The Use of Bone-like “Clay” for Contouring

Small dent or contour irregularities of the face and skull resulting from a congenital or posttraumatic deformity have been difficult problems in the past. Bone grafts have been used more or less successfully but have limitations because of their difficulty in molding, resorptive characteristics, and, at times, availability. The advent of newer, flexible, and puttylike bone substitutes has permitted more effective treatment. Bone substitutes have the significant advantage that they can be molded to the desired shape. They are easily available, without donor morbidity, and have been shown to be very well tolerated by the body. They are, in fact, derived from essential compounds of bone itself. These materials now are finding greater applications in the aesthetic arena for filling in or shaping foreheads, cheeks, and noses.

The two types of bone graft substitutes that I have had the most experience with are demineralized bone matrix in various forms (Grafton® gel, flex, putty; Osteotech, Inc., Eatontown, NJ) and hydroxyapatite cement (BoneSource®, Howmedica Liebinger, Inc., Dallas, TX). They display different bone healing characteristics and have physical attributes that make them applicable in different clinical settings.

Although the clinical experience with these materials is relatively short, I have been quite satisfied with the results to date. I am conducting animal studies that confirm my clinical experience and suggest some of the mechanisms regarding how these bone substitutes work.

I have treated more than 30 cases with these materials in patients from age 3 months to 49 years. The cause of the bone deformity was congenital, posttraumatic, or postsurgical in nature. These patients have been monitored both clinically and radiographically to better evaluate the longer term results.

Technique

Demineralized Bone Matrix

This material is aseptically processed from human cadaver bone while effectively maintaining important bone regenerating factors. It is now available in several different forms. I have found that all forms are best used with fibrin glue, which can be easily prepared, both autologous and from single donor blood, as described by Renato Saltz, MD, in the Hot Topics article, “Tissue Sealants in Plastic Surgery” (Aesthet Surg J 1997;17:203).

- The gel formulation, which looks like a gritty toothpaste, is best used in a contained defect such as a burr hole or a split-thickness cranial defect. Otherwise, it does not maintain its shape in spite of the addition of fibrin glue.
- A flexible sheet formulation is made in different thicknesses and is very useful for onlay grafting of contour irregularities. The addition of fibrin glue produces a sticky, stable compound that can be molded to a small degree. This property can be used in the supraorbital or temporal regions to provide smooth augmentation of these areas. Several layers can be combined as needed.
- Recently, a putty formulation has been introduced that is malleable and conforms well to superficial defects. Its consistency is a little thicker than the gel, but it still performs better when combined with fibrin glue. Because of the intrinsic ability of this material (including the gel and sheet) to remodel and to regenerate bone, I believe it is particularly useful in the developing craniofacial skeleton of infants and young children. The degree of resorption is still unknown; but as with autogenous bone grafts, I tend to slightly overcorrect.

Hydroxyapatite Cement

Hydroxyapatite forms the basic mineral content of bone. It has been available for clinical use for more than two decades, but only recently has the cement form been clinically available. It is manufactured as a fine, white powder that, when mixed with water or a sodium phosphate solution, takes on a pastelike consistency with very attractive characteristics. It has excellent biocompatibility and little or no inflammatory or immune response. The need to maintain a dry field has been a problem, but this has been partially offset by the use of methylcellulose in the form of Surgicel® (Johnson & Johnson, Inc., Arlington, TX) or a solution of sodium phosphate, which aids in quicker setting. A 0.25 mol/L solution of sodium phosphate will decrease the setting time to 10 to 15 minutes from 40 to 50 minutes with water.

The mixture can be premolded to fit the defect; or more commonly while it is setting, it can be sculpted to the...
desired shape. In cases of a full thickness cranial defect, pre-molding or the use of an absorbable base such as Surgicel® or absorbable mesh material (LactoSorb®, Walter Lorenz Surgical, Inc., Jacksonville, FL) avoids direct placement of the setting cement on a moist surface. It is extremely useful in obliterating the frontal sinus, especially in the case of comminuted fractures where bone loss is present. We have found it to be very resistant to infection, and there seems to be no significant resorption clinically or radiographically. As a result of this fact, we prefer to use this material in adults or older children who have reached most of their growth potential. We have used it for purely aesthetic problems such as cheek augmentation or nasal contouring. It can correct an open roof defect of the nose after dorsal hump resection without requiring osteotomies.

The search for the ideal bone graft substitute continues. Autologous bone still remains the gold standard for comparison. Newer materials, however, have given us the opportunity to better treat the subtle and more discrete contour irregularities of the face and skull. These materials are biologically sound and offer distinct advantages to the plastic surgeon. Like the sculptor working with clay, so too does the plastic surgeon have the ability to mold or shape his living subject.

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