EC Dental Science Editor's Column - 2016

"Bioengineered Tooth"

Sumanta Kar
North Dakota State University
USA

COLUMN ARTICLE

Loss of tooth due to dental caries, periodontal diseases have been a common problem worldwide among old and young people [1]. Several studies have identified odontogenesis or tooth development as a complex process because it not only involves a series of epithelial-mesenchymal interactions but also requires coordination between the crown and the root with its associated periodontium [2]. The field of dental tissue engineering have received a great deal of attention in the past few years as it has shown potential to regenerate not only the individual components of a tooth such as enamel, dentin, pulp, cementum, periodontal ligament and alveolar bone but also an entire tooth that is structurally and functionally sound [3]. Lately, there has been an increasing interest in transplanting bioengineered tooth germ to into the oral environment to regenerate a whole tooth as adult teeth do not regenerate itself. *Ikeda et al*. used cells dissociated from epithelium and mesenchymal tissue of prenatal or postnatal tooth germ to regenerate bioengineered tooth *in vitro* [4]. In another study, tooth-shaped polyglycolic/polylactide scaffolds seeded with cells isolated from dissociated postnatal porcine third molar tooth buds were implanted into rats. The results were very promising, the scaffolds implants were able to produce an entire tooth (consisting of dentine, pulp chamber, putative Hertwig's root sheath epithelia, putative cementoblasts and dental organ with enamel) [5]. It has been documented that prenatal tooth germ cells show more potential to form tooth with proper crown shape compared to postnatal germ cells [6]. *Duailibi et al*. reported formation of rat tooth in a shorter time period than pig tooth. Also, the 4-days post-natal rat molar tooth bud cells showed the highest cell yield/tooth bud and viability among 3-7 days' post-natal cells. From the study, it can be concluded that the regeneration ability of the cells not only depend on the source but also on the age of tooth bud [7]. Therefore, the effects of the source and age of tooth bud on the tooth regeneration needs to be investigated thoroughly. Nevertheless, all these achievements in dental tissue engineering do not undermine the fact that there are still several challenges that need to be addressed, such as optimization of number of tooth bud cells required for regeneration, identification of the ideal sources for odontogenic postnatal stem cells [8], thorough investigation of the requirement of growth factor and cytokines in tooth regeneration, proper understanding of the underlying cellular events associated with the regeneration of different types (incisors, canines, and premolars or molars) of teeth, restoring coordination between bioengineered teeth and jaw bone, and optimization of tooth regeneration time [3]. In conclusion, with the advent of new high-throughput technologies, the reality of having a bioengineered tooth in future has become fathomable.

Citation: Sumanta Kar. "Bioengineered Tooth". EC Dental Science ECO.01 (2016): 30-31.

BIBLIOGRAPHY

1. LK Evans A. "Slaughter, culturally sensitive oral health educational materials for older African Americans". *Journal of health care for the poor and underserved* 18.4 (2007): 868-886.

2. B Hu., *et al.* "Tissue engineering of tooth crown, root, and periodontium". *Tissue engineering* 12.8 (2006): 2069-2075.

3. EAA Neel W. "Tissue engineering in dentistry". *Journal of dentistry* 42.8 (2014): 915-928.

4. E Ikeda R. "Fully functional bioengineered tooth replacement as an organ replacement therapy". *Proceedings of the National Academy of Sciences* 106.32 (2009): 13475-13480.

5. C Young S. "Tissue engineering of complex tooth structures on biodegradable polymer scaffolds". *Journal of dental research* 81.10 (2002): 695-700.

6. MJ Honda., *et al.* "Tooth-forming potential in embryonic and postnatal tooth bud cells". *Medical molecular morphology* 41.4 (2008): 183-192.

7. M Duailibi S., *et al.* "Bioengineered teeth from cultured rat tooth bud cells". *Journal of Dental Research* 83.7 (2004): 523-528.

8. Y Zhang and Y Chen. "Bioengineering of a human whole tooth: progress and challenge". *Cell Regeneration* 3.1 (2014): 1.