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Editorial

Need for Further Advancement in Conventional Dentistry

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Last decade has been a witness of gradual transformation in the field of craniofacial and dental tissue engineering from synthetic implants and tissue grafts to biomimetic biomaterial scaffolds, and injectable hydrogels. Indeed, a vast variety of biomaterials is available e.g. natural or synthetic polymers, extracellular matrix, self-assembling systems, hydrogels, or bio-ceramics. Each material offers a unique chemistry, composition and structure, degradation profile, and possibility for modification. The role of the scaffold has changed from passive carrier toward a bioactive matrix, which can induce a desired cellular behavior. Gelatin, collagen, chitosan, alginate, carrageenan are some of the biopolymers that have proved their usefulness as scaffold in the field of dental tissue engineering. However, despite their good biological properties, the previously mentioned natural polymers lack bioactivity [1], which is the key factor in promoting hard tissue formation. They also share weak mechanical characteristics and somewhat rapid degradation rate [2] through enzymatic reaction. To overcome such undesired properties, scaffolds based on natural polymers are usually combined with bioactive materials (e.g., bioceramics) or mechanically strong ones (e.g., synthetic polymers or metals), depending on the area of application (e.g., load-bearing or not). Interestingly, although bio-ceramics are mechanically weak as well, they tend to increase the overall compressive strength of natural polymer based scaffolds [3]. Apart from natural polymers as mentioned above, biodegradable synthetic polymers have also received great interest because of their relatively low cost and ability to be produced in large quantities with long shelf life in comparison to their natural counterparts [4]. The most investigated biomaterials of this group are aliphatic polyesters which include polycaprolactone (PCL), polylactic acid (PLA), polyglycolic acid (PGA), and their copolymer poly (lactic-co-glycolic) acid (PLGA). Similarly, in regenerative endodontic, injectable hydrogels have demonstrated the feasibility of delivering dental pulp stem cells, supporting matrix (e.g. enamel derivative [5] and growth factors (e.g. stromal-derived growth factor (SDF)-α1, fibroblast growth factor (FGF)-2, and bone morphogenetic protein (BMP)-7) to support formation of the dentin-pulp complex [6]. Recently, T. Komabayashi., *et al*. [7] reported polyethylene glycol-maleate-citrate (PEGMC) hydrogel as an injectable drug delivery vehicle for regenerative endodontic treatment, including direct pulp capping. The results showed that the light-curing time for hydrogel is comparable to composite resin. The hydrogel had cell toxicity similar to adhesive systems. Moreover, controlled Ca^{2+} release was obtained from the calcium hydroxide incorporated hydrogel.

Although a lot of advancements have revolutionized modern dentistry, there are still several steps left to take to replace conventional dentistry. Delivery of active growth factor to the desired site is challenging and might provoke side effects. Biomaterials and scaffolds have played fundamental roles in facilitating partial dental tissue regeneration, but until today, none of the materials have met all the mechanical and biological standards required. Furthermore, 3-D bio-printing and microscale technologies are pushing the boundaries, but both are costly and are still in their early developmental stages.

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