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Editorial
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Prospective Technologies in Dental Tissues Regeneration

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Interest in applications for dental tissues regeneration continues to increas as clinically relevant methods alternative to traditional treatments. Dental tissues engineering is an opportunity that dentistry cannot afford to miss. Recent progress in the studies of molecular basis of tooth development, adult stem cell biology, and regeneration will provide fundamental knowledge for that. We are now starting to understand at the level of genes and molecules how the development of dental tissues is regulated. For instance, specific signal molecules have been identified which regulate the development of teeth and bones from progenitor cells. This information is already being used for the generation of dentoalveolar tissues *in vitro* and *in vivo* [1,2]. The mechanisms of dental tissues development and regeneration are largely dependent on sequential and reciprocal interactions between mesenchymal and epithelial componets. Stem cells and growth factors represent a very interesting research field for dental tissues regeneration and suppose a good perspective of future in the clinical dentistry [3]. The autologous application of human bone marrow cells which are not expanded ex vivo has medico-legal advantages in bone healing disorders [4]. Bone Marrow Derived Mononuclear Cells (BMMNCs) as a huge source of Bone Marrow-Derived Mesenchymal Stem Cells (BMMSCs) represent a potential key component in autologos graft for craniofacial tissues regeneration [5,6]. BMMSCs are multipotent and secrete many kinds of growth factors to regenerate tissues. To date, the majority of work in this area has focused on the ability of BMMSCs to differentiate into bone. *In vitro* expanded BMMSCs may be a rich source of osteogenic progenitor cells that are capable of promoting the repair or regeneration of alveolar bone defects.

Stem cells need a scaffolds that facility their integration, differentiation, matrix synthesis and promote multiple specific interactions between cells. Synthetic (alloplastic) substitutes has numerous interconnecting pathways similar to cancellous bone and facilitates bone formation by providing an exceptional osteoconductive scaffolding which results from the retention of the natural porous architecture and trabeculation of human cancellous bone. Synthetic scaffolds show resorbable characters during bone regeneration, and can be completely substituted for the bone tissue after stimulation of bone formation [7]. The use of autologous BMMNCs combined with synthetic scaffolds is a recent and promising innovation in alveolar bone regeneration [8]. BMMNCs has been successfully used in many recent studies, and favorable clinical outcomes have been reported following the incorporation of BMMNCs in the surgical procedures of the maxillofacial region, sinus augmentation, mandibular reconstruction and implant placement [9]. The adjunctive clinical benefit of the BMMNCs preparation can be explained on the basis of tissue engineering, i.e., tissue engineering generally combines three key elements for regeneration: 1) scaffolds or matrices, 2) signaling molecules or growth factors, and 3) cells. By combining these elements under the appropriate biologic and environmental conditions, as well as enough time, dental tissues regeneration will become more predictable [10].

Collagen as a material for scaffold-based therapy has demonstrated therapeutic promise in both preclinical and early clinical studies [11]. Recent research has begun to shed light on the interactions between collagen-based scaffold material properties, encapsulated and infiltrating cells, stimulatory molecules such as growth factors, and external regulatory variables such as stress, strain and vibration [12]. Collagen as an osteoinductive material is due to its osteoconductive property and when it is used in combination with osteoconductive carriers like hydroxyapatite or tricalcium phosphate. Scaffolding by collagen-based material combined with BMMSCs has shown to be effective in restoration/replacement of disordered dental tissues.

Many dental and craniofacial structures are readily accessible, thus presenting a convenient platform for biologists, bioengineers, and clinicians to test tissue-engineered prototypes [13]. The impact of dental tissues engineering extends beyond clinical practice. Dental tissues engineering could not have advanced to the current stage without the incorporation of interdisciplinary skill sets of stem cell biology, bioengineering, polymer chemistry, mechanical engineering, robotics, etc. Thus, dental tissues engineering and regenerative dental medicine are integral components of regenerative medicine.

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