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The Results of Acetabular Impaction Grafting in 129 Primary Cemented Total Hip Arthroplasties

Matthew J. Wilson, FRCS (Orth) [a], Sarah L. Whitehouse, PhD [b], Jonathan R. Howell, MSc, FRCS (Orth) [a], Matthew J.W. Hubble, FRCS (Orth) [a], A. John Timperley, FRCS, DPhil (Oxon) [a], Graham A. Gie, FRCSEd (Orth) [a]

[a] The Princess Elizabeth Orthopaedic Centre, Royal Devon and Exeter Hospital, Exeter, Devon UK
[b] Institute of Health and Biomedical Innovation, Queensland University of Technology, The Prince Charles Hospital, Chermside, Brisbane, Queensland, Australia

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ABSTRACT

Between 1995 and 2003, 129 cemented primary THAs were performed using full acetabular impaction grafting to reconstruct acetabular deficiencies. These were classified as cavitary in 74 and segmental in 55 hips. Eighty-one patients were reviewed at mean 9.1 (6.2–14.3) years post-operatively. There were seven acetabular component revisions due to aseptic loosening, and a further 11 cases that had migrated >5 mm or tilted >5° on radiological review — ten of which reported no symptoms. Kaplan–Meier analysis of revisions for aseptic loosening demonstrates 100% survival at nine years for cavitary defects compared to 82.6% for segmental defects. Our results suggest that the medium-term survival of this technique is excellent when used for purely cavitary defects but less predictable when used with large rim meshes in segmental defects.

Acetabular impaction grafting for the reconstruction of acetabular defects in total hip arthroplasty has the potential to recreate anatomy whilst also allowing the restoration of bone stock. The incorporation of impacted, morcellised bone graft has been demonstrated in histological studies [1].

The use of bone graft in the reconstruction of acetabular defects has evolved over the last four decades. In 1984, Slooff from Nijmegen published a paper on the modern concept of acetabular impaction grafting (AIG) for protrusio acetabuli using bone chips and hemispherical impactors [2]. Subsequently there have been numerous papers reporting good outcomes using AIG, mainly in revision surgery [3–12]. There are only a few studies which report the results of impaction grafting when used exclusively in primary hip arthroplasty [13–15]. Of these, none clearly differentiate 'full' impaction grafting, where cement is in contact with graft over 100% of the interface, from 'simple' impaction of cysts and isolated, cavitary, medial defects. In addition no papers report the difference in results when this technique is used in the reconstruction of cavitary defects and segmental defects that have been reconstructed using a rim mesh. In this paper we have studied our results of 'full' AIG when used in primary total hip arthroplasty, with particular emphasis on the results of AIG in cavitary and segmental defects.

Patients and Methods

Between August 1995 and August 2003, all patients who underwent primary total hip arthroplasty using AIG were identified. All of the initial clinical and operative data were collected prospectively and no patient was lost to follow-up.

Two hundred and three patients had undergone 217 primary total hip arthroplasties which had been coded as requiring the use of impaction grafting. Only cases requiring full, circumferential impaction grafting (defined as those cases in which the acetabular component is in contact with impacted graft over 100% of its interface) were included. This left a total of 129 THAs in 117 patients (89 female) with a mean age of 68.3 (22.9–100.1) years. There was no difference in the mean age at surgery between those with segmental and cavitary defects, 68.9 (SD 13.7) years compared to 66.2 (SD 13.6) respectively ($P = 0.27$ t-test).

Classification of Acetabular Defects

Acetabular defects were assessed using the American Academy of Orthopaedic Surgeons (AAOS) nomenclature, according to D'Antonio [16], of segmental, cavitary and combined deficiencies. Fifty hips were classified as Type 1, purely segmental defects, 74 hips as Type 2 cavitary defects and five as Type 3, combined segmental–cavitary defects. For the purpose of the study, Type 1 and Type 3 defects were

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Reprint requests: Matthew J. Wilson, FRCS (Orth), The Princess Elizabeth Orthopaedic Centre, Royal Devon and Exeter Hospital, Barrack Road, Exeter, Devon EX2 5DW, UK.

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Table 1
Primary Pre-Operative Diagnosis, Mean Age and Acetabular Defect.

Diagnosis	Age (Range)	Type of Defect			Total
		Segmental (Type 1)	Cavitary (Type 2)	Combined (Type 3)	
Ankylosing Spondylitis	69.0	–	1	–	1
Drug induced arthropathy	74.8 (70.3–79.2)	2	–	–	2
Dysplasia	55.2 (29.9–86.7)	16	1	1	18
Idiopathic avascular necrosis	69.4 (45.9–87.1)	14	5	3	22
Paget's disease	85.5 (70.5–100.1)	–	3	–	3
Previous fracture	81.7	–	1	–	1
Primary osteoarthritis	72.8 (57.6–85.8)	15	14	–	29
Post-traumatic osteoarthritis	43.0 (31.2–54.7)	–	2	–	2
Primary protrusio acetabuli	68.9 (22.9–99.2)	–	42	–	42
Rheumatoid	70.4 (57.3–85.8)	3	5	1	9
TOTAL		50	74	5	129

analysed together as 55 segmental defects that required reconstruction using a rim mesh. Of the 55 hips with segmental defects, 54 involved the supero-lateral acetabular wall and one case involved the anterior wall. The remaining 74 (57%) hips had pure cavitary defects with a fully supportive acetabular rim. Seven of the cavitary defects had a medial mesh inserted for reinforcement of a thin but intact medial wall.

The primary diagnosis, mean age at surgery and classification of acetabular defects are presented in Table 1.

Operative Technique

The majority of cases (96%) were performed by consultants or senior hip fellows. All patients received pre-operative systemic antibiotics and antibiotic loaded cement. The posterior approach was used in 126 hips and the direct lateral (transgluteal) in three. Defects were reconstructed using the techniques described by Schreurs et al [17]. The methods used in preparation of the bone graft varied; in 43 (33%) cases the bone chips for impaction were prepared by hand, using rongeurs; in 53 (41%) a commercially available bone mill was used and in 25 (19%) a combination of milled and hand-prepared bone chips was used. In eight cases the method of graft preparation was not recorded. Following full acetabular exposure, the defect was assessed for containment.

In cavitary defects, the acetabulum was prepared using standard acetabular reamers and burrs to reveal bleeding subchondral bone. In very sclerotic surfaces, a 2.5 mm drill was used to perforate the bone, increasing vascularity at the grafting surface. Bone graft was impacted, in layers, using hemispherical acetabular impactors (Stryker Orthopedics, Mahwah, NJ) placed at the level of the transverse acetabular ligament. The size of final impactor was chosen to fill the mouth of the defect but allowing at least 5 mm thickness of graft in the socket. Multiple impactions were made ensuring that the final graft surfaces were tightly packed and had the feel of cortical bone. A cemented polyethylene, component was trialled and the graft washed through a slotted mesh to protect its structure and then dried using gauzes soaked in dilute hydrogen peroxide. At this point low viscosity cement was mixed and then pressurized into the socket prior to socket implantation.

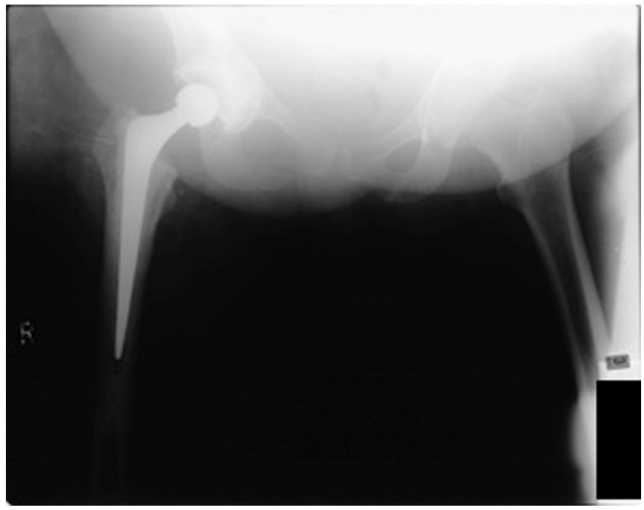

Fig. 2. Immediate post-operative radiograph of cavitary defect demonstrating good socket positioning.

Fig. 1. Pre-operative radiograph of cavitary acetabular defect.

Fig. 3. Thirteen year follow-up radiograph of impaction grafting of cavitary defect showing good incorporation of bone stock with no signs of loosening.