ECRONICON OPEN ACCESS

EC CLINICAL AND MEDICAL CASE REPORTS

Mini Review

Tooth Banking- A Revolution: Mini Review

Gurpreet Kaur*

Senior General Dental Surgeon, Bahrain

***Corresponding Author:** Gurpreet Kaur, Senior General Dental Surgeon, Bahrain.

Received: October 28, 2021; **Published:** November 29, 2021

Abstract

With the advancement of science tooth banking is now well-known field. Tooth banking is storage of stem cells extirpated from human teeth that have ability to regenerate in various cells. Various parts of teeth are valuable source of highly regenerative cells. Use of stem cells in regenerative medicine has been proven since more than last two decades. Not only milk teeth have these unique cells, healthy adult teeth like third molar can also be processed to isolate them. These stem cells are like mesenchymal cells that can go for self-renewal and have multipotent differential abilities. Preserving these cells at specialised stem cell bank offers a promising future need for children with 100% matching DNA. At present these cells are under more than 300 clinical trials including the treatment of cerebral palsy and autism, cancer, neural regeneration, organ transplant type 1 diabetes etc.

Keywords: *Stem Cells; Tooth Banking; Dental Pulp; Cryopreservation; Magnetic Freezing*

Abbreviations

AAPD: American Academy of Paediatrics Dentistry; CAS: Cell Alive System; DPSC: Dental Pulp Stem Cell; SHED: Stem Cells from Exfoliated Deciduous Teeth; SCAP: Stem Cell from Apical Papilla; PDSCL: Periodontal Ligament Stem Cells; ABSC: Alveolar Bone Stem Cells; PBSA: Phosphate Buffered Saline

Introduction

The dental stem cell revolution was introduced by Gronthos and Shi more than two decades ago. This research introduced the dentistry in the exciting field of regenerative medicine. AAPD has recognises the emerging field of regenerative dentistry and encourages dentist to follow evidence based literature to educate the parents about importance of dental stem cells. Stem cells collections from umbilical cord, bone marrow, blood and foetal material are more common and well-known methods have their own unique and ethical challenges. The dental stem cells are free from any ethical issues, because the stem cells are extirpated from exfoliated deciduous teeth, extracted healthy teeth (orthodontic purposes) or adult wisdom teeth and or their dental follicles. Dental stem cells are easily accessible without any invasive process. Dental stem cells have drawn attention in the field of regenerative medicine because of their accessibility, plasticity and high proliferative ability [1].

Materials and Methods

Not all the teeth are appropriate for stem cells collection. Like all the cells in our body stem cells deteriorate with age so cells from primary teeth are most valuable and healthier. Primary incisors and canines with no pathology and at least one third roots remaining are good source of stem cells. Third molars or teeth extracted for intervention orthodontics has viable pulp are also used for stem cell extirpation [2].

Stem cells isolated from teeth are named as per their source of origin:

- **Dental pulp stem cells DPSC:** These cells are multipotent mesenchymal cells which are useful for dental and systemic disease also. They can differentiate into neurons, osteoblasts, beta cells of islets of Pancreas, odontoblasts, adipocytes and neurocytes. These cells are first isolated from human teeth in 2000 [3-6].

- **Stem cells from exfoliated deciduous teeth SHED**: Deciduous pulp stem cells are multipotent stem cells with highly proliferative capable of differentiating into variety of cells like osteoblasts, adipocytes, neurons etc. Dental pulp is very accessible tissue source for enough stem cells for any clinical application [9,17].

- **Periodontal ligament stem cells PDLSC:** These stem cells are mesenchymal cells located in perivascular space of periodontium and these cells can be expatriated from supernumerary teeth also [7].

- **Stem cell from apical papilla SCAP:** These cells are mesenchymal cells found Plenty of numbers present in immature apical papilla of immature teeth. They have the characteristics of odontogenic, osteogenic, neurogenic adipogenic and chondrogenic and hepatogenic cells [8,9].

- **Dental follicle stem cells DFSC:** Third molars are good source of stem cells (16 - 20 years) although it is best to isolate them when teeth are still developing.

Isolation and preservation: After collection of teeth they are stored in hypophosphate buffered saline solution which prevent dryness and provide nutrition. Maximum four teeth are stored in a vial. Total processing time from exfoliation/extraction to processing storage should not exceed 40 hrs to preserve the vitality of stem cells. Vial is then sealed and put in thermette after which it is placed in insulated metal transport vessel. This maintains sample in hypothermic state during transportation.

Once the teeth received at tooth bank, stem cells are isolated. Teeth are first washed three times with phosphate buffered saline without calcium and Magnesium. After that tooth is disinfected with disinfectant such as povidone iodine, then again washed with PBSA. Dental pulp is extirpated with spoon excavator or small sterile forceps or water flushed. Pulp tissue is then again washed thrice with PBSA. Stem cells separated from tissue by adding collagenase which dissolves the tissue. These stem cells passed through filter to get single cell suspension. Then these cells are cultured in mesenchymal cell culture medium [10].

After isolation of stem cells from teeth by stem cell banks these cells are preserved by:

- **Cryopreservation:** In cryopreservation stem cells are restored at subzero temperature. Liquid nitrogen is used for this purpose. 1.5 ml freezing material is enough for 1-2 X 10^6 [11].

- **Magnetic freezing**: It is the cell alive system. In CAS even with the week magnetic field to stem cells or tissues are enough to lower their freezing temperature by 6-7 degrees centigrade once it freezes uniformly magnetic field is turned off. This method is much cheaper and reliable [12].

Result and Discussions

Dental stem cell gives very promising approach to treat structural defects. These cells can be used by the donor, and to certain extend by their immediate family members or relatives. Umbilical cord or tooth stem cells collected to treat blood disorders of a person might not be successful as they can have same genetic disorders that cause the diseases. Apart from systemic use stem cells are used in regenerative dentistry (orofacial reconstruction, tooth regeneration, regeneration of bone and Temporomandibular joint, regeneration of periodontium etc.) [13,14].

Conclusion

Dental stem cell therapy is emerging as revolutionary dentistry. Stem cells which obtained traditionally are either embryonic or obtained from adult tissues have ethical issues and invasive procedures, on the other hand stem cells obtained from teeth are simple to obtain and non-invasive. This is more readily available source, their potentiality is unquestionable, only need to understand more practical and therapeutic uses. Stem cells from younger teeth have more potential to regenerate. They have multiple applications in dentistry and in systemic disease treatment with some limitations.

Source of Support

Nil.

Conflict of Interest

None declared.

Bibliography

1. Gronthos S., *et al*. "Stem cell properties of human dental pulp stem cells". *Journal of Dental Research* 81.8 (2002): 531-535.
2. Adiyal Ananya., *et al*. "Applications of stem cells in dentistry: A review". *Gulhane Medical Journal* 60.1 (2018): 26.
3. Abbas Diakonov I and Sharpe P. "Neural crest origin of dental stem cells. Pan European Federation of the International Association for Dental Research (PEF IADR) Seq #96-Oral". Stem Cells Abs, 0917 (2008).
4. Yamamura T. "Differentiation of pulpal cells and inductive influences of various matrices with reference to pulpal wound healing". *Journal of Dental Research* 64 (1985): 530-540.
5. Kerkis I., *et al*. "Isolation and characterization of a population of immature dental pulp stem cells expressing OCT-4 and other embryonic stem cell markers". *Cells Tissues Organs* 184.3-4 (2006): 105-116.
6. Sonoyama W., *et al*. "Characterization of the apical papilla and its residing stem cells from human immature permanent teeth: A pilot study". *Journal of Endodontics* 34.2 (2008): 166-171.
7. Reznick JB. "Continuing education: Stem cells: Emerging medical and dental therapies for the dental professional". Dentaltown Magazine (2008): 42-53.
8. Sonoyama W., *et al*. "Mesenchymal stem cell-mediated functional tooth regeneration in swine". *PLoS One* 1.1 (2006): e79.
9. Gronthos S., *et al*. "Postnatal human dental pulp stem cells (DPSCs) in vitro and in vivo". *Proceedings of the National Academy of Sciences of the United States of America* 97.25 (2000): 13625-13630.
10. Hegde Mithra., *et al*. "REVIEW ARTCLE Tooth Stem Cell Banking-A Review". *International Journal of Research and Reviews in Pharmacy and Applied Science* 2.2 (2012).
11. Freshney Ian R., *et al*. "Culture of human stem cells". Chapter 8 (2007): 187-207.
12. Papaccio G., *et al*. "Long-term cryopreservation of dental pulp stem cells (SBP-DPSCs) and their differentiated osteoblasts: a cell source for tissue repair". *Journal of Cellular Physiology* 208.2 (2006): 319-325.

13. Rosemann A and Luo HY. "Attitudes towards the donation of human embryos for stem cell research among Chinese IVF patients and students". *Journal of Bioethical Inquiry* 15.3 (2018): 441-457.

14. Sivaraman MAF. "Using surplus embryos and research embryos in stem cell research: ethical viewpoints of buddhist, hindu and catholic leaders in Malaysia on the permissibility of research". *Science and Engineering Ethics* 24.1 (2018): 129-149.

15. Papaccio G., *et al*. "Long-term cryopreservation of dental pulp stem cells (SBP-DPSCs) and their differentiated osteoblasts: a cell source for tissue repair". *Journal of Cellular Physiology* 208.2 (2006): 319-325.

16. TT-450—Stem Cells and Teeth Banks, ebiz news from Japan.

17. Miura M., *et al*. "SHED: Stem cells from human exfoliated deciduous teeth". *Proceedings of the National Academy of Sciences of the United States of America* 100.10 (2003): 5807-5812.

Volume 4 Issue 12 December 2021