker) cables in 73 cases or trochanteric plate in 8 cases. None of the osteotomies required revision.

Post-operatively patients were not given any brace, and were allowed to partially weight bear for first 6 weeks, with about 50% of body-weight being transferred through operated hip. After 6 weeks weight bearing precautions were stopped and patients were allowed to mobilize without crutches or walking sticks, although some patients had to use walking aids up to 3 months post-operatively due to pain or for balance. Active range of movement of the hip and knee was encouraged from early post-operative period.

There occurred one intra-operative femoral fracture that required fixation with cables. ETO was not performed in this case.

Table 1

Femoral deficiency according to Paprosky classification in both groups. Fisher exact test used to calculate *p* value.

	Revitan (n = 47)	MP (n = 57)	<i>p</i> value
Paprosky I	4	3	0.7
Paprosky II	20	26	0.86
Paprosky IIIa	17	18	0.84
Paprosky IIIb	6	10	0.6

Table 2

Indication for revision surgery in both groups. Fisher exact test used to calculate *p* value.

	Revitan (n = 47)	MP (n = 57)	<i>p</i> value
Dislocation	5	10	0.42
Loose	34	35	0.64
Cup	7	10	0.8
Infection	1	2	1

Table 3

Patients' demographics in both groups. Fisher exact test used to calculate *p* value.

	Revitan (n = 47)	MP (n = 57)	<i>p</i> value
ASA	3.27	3.45	0.7
Age	68	75	0.45
Male	13	24	0.33
Female	34	33	0.53
Extended trochanteric osteotomy performed	41	40	0.55

In 12 cases the subsidence of the stem was observed on serial X-rays. Subsidence varied from 2 mm to 25 mm. In 3 cases (two in Revitan group and one in MP group) the stem was revised as a result of subsidence. In all cases an undersized stem was used during first revision, and the subsidence occurred within first 2–6 weeks. The post-operative complications and subsidence are listed in Table 4. The number of patients with subsidence, a mean subsidence if occurred and a significant (above 1 cm) subsidence occurrence were not statistically different between two groups.

One dislocation required acetabular revision; two other dislocations were managed conservatively. There was one recurrent infection in patient who had a staged revision of THR due to infection. This patient required stem removal and a girdlestone procedure as definitive treatment. In all remaining patients complete osteo-integration occurred and there were no radiological signs to suggest aseptic loosening of the stem.

In this group of patients, the aseptic failure of the Revitan stem was 4% (2 of 47), and failure of MP stem was 1.8 (1 of 57). This is not statistically significant difference.

Table 4

Table listing the subsidence of stems and complications.

	Revitan (n = 47)	MP (n = 57)	<i>p</i> value
Subsidence	2 mm, No ETO 2 mm, ETO done 2 mm, ETO done 2 mm, No ETO 15 mm, ETO done 20 mm, ETO done 25 mm, No ETO	2 mm, No ETO 2 mm, ETO done 3 mm, ETO done 5 mm, ETO done 20 mm, No ETO	<i>p</i> = 0.12 for mean (<i>t</i> -Test)
Subsidence above 1 cm	3 cases	1 case	0.33
Revision due to subsidence	2 cases	1 case	0.59
Complications	1. Dislocation 2. Dislocation 3. Revision (subsidence) – cemented stem 4. Revision (subsidence) – to MP stem	1. Hematoma evacuation 2. Dislocation 3. Infection – girdlestone 4. Revision (subsidence) – to MP	

6. Discussion

Uncemented modular fully porous coated femoral stem is reliable implant in revision surgery with excellent survivorship and rate of osteo-integration even in presence of significant femoral deficiencies. This design is widely used and there were reports that it outperforms cemented stems.¹⁰

Our mid-term results are in keeping with those reported previously. The excellent results are due to the concept of the stem build and method of fixation rather than specific brand of the stem or manufacturing details. Results reported for S-ROM stem (DePuySynthes) by Smith et al.³ or Profemur R stem (Wright Medical) by Walde et al.⁴ are similar to those presented in our series. In our patient cohort, there was no statistically significant difference in subsidence or failure rate between Revitan and MP stems. Both systems provided satisfactory primary fixation and lead to osteo-integration in majority of cases.

Few cases of subsidence can be contributed to surgical misjudgment and implantation of the stem that was too small. When careful pre-operative templating takes place and accurate implantation is performed with adequate exposure of femoral canal and liberal use of extended trochanteric osteotomy, the results of uncemented modular fully porous coated femoral stem are excellent.

We do acknowledge the weaknesses of the study. The retrospective nature with no control group and no randomization are obvious weaknesses. Both groups of patients are heterogeneous and the size of the cohort is small. There are so many variables in revision hip surgery that randomization and prospective studies are rare and very difficult to conduct however.

The follow-up in our study is short, with mean follow-up of 4.7 years (range 1–10). This is not enough to show long-term results and difference in longevity of the stem. It was sufficient to observe osteo-integration of the stem and subsidence of the stem after surgery, the primary goals of our study.

We did not present any functional scoring for our patients. This was not assessed and not collected in initial series of patients, and only recently we started collecting functional scores pre- and post-operatively. Patients were followed up clinically and radiologically till union of extended trochanteric osteotomy and till full osteo-integration of the stem and cup. Majority of patients are pain free or with minimal pain, with nine patients reporting trochanteric pain likely due to ETO.

The main strength of our study is that it is only paper to the best of our knowledge comparing two different modular uncemented stem brands used by same surgeon within same time period, interchangeably. Surgeon used same technique of exposure, implantation and used stems in same time period. Furthermore, despite lack of formal randomization, groups were similar as discussed earlier and received same post-operative care with physiotherapist or other health care professionals providing same care.

Post-operatively patients in both groups were allowed to partially weight bearing with crutches or frame, after that time the precautions were lifted. Woolson et al.¹⁰ showed that full and partial weight bearing leads to same results, but due to osteotomies and significant bone deficiencies, senior author protects all his patients for initial period of 6 weeks.

7. Conclusion

We did not see any significant difference of failure rate or subsidence between Revitan and MP stems used in revision hip arthroplasty and both systems provide good early fixation leading to good osteo-integration with good midterm results. Despite small differences in design of the stem and material used in stem manufacturing, both stems lead to similar clinical and radiological results. This is first study to the best of our knowledge comparing both stems in use by the same surgeon.

Ethical disclosures

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflicts of interest

The authors have none to declare.

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