age of 50 years. In ten patients surgery was for hallux valgus; six fusions were performed in five non-rheumatoid patients and five in five rheumatoid patients. In five patients (one bilateral procedure) surgery was for painful hallux rigidus. In the other two patients (three feet) the arthrodesis was used to salvage a poor result from previously performed Keller's arthroplasties. At 12 weeks postoperatively, 19 of the 20 joints had united clinically and radiographically. The one with nonunion at 12 weeks was in a 25-year-old woman with hallux rigidus who subsequently required a second fusion, but then achieved bony union.

Discussion. McKeever (1952) described a peg and socket fusion, using an osteotome to shape the metatarsal head and a Kerrison rongeur to make a socket in the proximal phalanx. This gave good results in experienced hands, but positioning while obtaining maximum bony contact was difficult and there was always some shortening. Marin (1960) devised matching hand-held reamers and Wilson (1967) modified these to provide a pencil-sharpening type of cutter for the metatarsal head. Wilkinson (1978) reported 100% fusion in 83 patients with these. This method, however, causes shortening and allows no adjustment of position. This is critical since interphalangeal osteoarthritis and

malrotation are major causes of the failure of surgery (Fitzgerald 1969).

The modified reamers which we describe provide rapid cutting and allow accurate adjustment of the position of the surfaces. A minimal amount of bone is removed, thereby maintaining length while achieving maximum body contact. This is particularly important when revising a failed arthrodesis or Keller's arthroplasty.

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REFERENCES

- Clutton HH. The treatment of hallux valgus. *St Thomas's Hospital Reports* 1984;NH22:1-12.
- Fitzgerald JAW. A review of long-term results of arthrodesis of the first metatarso-phalangeal joint. *J Bone Joint Surg [Br]* 1969;51-B:488-93.
- Marin GA. Arthrodesis of the first metatarsal joint for hallux valgus and hallux rigidus. *Guy's Hospital Reports* 1960;109:174-8.
- McKeever DC. Arthrodesis of the first metatarso-phalangeal joint for hallux valgus, hallux rigidus and metatarsus primus varus. *J Bone Joint Surg [Am]* 1952;34-A:129-34.
- Wilkinson J. Cone arthrodesis of the first metatarsal joint. *Acta Orthop Scand* 1978;49:627-30.
- Wilson JN. Cone arthrodesis of the first metatarsophalangeal joint. *J Bone Joint Surg [Br]* 1967;49-B:98-101.

CEMENT HYPERSENSITIVITY: A CAUSE OF ASEPTIC LOOSENING?

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A proportion of cemented total hip replacements still fail due to aseptic loosening. Several hypotheses have been proposed to explain this such as mechanical factors (Charnley 1979; Jasty et al 1991) and biological reactions to the implanted foreign material, particularly polyethylene debris (Sutherland et al 1982; Jasty et al 1986). Most patients with cemented hip replacements achieve satisfactory long-term fixation but there is a small subgroup who suffer early loosening and in whom polyethylene debris is highly unlikely to be responsible (Jones and Hungerford 1987).

Loosening usually occurs at the cement-bone interface where a synovium-like membrane forms which has the

capacity to produce prostaglandin E₂, collagenase and other osteolytic products such as interleukin-1 factor and tumour necrosis factor (Eskola et al 1990). The macrophage/giant-cell reaction that occurs has been likened to type-IV hypersensitivity, and although it is not clear whether this is a primary or a secondary phenomenon, intensive studies have been made to find allergens within the implanted materials. High concentrations of cobalt, chromium and nickel have been implicated particularly in metal-to-metal prostheses (Evans et al 1974; Benson, Goodwin and Brostoff 1975) and the possibility of titanium sensitivity has been suggested (Lalor et al 1991). There has, however, been more interest in the bone cement itself. Many cases of allergic contact dermatitis have been reported in dental and orthopaedic surgeons (Pegum and Medhurst 1971; Fries, Fisher and Salvati 1975) and allergic contact dermatitis due to methacrylate resins has been shown to occur in relation to hearing aids, spectacle frames and limb-replacement prostheses (Romaguera et al 1989; Marren, De Berker and Powell 1991). Methacrylate is known to be an allergen in a small percentage of the population (Cavelier et al 1981).

We report a patient who had loosening of rapid onset after total hip replacement and who was subsequently found to be hypersensitive to one of the components of bone cement.

Case report. A 60-year-old joiner with no personal or

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family history of atopy had total hip replacement for primary osteoarthritis using a Stanmore prosthesis (Biomet Ltd, Bridgend, UK) and Simplex (Howmedica Ltd, London, UK) cement (Fig. 1). There was no history of any previous allergy or dental exposure to any of the materials used. The operation and the postoperative course proceeded normally.

Two months later, he complained of progressively increasing pain which incapacitated him much more than his original osteoarthritis; there was clinical and radiological evidence of loosening (Fig. 2). There was no clinical, biochemical or serological indication of infection, and samples of fluid from aspiration of the joint and tissue samples taken at the revision operation were sterile. At revision both components were grossly loose with a florid fibrous reaction in the femur and the acetabulum. A cementless prosthesis was inserted; he made an uneventful recovery and returned to full painfree activity. Two years after the reoperation there was no clinical or radiological evidence of loosening. Histological examination of the resected specimen showed fibroblastic pseudocapsular tissue containing focal collections of osteoclasts actively resorbing incorporated mineral debris. There were also histiocytes containing particulate wear debris associated with a significant inflammatory infiltrate.

Skin-patch tests were performed on the patient's back, using a battery of materials including various metals, polyethylene and the separated individual components of Simplex cement. The test sites were examined at 48 and 96 hours by a dermatologist. A positive result to N,N-dimethylparatoluidine (DMT) with palpable erythema was noted at both 48 and 96 hours. There was no reaction to any of the other materials.

Discussion. The curing of bone cement involves the induction of polymerisation at room temperature of a mixture of methylmethacrylate monomer and polymethylmethacrylate powder using benzoyl peroxide as a catalyst and DMT as an accelerator. Polymerisation is rarely complete and some DMT is left free in the final compound and may have been responsible for the hypersensitivity. This has already aroused interest in the dental literature with regard to contact stomatitis and the 'denture sore mouth' or 'burning-mouth' syndrome (Kaaber, Thulin and Nielsen 1979; Tosti et al 1990).

Our patient handled many glues in the course of his work as a joiner. Although he gave no history of contact dermatitis he may unknowingly have been sensitised to DMT; this may have contributed to the early and catastrophic loosening of his total hip replacement. We are now studying whether DMT is implicated in a significant proportion of cases of early aseptic loosening.

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REFERENCES

- Benson MKD, Goodwin PG, Brostoff J. Metal sensitivity in patients with joint replacement arthroplasties. *Br Med J* 1975;4:374-5.

Fig. 1

Fig. 2

- Cavelier C, Jelen G, Hervé-Bazin B, Fousereau J. Irritation and allergy to acrylates and methacrylates. Parts I and II. *Ann Dermatol Vénérol* 1981;108:549-68.
- Charnley J. *Low friction arthroplasty of the hip: theory and practice*. Berlin, etc: Springer-Verlag, 1979:20-90.
- Eskola A, Santavirta S, Kontinen, et al. Cementless revision of aggressive granulomatous lesions in hip replacements. *J Bone Joint Surg [Br]* 1990;72-B:212-6.
- Evans EM, Freeman MAR, Miller AJ, Vernon-Roberts B. Metal sensitivity as a cause of bone necrosis and loosening of the prosthesis in total joint replacement. *J Bone Joint Surg [Br]* 1974;56-B:626-42.
- Fries IB, Fisher AA, Salvati EA. Contact dermatitis in surgeons from methylmethacrylate bone cement. *J Bone Joint Surg [Am]* 1975;57-A:547-9.
- Jasty M, Maloney WJ, Bragdon CR, et al. The initiation of failure in cemented femoral components of hip arthroplasties. *J Bone Joint Surg [Br]* 1991;73-B:551-8.
- Jasty MJ, Floyd WE III, Schiller AL, Goldring SR, Harris WH. Localized osteolysis in stable, non-septic total hip replacement. *J Bone Joint Surg [Am]* 1986;68-A:912-9.
- Jones LC, Hungerford DS. Cement disease. *Clin Orthop* 1987;225:192-206.
- Kaaber S, Thulin H, Nielsen E. Skin sensitivity to denture base materials in the burning mouth syndrome. *Contact Dermatitis* 1979;5:90-6.
- Lalor PA, Revell PA, Gray AB, et al. Sensitivity to titanium: a cause of implant failure? *J Bone Joint Surg [Br]* 1991;73-B:25-8.
- Marren P, De Berker D, Powell S. Methacrylate sensitivity and transcutaneous electrical nerve stimulation (TENS). *Contact Dermatitis* 1991;25:190-1.
- Pegum JS, Medhurst FA. Contact dermatitis from penetration of rubber gloves by acrylic monomer. *Br Med J* 1971;2:141-3.
- Romaguera C, Vilaplana J, Grimalt F, Ferrando J. Contact sensitivity to meth(acrylates) in a limb prosthesis. *Contact Dermatitis* 1989;21:125.
- Sutherland CJ, Wilde AH, Borden LS, Marks KE. A ten-year follow-up of one hundred consecutive Müller curved-stem total hip-replacement arthroplasties. *J Bone Joint Surg [Am]* 1982;64-A:970-82.
- Tosti A, Bardazzi F, Piancastelli E, Brasile GP. Contact stomatitis due to N,N-dimethyl-para-toluidine. *Contact Dermatitis* 1990;22:113.