Bone Grafting Overview

Thomas Rambacher
D.P.M., M.A.T., B.S.
History

Church literature presented the first mention of bone transplantation in 1682. A Russian soldier's cranial defect was successfully treated with a piece of dog skull. It was told that he was excommunicated for this unnatural condition but later given a Christian burial after an elective procedure to remove the implant.
History

The first successful autograft was reported by Dr. P. Von Walther in 1820 and Macewen, 58 years later using an aseptic technique, performed the first successful allograft bone transplant.
Bone Graft Theory

According to Wolf's law, a fusion mass consisting of 100% viable modeled host bone has optimal biomechanical properties and the ability to remodel. Bone fillers in the graft introduce stress concentrators, reduce the cross-sectional area of the callus, and present a biomechanically weaker fusion.
In comparison to cancellous bone and marrow grafts, cortical bone is relatively acellular and low in its bioavailability of proteins active in revascularization and bone formation. In the graft site, cortical bone is slower to revascularize, elicits osteoclastic resorption prior to new bone formation.
Cancellous versus Cortical Bone Autografts

In load bearing situations, like the foot, cortical bone structure and initial strength may be required.
Autogenic versus Allogeneric Bone

- Allogeneric bone matrix is void of cells and living constituents and, therefore, is necrotic tissue.
- Autogenic cancellous bone and marrow grafts provide all of the cells, proteins and matrix required to stimulate the formation of new bone.
- Which one can directly incorporated into the graft by end-to-end anastomosis with the host vessels?


Case Study

54 Year old Female, tennis player. CC my left foot Hurts. PMH: Chronic Low back pain Meds: OTC Pain meds, Herbal Medications.
Work Up

- Treatments?
- What Surgery too consent for?
3 Day Post Op
Bone Graft Alternatives

- Demineralized Bone Matrix (DBM)—a product of processed allograft bone. DBM contains collagen, proteins and growth factors that are extracted from the allograft bone. It is available in the form of a powder, crushed granules, putty, chips or as a gel that can be injected through a syringe. DBM is extensively processed and therefore has little risk for disease transmission; however, because of the form it takes it does not provide strength to the surgical site.
Bone Graft Alternatives

Ceramics—Ceramics are also used as a substitute for bone grafts. Ceramics offer no possibility for disease transmission, although they may be associated with inflammation in some patients. They are available in many forms such as porous and mesh. Although ceramics may provide a framework for bone growth, they contain none of the natural proteins that influence bone growth.
Bone Graft Alternatives

**Coral**—Bone implants made from coral have shown to be useful in the treatment of bone defects due to trauma, tumors and cysts. It is also used for spinal surgery as either a graft additive, or extender, or as an implant to provide a framework for bone to grow into.
Bone Graft Alternatives

Graft Composites use combinations of other bone grafting materials and/or bone growth factors to gain the benefits of a variety of substances. Among the combinations in use are a collagen/ceramic composite, which closely reproduces the composition of natural bone; DBM combined with bone marrow cells, which aid in the growth of new bone; and a collagen/ceramic/autograft composite.
Bone Graft Alternatives

Bone Morphogenetic Proteins—Bone morphogenetic proteins (BMPs) are produced in our bodies and regulate bone formation and healing. Scientists have discovered that these proteins can speed up healing as well as limit the negative reaction some people have to donor bone and the nonbone substitutes.