Autogenous Bone Harvest for Implant Reconstruction

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KEYWORDS

• Autogenous bone harvest • Intra-oral donor sites • Extra oral donor sites
• Anterior iliac crest bone harvest • Comparison of intra-oral harvest sites
• Autogenous bone • Xenograft • Allograft

KEY POINTS

- Autogenous bone harvest is the gold standard for restoring deficiencies of the recipient site.
- A deficient site requires adequate grafting before placement of implants; therefore, proper understanding of grafting options is a key to successfully planned implant dentistry.
- General dentists require an understanding of autogenous bone harvest and variety of techniques available to provide the best outcomes for the patient.

INTRODUCTION

Bone volume deficit in completely edentulous and partially edentulous patients creates both surgical and prosthetic challenges in implant dentistry. Placement of endosseous implants in a location with inadequate alveolar bone leads commonly to disappointing results for both the patient and the provider. In severe atrophic cases, compromised bony structure prevents placement of endousseous implants. The cosmetic and functional success of dental implant reconstruction depends on proper and adequate restoration of bony structure contour, continuity, and volume. In this article, we introduce the reader to basic concepts in alveolar bone reconstruction using autogenous bone, including biology, donor sites, technique, risks, and common complications.[1,2]

Autogenous Bone Versus Other Sources (Xenograft, Allograft, Alloplast)

The ideal bone graft should possess 3 qualities: osteoconductivity, osteoinductivity, and existing osteogenic cells. The presence of an osteoconductive matrix allows for vascular ingrowth and migration of osteoprogenitor cells into the graft site. This matrix can be composed of biologic or nonbiologic material and often is resorbed during the

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bone maturation process. Osteoinductivity speaks to the ability of graft components to stimulate native tissues to produce and/or recruit osteogenic cells. The presence of existing osteogenic cells in the grafted tissue allows for earlier de novo bone formation in the grafted tissue than if those cells were not present.[1,2]

There are several possible sources for obtaining graft material for bone reconstruction. Allogeneic bone is donated cadaveric human bone. Potential donors are prescreened for communicable diseases and all bone that is ultimately donated is heat sterilized and freeze dried to remove all biologic components. This process, although it minimizes the potential for disease transmission and graft rejection, also eliminates the bone's osteoinductive capacity and osteogenic cells. The graft retains its utility by functioning as an osteogenic scaffold. Xenograft material obtained from another species behaves similarly because all biologic material is eliminated during processing. A xenograft may be indicated over allogeneic bone in certain circumstances owing to its greater longevity. Alloplastic materials such as calcium sulfate, calcium phosphate and hydroxyapatite (S + A coral) are nonbiologic and have no intrinsic osteoinductive properties or osteogenic potential; however, they are biocompatible and function as an osteoconductive scaffold. Recombinant human bone morphogenic protein (BMP) 2 is a bioengineered version of a potent osteoinductive cytokine generally produced during normal bone healing. After reconstitution, the protein is delivered via a sponge to the proposed graft site. Although recombinant human BMP 2 is powerfully osteoinductive, the delivery medium has no bulk and therefore has no osteoconductive properties.[1,2]

Autogenous bone is the gold standard material for bone grafting. Autogenous bone is the only graft material that contains intrinsic osteogenic potential through the always present osteoprogenitor cells. Naturally present BMP is the source of osteoinduction in living bone grafts. Of course, regardless of whether the graft used is cortical or cancellous, the solid nature of the graft provides an osteoconductive medium through which vascular ingrowth can occur and over which new bone growth can take place. The cellular and molecular elements that accompany autogenous bone graft serve multiple purposes. The first advantage is that the osteoconductive scaffolding recruits osteoprogenitor cells. This osteoconduction makes the autogenous graft more reliable and predictable. The second advantage of the autogenous bone graft is owing to its osteoinductive qualities derived from the molecular growth factors embedded in the autogenous graft. These factors include fibroblasts growth factors, transforming growth factor beta 1, vascular endothelial growth factor, and the BMP. These factors play an important role in new bone formation. This article discusses some of the most common autogenous sites for bone graft harvest and provides a guide for general practitioners. Each option carries its own limitations, such as volume constraints, donor site morbidity, and patient comfort.[1,2]

To review, alloplasts, xenografts, and autografts all have osteoconductive properties; recombinant human BMP has osteoinductive properties. However, only autogenous bone grafts possess osteogenic potential and osteconductive and osteoinductive properties.[1,2]

CORTICAL BONE: INDICATIONS AND DONOR SITES

Cortical bone grafts contain a rigid lamellar architecture that does not deform with compression or tension. This unique feature allows rigid fixation of the graft in high stress areas. Owing to its high concentration of BMP, it enhances osteoinductive properties of the graft. However, owing to the lamellar architecture of the cortical bone, it does not possess a high concentration of osteocompetent cells; therefore, maintenance of viable osteoblasts or osteoprogenitor cells becomes difficult. Cortical