Bone Grafting for Dental Implant Placement

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Ideal bone support affects the health of dental implants in many ways. Not only is bone around a dental implant needed to support the implant, but the surrounding bone also supports the soft tissue, which in turn affects hygiene, aesthetics, and the overall health of the implant itself. Bone grafting, to support deficient bone for implant placement and health, is often a concurrent discipline of dentistry that goes hand in hand with implant treatment. This month's *Implants Today* has an outstanding article by *Dentistry Today*'s implant advisory board member Dr. Randy Resnik on bone grafting for oral implantology. This article highlights the main concepts and materials related to grafting bone.

In order to be able to graft bone for implant health and support, various aspects of grafting science and adjunctive principles need to be understood.

It is important to understand bone biology, and the basic cellular process that occurs in bone. For example, through understanding the role of osteoblasts, osteoclasts, and osteocytes, the clinician can better visualize what is happening when a graft material is placed into a site and remodels into mature bone. Understanding bone biology also helps to gleam insight into how newer grafting concepts such as recombinant version of bone morphogenetic protein-2 (rhBMP-2) works. Dr. Resnik talks about this in his article and shows examples.

It is important to understand bone anatomy. Through understanding the different Misch division classifications of bone—D1, D2, D3, D4—including their respective hardness and where they are found in the mouth, many clinical decisions can be made. For instance, the posterior maxilla usually has soft D4 bone, where longer healing times and less osteotomy preparation is needed. From an anatomical standpoint, it is important for the clinician to clearly understand the anatomical landmarks of bone and the innervation points that are associated with them. This is especially true for more advanced grafting cases and sites. There are plenty of continuing education venues available covering these topics, including cadaver and grafting courses offered by the implant organizations, such as the American Academy of Implant Dentistry.

It is important to understand the available grafting materials and properties of each. There are various choices of grafting materials available and Dr. Resnik's article spells out the choices of autografts and allografts very clearly. Every graft material choice is osteconductive, meaning it is a basic scaffold allowing bone cells to take over and grow bone. Allografts (donor bone) can be osteoinductive, meaning these help induce bone growth from surrounding bone. Only an autograft, a patient's own bone, has osteogenic properties, meaning it can initiate bone growth on its own. Through understanding these principles, a clinician can choose the appropriate material, depending on the size of the defect. The handling properties of the various available materials have to also be taken into consideration. Whether the material is a particulate material or a putty creates a different clinical treatment for a grafting site. The handling properties of a material can also influence whether or not a membrane needs to be used.

The purpose of a membrane is to exclude soft tissue and contain the graft material. For example, often times with some grafting putties, because of their rigidity and containment, a membrane is not necessary.

It is important to understand how to handle the soft tissue around a graft site and suturing techniques. An important aspect of bone grafting is getting closure of soft tissue around a graft site, and obtaining good keratinized tissue in the area. Even though bone grafting is about hard tissue, the surrounding soft tissue plays a large part of the graft's success. Flap design, suturing techniques, and even soft tissue augmentation comes into play when grafting bone. It is beneficial for a clinician to be adept at manipulation of the soft tissue and suturing procedures, especially in more advanced bone grafting cases.

It is important for a clinician to utilize information from CBCT scanning technology. For many reasons, a CBCT comes into the picture when a bone graft is being treatment planned and done. From a medical/legal standpoint, a preoperative CBCT before grafting is done can offer ideal protection; with respect to visualizing variant anatomy, relating the graft to the prosthetic end point, and helping visualize the proposed implant position. While this may not be needed for a 5-wall extraction site defect, it becomes more important as increased walls of bone are missing. A postoperative CBCT scan done after the graft has healed is also important before placing implants so that the clinician can see the volume of bone generated, the quality of bone generated, and the final planned implant position.

This important area of implant dentistry, bone grafting, requires many considerations for success. While at first glance it appears to be a hard-tissue-focused discipline, for true success, a clinician needs to have an understanding of the following: the biology of bone; bone anatomy itself and the surrounding anatomy being grafted; the various materials that are available and properties of them; the soft tissue around the graft and how to handle the tissue and suture it; and be able to utilize CBCT scan information to tie it all together. Once these principles are combined, bone grafting becomes a real science and art for treatment success.

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