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Editorial

Innovation in the reconstruction of orofacial region: Challenges and opportunities

One of the major surgical challenges in the field of regenerative medicine has been the reconstruction of large bony defects in the maxillofacial region. The autogenous bone grafts have always been the gold standard for maxillofacial reconstruction; they facilitate osteoconduction, osteoinduction, and osteogenesis. Osteoconduction occurs when the bone graft material serves as a scaffold for new bone growth that is perpetuated by the native bone. Osteoinduction involves the stimulation of osteoprogenitor cells to differentiate into osteoblasts for the formation of new bone. Osteogenesis occurs when vital osteoblasts originating from the bone graft material contribute to new bone growth. However, the harvesting of autogenous bone graft is associated with donor site morbidities and limited availability. These restrictions inspired the researchers across the world to engineer tissue to replace the lost one. Tissue engineering was initially introduced to describe the synthesis of biological tissue *in vitro*. Recently, the term "regenerative medicine" has been used to describe the development of technology for the regeneration of tissue *in vivo*. The objectives of tissue engineering and regenerative medicine are to promote healing, and ideally, true regeneration of a tissue structure and function more predictably and less invasively than the previous grafting techniques.

Bone tissue bioengineering originated with the introduction of 3D biomaterial scaffolds to support the regeneration and to replace the need for autogenous bone graft. However, osteogenesis in these large scaffolds occurred primarily on the outer surfaces, indicating a nonhomogenous distribution of cells and a predominantly osteoconductive rather than osteoinductive pattern of bone formation. The introduction of bone mesenchymal stem cells (MSCs) has been tested in the repair of large bony defects in animal models and in humans, with variable degrees of success.In these studies, expanded MSCs seeded onto various scaffolds were applied in animal models; the reported success was variable and dependent on the animal species, the animal's age, the methodology of MSC culture and its expansion, the cell seeding technique, and the scaffold type and its geometry. The major turning point in the arena of bone reconstruction is the introduction of bone morphogenic proteins (BMPs). BMPs are osteoinductive, and at the level of preclinical research, the use of BMP has shown promising results. The clinical applications are still limited.

One of the major obstacles of a successful bone bioengineering is the compromised vascularity at the graft site due to previous radiotherapy or a vascular disease. In an attempt to solve this problem, a prefabricated tissue engineered graft which was transferred in pedicled flaps has been considered with a moderate degree of success. Further studies are required to improve the blood supply at the surgical site.

There is no doubt that enormous progress has been made over the last 40 years. The application of tissue engineering and prefabrication scaffolding showed great and exciting promising results at preclinical and in some clinical studies. Yet, refinement of the technique, identification of the ideal scaffolding, and improving the vascularity at the surgical site are necessary.

It is our opportunity and responsibility to forge and establish links with the multidisciplinary team of investigators to take the research from the lab to the patients' side, which is essential to fulfil our clinical and academic aspirations.

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