Policy on Using Harvested Dental Stem Cells

Latest Revision

2022

How to Cite: American Academy of Pediatric Dentistry. Policy on using harvested dental stem cells. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2023:200-1.

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes the emerging field of regenerative medicine and encourages dentists to follow evidence-based literature in order to educate parents about the collection, storage, viability, and use of dental stem cells with respect to autologous regenerative therapies. The AAPD also recognizes that harvested dental stem cells is an emerging science which may have application for oral health care but, at present, there are no treatments available using harvested dental stem cells in humans. This policy is related to the use of harvested dental stem cells from a tooth or follicle.

Methods

This policy was developed by the Council on Clinical Affairs, adopted in 2008[1], and last revised in 2017[2]. This revision included a review of current dental and medical literature and sources of recognized professional expertise related to dental stem cells. A literature search of the PubMed®/MEDLINE database was conducted using the terms: dental stem cell, harvested tooth cell; fields: all; limits: within the last 10 years, humans, English, birth through age 99, resulting in 151 papers that were reviewed by title and abstract. Papers for review were chosen from this list and from the references within selected articles. Expert and/or consensus opinion by experienced researchers and clinicians was also considered.

Background

Stem cells are pluripotential cells that can divide and multiply for an extended period of time, differentiating into a diverse range of specialized cell types and tissues. Dental stem cells are a minor population of mesenchymal stem cells (**MSC**) existing in specialized dental tissues, such as dental pulp, periodontium, apical papilla, and dental follicle.[3,4] Numerous types of stem cells have been isolated from dental tissue, such as dental pulp stem cells (**DPSC**), stem cells isolated from human pulp of exfoliated deciduous teeth (SHED cells), periodontal ligament stem cells (PDLSC), stem cells from apical papilla (SCAP), and dental follicle cell. All these cells can regenerate the tissue of tooth to provide theoretical basis for clinical treatments.[5,6] DPSC have received special attention because they represent a readily accessible source of stem cells. Their high plasticity and multipotential capacity to differentiate and produce a variety of dental tissues can be explained by its neural crest origin, which supports applications beyond the scope of oral tissues.[7] Stem cells used for regenerative endodontics and scaffolding have shown successful regeneration in laboratory and animal studies.[8-10] Dental stem cells-based regenerative medicine provides the possibility to repair damaged dental tissues or generate new teeth.[4,11] Clinical studies for pulpal regeneration and periodontal tissue generation using dental tissue-derived stem cells have been published, and evidence that these cells could be beneficial in therapies beyond oral tissues is growing.[12]

Due to their differentiation potential, oral-derived MSC are promising for tissue engineering and regenerative medicine.[11,13] The most familiar application of adult stem cell therapy is bone marrow transplantation to treat hematopoietic cancers, metabolic disorders, and congenital immunodeficiency syndromes. Dental stem cells with high potentials such as ability of self-renewal, MSC characteristics, multilineage differentiation, and immunomodulation are promising tools for *in vitro* and *in vivo* differentiation studies as well as the therapy of immune-related diseases.[14] Dental MSC are not only easily accessible but are also expandable *in vitro* with relative genomic stability for a long period of time.[15] Several preclinical studies and clinical trials have been performed using dental MSC in the treatment of multiple ailments, ranging from dental diseases to nondental diseases[15]; these are a promising treatment alternative for neurological disease including stroke.[16] Some clinical trials with dental MSC have demonstrated the efficacy and safety of dental MSC-based therapy for oral diseases.[15] Human exfoliated deciduous teeth stem cells have shown promise in an initial small safety-phase clinical trial for treating a nondental disease.[17]

Parents may elect to preserve umbilical cord blood of their child for future harvesting of stem cells if autologous regenerative therapies are indicated. Pulpal tissue of exfoliating primary teeth, oral mucosa fibroblasts[18], surgically removed third molars, periodontal ligament[19], and gingival fibroblasts[19] may serve as a source of MSC.[9,20]

The public is increasingly aware of this emerging science, and more parents are expressing interest in harvesting/banking dental stem cells. While sources of dental stem cells are readily accessible, those cells must be secured and stored properly

ABBREVIATIONS

AAPD: American Academy of Pediatric Dentistry. **DPSC:** Dental pulp stem cells. **MSC:** Mesenchymal stem cells.

to maintain the potential to proliferate and differentiate.[21,22] Ongoing clinical trials using human DPSC may be searched using the web-based resources of the National Library of Medicine at the National Institutes of Health.[23]

Policy statement

While no treatment using harvested dental stem cells in humans is currently available, the AAPD recognizes that this is an emerging science which may have application for oral healthcare. As the technology continues to evolve, the process of procurement of dental stems cells should be accomplished only with deliberate integrity and appropriate informed consent to assure the highest ethical standards and quality of outcomes.

References

1. American Academy of Pediatric Dentistry. Policy on stem cells. Pediatr Dent 2008;30(suppl):84.
2. American Academy of Pediatric Dentistry. Policy on using harvested dental stem cells. Pediatr Dent 2017;39 (6):142-3.
3. Govindasamy V, Ronald VS, Abdullah AN, et al. Differentiation of dental pulp stem cells into islet-like aggregates. J Dent Res 2011;90(5):626-52.
4. Shuai Y, Ma Y, Guo T, et al. Dental stem cells and tooth regeneration. Adv Med Biol 2018;1107:41-52.
5. Zhai Q, Dong Z, Wang W, Li B, Jin Y. Dental stem cell and dental tissue regeneration. Front Med 2019;13(2): 152-9.
6. Bansal R, Jain A. Current overview on dental stem cells applications in regenerative dentistry. J Nat Sci Biol Med 2015;6(1):29-34.
7. Anitua E, Troya M, Zalduendo M. Progress in the use of dental pulp stem cells in regenerative medicine. Cytotherapy 2018;20(4):479-98.
8. Conde MC, Chisini LA, Demarco FF, et al. Stem cell-based pulp tissue engineering: Variables enrolled in translation from the bench to the bedside, a systematic review of literature. Int Endod J 2016;49(6):543-50.
9. Hynes K, Menichanin D, Bright R, et al. Induced pluripotent stem cells: A new frontier for stem cells in dentistry. J Dent Res 2015;94(11):1508-15.
10. Yang J, Yuan G, Chen Z. Pulp regeneration: Current approaches and future challenges. Front Physiol 2016; 7:58.
11. Morsczek C, Reicjert TE. Dental stem cells in tooth regeneration and repair in the future. Expert Opin Biol Ther 2018;18(2):187-96.
12. Campanella V. Dental stem cells: Current research and future applications. Eur J Paediatr Dent 2018;19(4):257. Available at: "https://www.ejpd.eu/pdf/EJPD_2018_19_4_1.pdf ". Accessed June 26, 2022.
13. Tatullo M, Codispoti B, Paduano F, Nuzzolese M, Makeeva I. Strategic tools in regenerative and translational dentistry. Int J Mol Sci 2019;20(8):1879. Available at: "https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6514784/". Accessed June 26, 2022.
14. Ayadin S, Sahin F. Stem cells derived from dental tissues. Adv Exp Med Biol 2019;1144:123-32.
15. Gan L, Liu Y, Cui D, Pan Y, Zheng L, Wan M. Dental tissue-derived human mesenchymal stem cells and their potential in therapeutic application. Stem Cells Int 2020;2020:8864572. Available at: "https://pubmed.ncbi.nlm.nih.gov/32952572/". Accessed June 26, 2022.
16. Gancheva MR, Kremer KL, Gronthos S, Koblar SA. Using dental pulp stem cells for stroke therapy. Front Neurol 2019;10:422.
17. Li W, Jiao X, Song J, et al. Therapeutic potential of stem cells from human exfoliated deciduous teeth infusion into patients with type 2 diabetes depends on basal lipid levels and islet function. Stem Cells Transl Med 2021;10(7): 956-67.
18. Miyoshi K, Tsuji D, Kudoh K, et al. Generation of human induced pluripotent stem cells from oral mucosa. J Biosci Bioeng 2010;110(3):345-50.
19. Wada N, Wang B, Lin NH, Laslett AL, et al. Induced pluripotent stem cell lines derived from human gingival fibroblasts and periodontal ligament fibroblasts. J Periodontal Res 2011;46(4):438-47.
20. Eslaminejad MB, Vahabi S, Shariati M, Nazarian H. In vitro growth and characterization of stem cells from human dental pulp of deciduous versus permanent teeth. J Dent (Tehran) 2010;7(4):185-95.
21. Perry BC, Zhou D, Wu X, et al. Collection, cryopreservation, and characterization of human dental pulp-derived mesenchymal stem cells for banking and clinical use. Tissue Eng Part C Methods 2008;14(2):149-56.
22. Yildirim S, Zibandeh N, Genc D, Ozcan EM, Goker K, Akkoc T. The comparison of the immunologic properties of stem cells isolated from human exfoliated deciduous teeth, dental pulp, and dental follicles. Stem Cells Int 2016;2016:4682875. Available at: "https://www.hindawi.com/journals/sci/2016/4682875/". Accessed June 26, 2022.
23. National Institutes of Health National Library of Medicine. Find a Study. Available at: "https://www.clinicaltrials.gov/ct2/home". Accessed March 23, 2022.