Guided bone regeneration (GBR) describes a surgical technique that increases and augments alveolar bone volume in areas designated for future implant placement, or around previously placed implants. The principle of GBR is based on the principles of guided tissue regeneration. The principles delineated by Melcher described the need for cell exclusion to enable the healing wound to be populated by cells thought to be more favorable for regeneration. In GBR, the cells that are required to repopulate the wound are primarily osteoblasts. Osteoblasts are responsible for laying down new alveolar bone and for future bone remodeling. By selectively excluding epithelium and connective tissue with the use of bone grafting and barrier materials, bone is “guided” into the desired position. Dahlin et al. were the first to show that bony defects created in rat mandibles could be successfully closed using guided tissue regeneration procedures.

The success and predictability of GBR have since vastly broadened the applicability of implant therapy. Implants can now be placed in areas of previously deficient bone volume, with success rates reported higher than 95%. However, to ensure predictability of this technique, clinical procedures should be based on sound biologic principles. This article outlines the 4 major principles underlying successful GBR (Fig. 1): primary wound closure, angiogenesis, space creation/maintenance, and stability of both the initial blood clot and implant fixture (PASS).

**Primary Closure**

The 2 basic methods of wound healing are termed healing by primary intention and secondary intention, respectively. In healing by primary intention, the edges of a wound are placed together in virtually the same position they held before the injury. Secondary intention describes healing that occurs when wound edges cannot be closely approximated, resulting in a wound that is slower to heal, requires more collagen remodeling, and is more likely to result in scar formation. Realistically, true healing by primary intention is often difficult to achieve. However, primary wound closure is a fundamental surgical principle for GBR because it creates an environment that is undisturbed/unaltered by outside bacterial or mechanical insult.

Passive closure of wound edges enables the wound to heal with less reepithelialization, collagen formation and remodeling, wound contraction, and overall tissue remodeling. In addition, postoperative discomfort may be reduced as a result of less exposure of underlying connective tissue. Most investigators have advocated the necessity of primary closure following implant placement to ensure predictable GBR outcomes, while others have disputed its importance. Nonetheless, there is a consensus that primary wound coverage should be accomplished whenever possible.

Examining the effect of membrane exposure on bone volume gains highlights the importance of primary wound closure. Machtei performed a metaanalysis to evaluate the effects of membrane exposure on treatment outcomes in guided tissue regeneration and GBR. When looking at guided tissue regeneration cases alone, exposed membranes showed only 0.47 mm less attachment gain compared to membranes that remained submerged. In comparison, membrane exposure seemed to have a significant deleterious effect on bone formation. In cases in which the membrane remained submerged, a mean 3.01 mm of new bone growth was observed.