

Histology of Allograft-Prosthesis Composites in Reconstruction of the Bone-Deficient Proximal Femur

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INTRODUCTION: A proximal femoral allograft and cemented stem has been used in reconstruction for severe circumferential bone loss, but little is known about the histology of such a construct. We hypothesized that proximal femoral allografts harvested postmortem would demonstrate revascularization, new bone formation, remodeling of the graft, union with the host bone and a minimal inflammatory response.

METHODS: Seven allograft-prosthesis composites were retrieved postmortem from 4 females and 3 males, after a mean of 7 (1 to 13) years following revision arthroplasty for severe femoral bone loss associated with aseptic loosening and osteolysis. The patients ranged in age from 61 to 79 years. Postmortem specimens were evaluated from high-resolution cross section radiographs and stained histological sections.

RESULTS: Transverse section radiographs revealed periosteal scalloping and cortical cancellization in the longer-term allografts. Evaluation of stained histological slides revealed focal revascularization, periosteal remodeling, and new bone formation within the outer 1/3 of all of the allograft femora without evidence of graft rejection. There was no graft remodeling within the inner 2/3 of the cortex or at endosteal surfaces. The stems were firmly fixed within the allograft bone and cement mantle fractures were not identified. Some degree of cortical or extra-cortical union with the distal femur was apparent in 6 of the 7 specimens. However, in 3 patients, cement intrusion limited cortical union at the junction between the allograft and the distal femur.

DISCUSSION AND CONCLUSION:

Proximal femoral allograft-prosthesis composites seem to be well tolerated with no signs of rejection and with histological evidence of union with the host bone up to 13 years following insertion. Massive allografts are successful because of their selective replacement with new bone. Complete replacement by new bone is not desirable, and the bulk of the graft should remain as an inert implant. Partial incorporation is only desirable at the junction to promote union and at the cortices to satisfy soft tissue attachments. Revascularization of the entire graft would likely lead to failure - therefore we recommend only partial cementation. Cementing the prosthetic device prevents revascularization of the endocortex, but cementing distally, is not desirable in most instances because of the potential for impeding allograft-host bone union.

