Editorial

How to Plan Bone Augmentation with Guided Bone Regeneration

Guided bone regeneration (GBR) is the most frequently used technique to augment missing bone around implants, especially in the esthetic zone. The decision whether GBR is done simultaneously when placing the implant or as part of a two-stage procedure depends on the remaining volume of bone. If enough bone is present to anchor the implant with good primary stability in an ideal position and the defect and its environment allow a risk-free placement of a dimensionally stable membrane, which is used for large-scale bone augmentation, a simultaneous procedure is the method of choice. If one of these two conditions is not present, a two-stage approach is indicated. For proper planning, accurate monitoring of the periodontal situation is essential. The attachment level of the neighboring teeth is a limiting factor for bone augmentation. Cone-beam computed tomography (CBCT) can be useful to discuss with the patient which procedure is indicated. But most often CBCT is not really necessary; the bone situation is best judged after surgically exposing the site. For planning an augmentation in the esthetic zone, a surgical template can be useful. Such a template should not only determine the position and orientation of the implant but should also take into consideration the desired soft tissue margin, or emergence profile. This lets the surgeon know how much bone must be augmented vertically and horizontally so that from an esthetic viewpoint sufficient volume will be available. In the case of several implants next to one another, the prosthetic plan must also include information about the required contact point between neighboring implant crowns. This will clarify the extent to which the bone must be built up vertically so that in the end a papilla will properly fill the interproximal space.

GBR regenerates or generates bone using a barrier for the preservation and protection of the blood clot and mechanically impeding the invasion of soft tissue into osseous defects. The selection of material for GBR depends on how much volume stability is needed and how long it will take for the bone to regenerate. How much volume stability the material needs depends on whether bone has to be regenerated within a defect that is surrounded by existing bone (critical size defect) or there is a need to create new bone (de nuovo bone formation), as in the case of bone regeneration starting from a more or less flat bony surface, or even generate bone beyond the genetically determined skeletal envelope. If the GBR only involves filling in a defect surrounded by bone, one can use materials that are not volume stable because in these cases the bony environment already provides the necessary stability. In such cases, different kinds of xenograft materials and a resorbable membrane such as a native collagen membrane can be used. In the case of de nuovo bone formation, the filling material or the membrane must be volume-stable. Titanium reinforcement of a membrane offers the best possible stability and allows an ideal adaptation.

Regarding the time needed for bone formation, the kind of defect and the expected amount of horizontal and vertical bone augmentation are the important parameters. In a four-wall defect, for example, the regenerative capacity comes from the existing four bony walls. This allows relatively rapid bone formation, and it's enough if the membrane inhibits ingrowth of soft tissue for just a few weeks. Single-wall defects, on the other hand, regenerate slowly. One can accelerate this process by mixing autologous bone chips (and therefore bone growth factors) into the bone substitute material or use a membrane with a long-lasting barrier function. Such membranes are frequently nonresorbable.

Selection of the ideal method for each case depends on the goal and the anatomical situation. Several factors must be considered. Published decision trees are not really useful and may even be dangerous. Decision trees give users the sense of being able to reach the right decision based on simple criteria, while in actual fact numerous factors come into play. A rigid decision can mean certain details are missed and the wrong procedure selected. It's better to keep the focus on which factors play which roles and to understand these relationships. It's all about volume stability and time.

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