

Salvaging unstable or recurrent dislocating total hip arthroplasty with the constrained acetabular component

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ABSTRACT

Purpose. To review cases of implantation of constraining acetabular components for unstable or recurrent dislocating total hip arthroplasty at the Department of Orthopaedics, Concord Hospital, Sydney.

Methods. A retrospective analysis was performed on prospectively collected data of 13 consecutively enrolled patients.

Results. From 1989 to 2000, 13 constraining acetabular components were implanted into 13 patients as a revision procedure. The surgical approach for the implantation of the constrained liner was posterolateral in 11 cases; a modified Hardinge approach was applied in 2 cases. The mean clinical follow-up duration was 43 months (range, 14–121 months) and the mean age at the time of surgery was 73 years (range, 52–84 years). No patients were lost to follow-up. Indications for using the constrained acetabular component were recurrent dislocation in revision hip replacements (n=8), and intra-operative instability (n=5). There were no episodes of dislocation of the constrained arthroplasty. In 7 cases, the constrained component was implanted into a previously well-fixed shell.

Conclusion. We recommend the judicious use of the constrained component in cases of hip instability during or after total hip arthroplasty when other methods are not successful.

Key words: constrained total hip arthroplasty; dislocation; unstable total hip arthroplasty

INTRODUCTION

Hip instability after total hip arthroplasty is a complex and challenging problem. In experienced units, 3% of patients undergoing total hip arthroplasty require revision surgery for hip instability,¹ but only 60% to 75% of such treatments are successful.^{2,3} By using the various constrained systems available, researchers have found dislocation rates ranging from 4% to 29% after implantation of the constrained component.^{4–6} Proposed reasons for dislocation include increased acetabular abduction angle and extensive acetabular bone loss. The purpose of this study was to review cases of implantation of constraining acetabular components in a major teaching hospital in Sydney, Australia. Indications, methods, and complications were reported based on our experience of this procedure.

MATERIALS AND METHODS

The study was performed according to relevant ethical guidelines determined by the department at which the procedures were performed. This was a retrospective analysis of prospectively collected data in consecutively enrolled patients. From 1989 to 2000, 13 constraining acetabular components were implanted into 13 patients at the Department of Orthopaedics, Concord Hospital, Sydney, as a revision procedure (Table). The mean follow-up duration was 43 months (range, 14–121 months). The component was implanted into 11 males and 2 females, whose mean age at the time of surgery was 73 years (range, 52–84 years). Ten procedures were performed on the right side and 3 on the left. All constrained procedures were performed or supervised by the same senior surgeon (WJMB).

The indication for using the constrained liner was either a dislocating primary total hip arthroplasty or, according to the senior surgeon during revision

surgery, that the arthroplasty was potentially unstable despite good alignment of the prosthesis. In 8 cases, the indication was recurrent dislocation (in one case, dislocation started only after ipsilateral hemiparesis, with resultant pyramidal weakness); while in 5 cases, the indication was intra-operative instability of the revision prosthesis.

The 8 cases with a history of recurrent dislocation had a mean of 4 documented prior dislocations (range, 2–7). The cases of revision with intra-operative instability that led to the use of this component included soft tissue laxity in conjunction with a well-fixed femoral component and insufficient abductor mechanism; or massive proximal femoral bone loss, which required allograft replacement. The surgeon had ruled out misalignment causing impingement as a primary cause for dislocation before the use of the constrained liner.

The history of arthroplasty in all patients was complex; the mean number of ipsilateral hip procedures was 3.7 (range, 2–6). The initial total hip

Table
Features of patients undergoing revision hip arthroplasty*

Sex/ Age (years)	Side	Initial indication for THA [†]	Indication for constrained THA	No. of previous operations	Approach/ Acetabular prosthesis implanted	Liner/ head diameter (mm)	Cemented acetabulum	Harris hip score
M/73	R	Fracture	Instability	4	PL [‡] /SROM	66/32	No	78
F/78	R	Osteoarthritis	Instability	2	PL/SROM	56/32	No	67
M/55	L	Fracture	Dislocation	4	PL/Mallory-Head	66/32	No	71
M/76	R	Osteoarthritis	Neurological	3	AL [§] /Osteonics	62/28	No	83
M/80	R	Osteoarthritis	Instability	3	PL/SROM	64/32	No	64
M/75	R	Fracture	Instability	2	PL/SROM	60/28	No	72
M/69	R	Osteoarthritis	Dislocation	5	PL/SROM	58/32	Yes	61
M/84	L	Fracture	Dislocation	5	PL/SROM	50/28	No	87
M/74	R	Osteoarthritis	Dislocation	6	AL/SROM	58/32	No	77
M/76	R	Osteoarthritis	Dislocation	4	AL/SROM	51/32	No	42
M/52	R	Osteoarthritis	Dislocation	2	PL/SROM	60/28	No	89
M/76	R	Osteoarthritis	Dislocation	3	PL/SROM	60/32	No	87
F/84	L	Fracture	Dislocation	5	PL/SROM	60/28	Yes	60

* No patients had a cemented femur, were lost to follow-up, or died

[†] THA total hip arthroplasty

[‡] PL posterolateral

[§] AL anterolateral

arthroplasty procedure was performed for osteoarthritis in 8 cases and fracture in 5. The surgical approach for the implantation of the constrained liner was posterolateral in 11 cases, while a modified Hardinge approach was applied in 2 cases. The acetabular prosthesis used in 11 cases was an SROM Polydial liner with a constraining metal ring (Johnson & Johnson Medical, Sydney, Australia). In one case, the patient received an Osteonics constrained liner (Stryker, New Jersey, US), because the patient had had a previous well-fixed Osteonics acetabular metal backed component in situ. The other patient received a Mallory-Head constrained ring-locking system and a metal-backed shell (Biomet, Sydney, Australia). Eight constrained components had a liner of 32-mm inner diameter and 5 had a liner of 28-mm inner diameter (Fig. 1 and 2).

In 11 cases, the constrained liner was implanted into metal-backed uncemented acetabular shells: 7 had been previously inserted, whereas a new metal-backed acetabular shell was inserted in 4 cases. In the remaining 2 cases, the constrained liner was cemented into a protrusio cage; one of these had been previously placed. 12 femoral components were uncemented while one component was cemented (Elite Plus; Depuy, Leeds, UK).

Patients were assessed postoperatively to see if they needed traction, as well as to determine weightbearing status. The outcomes were measured by bone stock and quality of fixation. Once traction

was removed, no patients were protected by brace or spica postoperatively. All patients were followed up by the same surgeon prospectively. All patients were examined clinically, as were their radiographs. The Harris hip score⁹ was obtained for all patients. At the time of writing, no patient had died or had been lost to follow-up.

Radiographic evaluation

Serial anteroposterior and lateral radiographs of the pelvis and femur were evaluated during follow-up without blinding. Both immediate postoperative and follow-up radiographs were made available for review. All radiographs were evaluated for osteolysis, evidence of loosening, and radiolucent lines. All patients in this study were involved in radiographic follow-up.

Loosening of the uncemented femoral components used was evaluated according to the criteria of Engh et al.⁷ Two types of stable fixation were assessed and recorded. Fixation by fibrous in-growth was identified when the radiograph showed widely divergent radiolucent lines but with no progressive migration of the femoral component. In contrast, fixation by bony on-growth was determined by the absence of radiolucent lines with a femoral component that showed no migration. Loosening of the uncemented acetabular component was assessed in the same fashion. Loosening of the femoral component that

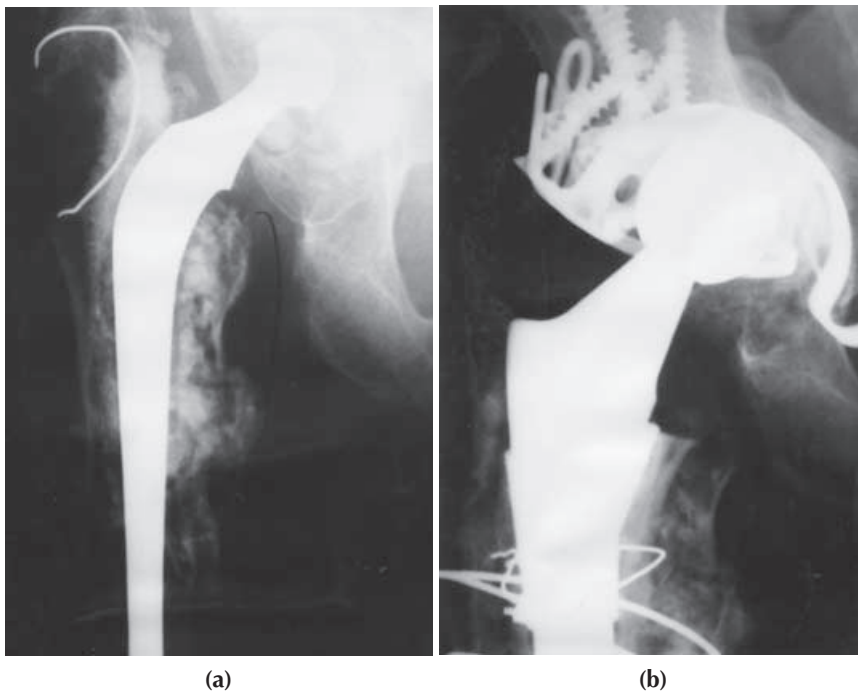


Figure 1 Course of treatment of a 75-year-old male: (a) preoperative X-ray of loose long stem Charnley prosthesis, and (b) postoperative X-ray showing SROM ring.

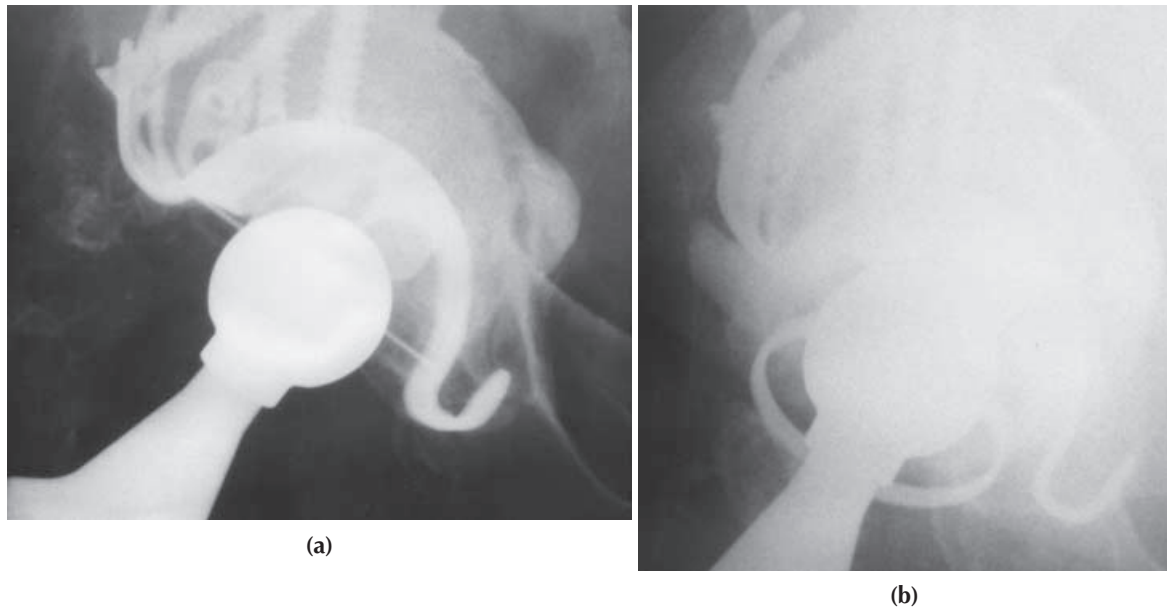


Figure 2 Course of treatment of a 76-year-old male: (a) preoperative X-ray of recurrently dislocating hip arthroplasty, and (b) postoperative X-ray showing SROM ring.

had been inserted with cement was classified according to the criteria of Harris and McGann⁸ in terms of definite loosening, probable loosening, and possible loosening.

Radiographic results were classified in a manner described by Goetz et al.⁴ The categories for the acetabular components included:

- (1) A new acetabular shell and a new constrained liner, both inserted without cement;
- (2) An old acetabular shell and a new constrained liner, both inserted without cement; and
- (3) A new constrained acetabular liner inserted with cement directly into a protrusio cage.

The categories for the femoral components included:

- (1) A new femoral component (at the time of constrained procedure); or
- (2) A previously well-fixed component that was not revised at the time of placement of the constrained liner.

RESULTS

No dislocations were noticed in our series. At the time of writing, there were no redislocations with the constrained prostheses. Only one patient required reoperation for the index hip; this was performed for a previously established infection (prior to the

implantation of the constrained acetabular component). This patient required debridement (with retention of components) because of infection, which was thus far suppressed or cured.

Clinical results

Of the 13 patients, 7 walked without pain and 4 had only mild pain. Six patients had no limp, 2 had a slight limp, and 4 had a moderate limp; one patient was unable to mobilise secondary to hemiparesis. The average Harris hip score was 72 (range, 42–89). None of the patients had symptomatic deep venous thrombosis or nerve palsy associated with the operation.

Radiographic results

At time of latest follow-up, 11 patients whose hips were treated with an uncemented acetabular shell and constrained liner were fixed by bony in-growth, and none were loose according to the Engh criteria.⁷ No component had been revised, and there was no evidence of acetabular osteolysis. In the other 2 cases, a new constrained liner was placed with cement into a protrusio cage that was fixed with intraosseous screws. In one of these cases, the protrusio cage had previously been inserted.

Two of the 10 femoral components of the uncemented SROM type were inserted at the time of

the operation when the constrained prosthesis was inserted; 7 had been previously implanted. Up to the time of writing, none had become loose or revised. The 2 uncemented femoral prostheses that were Osteonics Omnifit stems had been previously implanted. None had become loose and none had been revised. The only cemented stem of the Elite Plus type had been previously implanted. This prosthesis was not loose and has not been revised.

DISCUSSION

This case series has had no increased wear rates of the acetabular components. However, it is difficult to assess radiological wear rates, because the radio-opaque portion of the constrained liner prevents accurate radiological assessment. Realistically, this can only be inferred by rates of component loosening and osteolysis, and no hips in our series are radiologically loose.

The patients, for whom constrained components were used, were generally older (mean age, 73 years), had been revised before the use of the constrained liner, or have irreversible neurological deficit as a cause of their instability. Thus, it is difficult to interpret clinical results for pain and ambulatory function. However, all patients in our series reported substantial improvement in pain and hip scores.

A constrained acetabular component as a treatment for recurrent dislocation is a long-established treatment option, with varied reported redislocation rates. We found no dislocations in our series. We identified a number of reasons for this. Firstly, in the majority of

our cases, the constrained acetabular component was implanted into a previously placed well-fixed shell. The use of a new liner in a well-fixed acetabular shell would also decrease the theoretical risk of complications from increased interfacial stresses. Secondly, there was no intra-operative evidence of significant impingement of the prosthesis. Thirdly, impingement from misalignment of the prosthesis was also addressed before the use of a constrained acetabular component. The only exception to this rule was in the very unwell, or when the addressing prosthesis impingement would result in massive surgery that may not be in the best interest of the patient. If impingement issues could not be addressed intra-operatively, a constrained liner was not used. Fourthly, the surgeon implanted femoral heads without skirts. If a patient required a femoral head that was only available with a skirt, other lengthening options were attempted. Fifthly, all operations were performed by an experienced revision surgeon, who was able to use very strict criteria when deciding on the use of a constrained liner. Finally, we used a 32-mm head and liner whenever possible to potentially decrease the rate of dislocation, and, in our view, the use of a 32-mm head can significantly decrease dislocation rates.

We do not believe that the low redislocation rate is prosthesis-specific, because a number of different prostheses were used throughout the course of the study. However, we recommend the use of constrained liners as a salvage measure for extreme cases of total hip arthroplasty instability, especially when other methods are not successful, although concerns remain regarding wear rates.

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