Students' Corner
Letter to the Editor

Stem cells and tissue engineering in dentistry — a Myth or Reality

Madam, Teeth have very limited repair potential. Thus, in case of trauma, caries or tooth wear, they are restored with artificial substitutes. The dental restorations or prostheses have limited service life, simply because artificial materials lack repair potential. Furthermore, the oral cavity is a very harsh environment where restorative materials are subjected to extreme changes in temperature, pH, and a continuous challenge of facing high masticatory load. Furthermore, invasive dental procedures (such as fillings, root canal treatment, crown and bridge or implant placement) have certain morbidities associated with them. These include undue loss of tooth structure, loss of pulp vitality, drilling in bone tissue or to the extreme, loss of complete tooth.

The use of embryonic stem cells for medical treatment remains controversial, whereas, the use of somatic stem cells is currently a more attractive option and consequently the subject of widespread investigation. The discovery of stem cells in dental pulp of primary and permanent teeth have created an opportunity for the dental profession to devise alternative treatment methods for repairing decayed or traumatized teeth.[1] To date, five different human dental stem cells have been isolated and characterized:[2]

1. Dental Pulp Stem Cells (DPSCs),
2. Stem Cells from Exfoliated Deciduous teeth (SHED),
3. Periodontal Ligament Stem Cells (PDLSCs),
4. Stem Cells from Apical Papilla (SCAP), and
5. Dental Follicle Progenitor Cells (DFPCs).

These postnatal dental stem cells have the potential for self-renewal and multi-lineage differentiation. The advantages of utilizing dental stem cells are: their easy access, low morbidity of the anatomical site from where they are obtained, high efficiency of isolation from pulp tissue, differentiation ability, and demonstrated interactivity with biomaterials for tissue engineering.[3] Growing a whole tooth in the laboratory may not become a reality in the near future but there are certain clinical scenarios in which regenerative stem cell therapy has the potential to be employed. These include:

1. Repair of tooth root perforations; a common iatrogenic complication during tooth preparation for filling or root canal treatment,
2. As a pulp capping/ regenerating method for deep carious cavities,
3. Conservative root apex induction (apexification) in young permanent tooth whose vitality is lost due to trauma,
4. A method to re-vitalize the pulp canal space of a tooth whose nerve has been removed during root canal procedure.

The advancement in stem cells culture and tissue engineering techniques is the next big discovery that is on the doorstep in dentistry.

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References

1. Gronthos S, Mankani M, Brahim J, Robey PG, Shi S. Postnatal human dental pulp stem cells (DPSCs) in vitro and in vivo. Proc Natl Acad Sci USA 2000; 97: 13625-30.
2. Huang GT, Gronthos S, Shi S. Mesenchymal stem cells derived from dental tissues vs. those from other sources: their biology and role in regenerative medicine. J Dent Res 2009; 88: 792-806.
3. Graziano A, d'Aquino R, Laino G, Papaccio G. Dental pulp stem cells: a promising tool for bone regeneration. Stem Cell Rev 2008; 4: 21-6.