Impacted morsellized allograft and cement for revision total knee arthroplasty

A preliminary report of 3 cases

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In 3 cases we have revised a failed knee arthroplasty with intramedullary impaction of morsellized allograft similar to the technique described for the hip. Follow-up after 18, 21 and 28 months showed good clinical and radiographic results.

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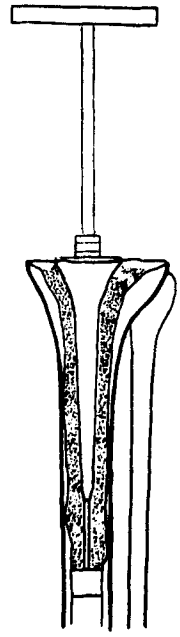
Allografts have been employed in knee revisions with promising results (Samuelson 1988, Wilde et al. 1990). Morsellized allografts were used in combination with allograft blocks and pieces in 22 cases by Samuelson (1988) and in 36 cases by de Waal Malefijt et al. (1995). A technique with impaction of morsellized allografts both in the femur and/or acetabulum has been used with good results in revision hip arthroplasty (Gie et al. 1993, Slooff et al. 1993). We report a surgical technique and preliminary results in our first 3 cases revised with impacted morsellized allografts surrounding the entire stems.

Patients and methods

Surgical technique

The loose prosthesis was removed with cement, debris and fibrous membrane. Then the caverns were reamed to obtain continuity with the femoral and tibial marrow canals. The sclerotic inner surfaces of the revision caverns were roughened with a cutter and then thoroughly irrigated. Starting with the tibia, the marrow canal was occluded by a firm-fitting acrylic plug (Mitab) placed at least 1 cm distal to the end of the revision cavern. A centralizing device screwed into the plug was left in place during the graft impaction procedure.

The bone grafts were prepared from frozen femoral heads, using a new design of bone mill (Howex). 9 cutting edges on 8 separate knives osteotomize the heads into small chips of different sizes (1.5 × 2 × 2–10 mm) which makes the impaction stable. The morsellized grafts were partially defatted by washing in 40 °C saline solution. The grafts were then packed firmly down on top of the plug in the distal end of the revision cavern with a distal impactor until the chips reached some centimeters above the planned level of the tip of the stem. The entire cavern was then filled with morsellized grafts that were gently pressed together with a distal impactor of appropriate size. A tibia impactor suitable for the semiconstrained Link rotation knee was then intruded on the centralizer down in the grafted cavern, to produce a firm graft impaction (Figure). Proximally, additional grafts were impacted around the end of the impactor to a level just beneath the edges of the tibial condyle. The centralizing device screwed into the acrylic plug was now detached. With a small suction catheter all fluid was extracted from the canal inside the impactor which was then extracted just prior to the insertion of the bone cement. A cement gun with a conical end was used to fill the cavity in a retrograde direction with cooled antibiotic-loaded cement which was pressurized for only a few seconds to force it into the grafted bone. The tibial component was inserted, while the cement still had a low viscosity.



After filling the total cavity with morsellized grafts the tibia side impactor is brought down along the centralizer to an appropriate level.

Case 1. Before (Guepar) and after revision.

The revision cavern of the femur was prepared in the same way. A special side impactor suitable for the femoral component was used for impaction over the same centralizer as in the tibia. The ventral part of the femur between and proximal to the condyles is prone to longitudinal fissuring during impaction. Therefore the distal femur was prophylactically wired. Before cementation of the femoral stem, alignment and appropriate ligament tension were evaluated by trial reduction of the femur impactor against the cemented tibial component.

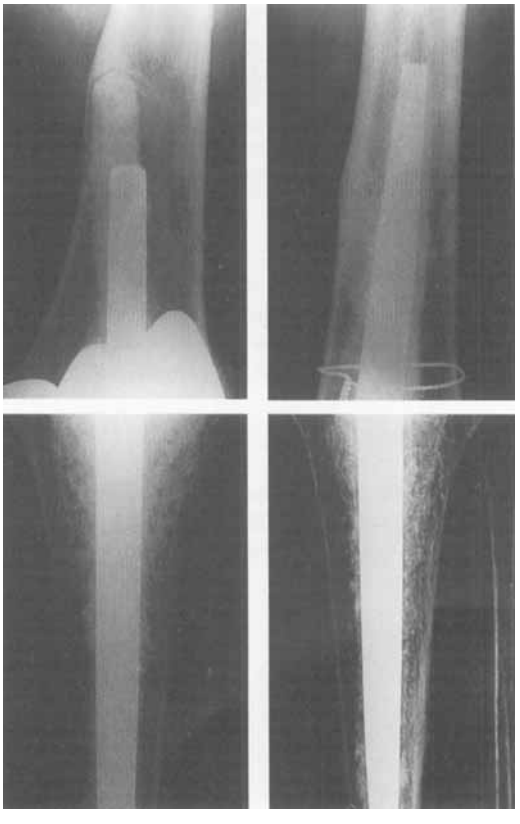
The patients were mobilized within 3 days after surgery. Case 1 was advised to have protected weight bearing for 3 months, while cases 2 and 3 were immediately allowed full weight bearing.

Case 1

A woman born in 1934 had rheumatoid arthritis since 1940. In 1977 she had unicondylar replacement of the lateral compartment and synovectomy of her right knee. A revision procedure with bone transplantation using a Townley total condylar prosthesis was undertaken 6 years later because of mechanical loosening. In 1985 an ipsilateral hip arthroplasty (Exeter) was performed. In 1986 a second revision of the right knee with a constrained Guepar prosthesis was necessary because of loosening. The patient was pain-free for 5 years. However, in 1992 she was very disabled and the prosthesis was loose, with massive bone resorption. In October 1992, a third revision with our technique was undertaken. 3 months later the patient was walking with one stick and the knee motion was 5–90°. 28 months after surgery, radiographs were unchanged compared to the postoperative examination, and the patient was pain-free.

Case 2

A man born in 1930 had since 1969 rheumatoid arthritis involving the hips, shoulders, elbows and the left knee. In 1980 synovectomy of his left knee was undertaken and 3 years later replacement with a total condylar Townley prosthesis. A Link revision prosthesis was inserted in 1988 because of aseptic loosening. 5 months later a septic arthritis of the knee secondary to erysipelas (*Staphylococcus aureus*) was successfully treated with drainage and antibiotics. In February 1992 revision of the left hip was undertaken because of mechanical loosening with morsellized graft impaction and a cemented Lubinus SPII-prosthesis. In December 1993 a second revision because of loosening of the knee arthroplasty was performed



Case 2. The cavity around the tip of the femoral stem and the thin cortex before revision (left) and after 21 months (right) with remodeling.

Case 3. Radiographs after revision of an infected Tillman prosthesis with inlay of a spacer and gentamicin-loaded beads (left) and 18 months after impaction of the morsellized graft and arthroplasty with new trabeculation (right).

with our technique. The patient was pain-free with knee motion 0–100° at the last follow-up 21 months after surgery. Radiographs showed some remodeling at 21 months after surgery, as compared to the postoperative examination.

Case 3

A woman born in 1929 had in 1986 a Tillman bicondylar left knee replacement because of rheumatoid arthritis. In October 1993 a septic arthritis with a suppurating sinus developed (beta-streptococcus, group G). In a two-step exchange procedure the prosthesis and cement were extruded and a gentamicin-loaded bone cement spacer and septopal beads were inserted for 1 month, whereafter a revision was performed with morsellized allografts. After replacement, she had no clinical signs of infection, a motion of 0–120° and was pain-free. Radiographs after 6 months were identical with the postoperative examination. After 18 months, new trabeculation of the graft could be seen.

Discussion

Several options exist when revising failed knee arthroplasties. Our technique has so far shown promising results and may be an alternative for cases with large intramedullary cavities. Many of these patients may also have stems from hip prostheses preventing knee arthroplasty with a longer femoral stem. The diagnosis at the index operation was rheumatoid arthritis for those three patients. In case 2, new cortical bone formation was evident. In case 3 new trabeculation was visible on radiographs. Thus, this technique may restore a deficient bone stock.

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