Revista Odontológica Mexicana
Facultad de Odontología
Vol. 18, No. 1 • January-March 2014
pp 6-8
EDITORIAL

# Does preserving a tooth save a life?

## *Guardar un diente, ¿salva una vida?*

Enrique Grageda Núñez*

*«Science is fact: just like houses are made of stone, science is made of facts; nevertheless, a heap of stones does not make a house and a collection of facts is not necessarily science.»*

*Henri Poincaré*

«Save a tooth, save a life». Teeth are an abundant source of stem cells which can be preserved, and thus secure biological insurance for the patient and his family.[1] This would be one of the flags unethically publicized by banks of dental stem cells. These banks invest large amounts of financial resources directed to mass-media: they promote lectures in dental forums, delivered by their own «scientific advisors» and are aimed at the dental community in our country.

Dr Shi (Craniofacial Biology Professor at the University of Southern California),[2,3] in 2003 announced the possibility of isolating these cells from primary teeth. Expectations raised upon this assertion gave way to research diversifications in the scientific world. This research was focused on embryonic and umbilical cord stem cells, since, up to a few years ago, these cells were believed to be the only cells capable of experiencing this differentiation. Furthermore, this research has motivated scientists to look for new therapeutic applications which would be impossible to achieve with other types of stem cells.

This information is clearly presented and effectively manipulated by dental cell stem banks which, through their workforce and scientific advisors, have promoted the dogmatic safe-keeping of these cells. However, they are lacking in scientific foundations and they are omitting the most basic concepts of molecular biology and genetic engineering. These banks offer their services to a dental community which is willing to offer their patients, at a time of continuous technological advances, new alternatives to prevent diseases or future ailments. They also appeal to a new generation eager for new medical treatments which might cure, preserve, or at least maintain quality of life along the years.

In present days, these mesenchymal origin cells have shown their ability to differentiate, at experimental level, in nerve, muscular, bone or cardiac cells.[4] Nothing could be farther from the truth, in case we think these cells could be used as true therapeutic alternative to treat such illnesses which, up to this date, were considered incurable. It is crucial to be able to differentiate between animal studies, be it *in vitro* or *in vivo*, from real clinical applications in human beings as these banks want us to believe. In order to be able to achieve therapeutic applications with dental stem cells, it would be necessary, among many other things, to be able to identify all genes involved in the differentiation process of these cells. It would also be necessary to be cognizant with their interaction and expression once they are activated. It would equally be necessary to isolate and analyze all transcription and growth factors involved in the differentiation process of these cells. Up to the present date, these factors are mostly unknown, and they behaved differently, according to the order and presence of one or many of these factors during their function.[5] Finally it would be necessary to determine the ideal method of administration and the most suitable proliferation medium which might allow growth without altering characteristics, quality and type of cells in which a differentiation might be achieved.[6]

Explaining the aforementioned considerations would be tantamount to baking a cake without knowing the ingredients. Private stem cells banks partially try it and accept the fact that no further information will be available in at least 10 to 15 years, shielding themselves when stating that. Their function as a bank does not lie in offering innovative therapies or



* Certificate in Orthodontics. Master in Craniofacial Molecular Biology, Professor, National School of Dentistry, National University of Mexico (UNAM).

medical treatments to those patients who hire their services.[7] Notwithstanding all these facts, these banks justify their presence as one additional alternative for those subjects who are interested in safekeeping and obtaining a «biological insurance» with these cells, for further therapeutic use and possible cure of diseases such as Alzheimer, Parkinson, multiple sclerosis, heart disease and diabetes, to mention but a few.[1]

Numerous studies on umbilical chord stem cell cryo-preservation have shown that its maximum life span is ten years, up to this moment, maximum life span of dental stem cells is two to three years. This does not take into consideration the fact that these cells´ ideal cryo-preservation method must be specific, and contingent upon the type and amount of cells destined to safe-keeping. Up to the present date, it has been shown that the same method used to cryo-preserve umbilical cord stem cells, cannot be applied to dental cells, since these latter lose many characteristics. The ideal method for cryo-preservation and storage of these cells, aiming at long-term preservation without loss of characteristics, is still subject of discussion. Finally, in scientific literature, there are multiple reports of studies showing the continuous risk of cross-contamination during storage of different patients' samples when undergoing cryo-preservation processes.[8-11]

Therefore, the question arises on whether it is appropriate to pay a private bank for the safekeeping of cells during a few years, even though the aforementioned illnesses are most frequently present after the third decade of life. Another question that arises is why, even though we know that these cells preserve their characteristics for very short periods of time, the banks offer financial plans to safe-keep these cells for 10 or 20 years.

Moreover, recent studies have shown that permanent teeth also offer a possible source for stem cells, even though they exhibit different characteristics to those of primary teeth. Nevertheless, manipulation is possible with the aim of achieving these progenitor cells from other stem cells or periodontium conventional cells. Even more so, to obtain mesenchymal origin stem cells from other body areas, such as adipose tissue.[12-14]

In other words, we face the question on whether we could not have the same, or even better probabilities of using these cells while preserving the teeth in our mouth avoiding thus payment for safe-keeping of these dental stem cells in the bank, allowing thus science advancement and avoiding expiration of cryo-preservation time.

Legislation on these matters varies in different parts of the world. In the USA, the FDA (Federal Drug Administration) holds an ambiguous and unclear position. Nevertheless, other countries have established very specific laws, institutions and regulations. The aforementioned measures have allowed regulation and clear information for dentists and patients, thus efficiently limiting these private banks of dental stem cells.[15]

In Mexico, the National School of Dentistry, National University of Mexico (UNAM) has once more, assumed leadership in this subject by promoting continuous education courses, which are sponsor-free and do not exhibit any commercial or lucrative interests. The National School of Dentistry targets the diffusion amongst the dental community of a realistic vision of the scope and limitations of the use of these cells so as to be in a position to properly informing the patients.

The Secretaria de Salud (Health Ministry) has not yet established an Official Mexican Norm to thoroughly determine usage, safe-keeping, regulation, manipulation and properties as well as therapeutic applications of stem cells of any type including dental stem cells. This creates a legal vacuum in our country and favors disinformation, as well as the opportunistic and improper information handling that dental stem cell banks have been capitalizing on up to this moment.

Presently in Mexico, dental stem cells banks are private trans-national companies with representatives in our country. They operate with registration at the Secretaria de Salud (Health Ministry) through COFEPRIS (Federal Commission for the Protection Against Sanitary Risks) and exhibit the sanitary permit to safe-keep these cells with «research» aims. According to the Ley General de Salud (General Health Law) up to this date, any therapy or medical treatment in human beings with these dental cell stems are prohibited by Mexican law. Therefore, conducting these treatments in human beings would be tantamount to performing acts of thorough irresponsibility, ignorance, and lack of professional ethics, since, to this date, there are no rationale or scientific bases required to conduct them.[16]

I am totally convinced that no patient disburses a significant amount of money with the aim of preserving his dental stem cells to the see them used for research purposes. All patients have the expectations, hope and certainty of using these cells in the future for a relative, or themselves if the need should arise.

According to the American Blood and Bone Marrow Transplant Association, the probabilities for a patient to use umbilical cord stem cells kept in a private bank are of 0.001% only. By the weight of the law of probabilities, it is impossible that this percentage would significantly increase for dental stem cells, in at least the coming years.[17]

Before recommending a patient to «save a tooth and save a life» we should stop and think about financial, legal and ethical implications involved in the use of these banks, as well as the role we must play as dentists facing our communities when dealing with dental stem cells.

## REFERENCES

1. Tríptico publicitario y página web de Bio Eden México. Disponible en: www.bioeden.mx
2. Shi S, Gronthos S. Perivascular niche of postnatal mesenchymal stem cells in human bone marrow and dental pulp. *J Bone Miner Res*. 2003; 18: 696-704.
3. Miura M, Gronthos S, Zhao M et al. SHED: stem cells from human exfoliated deciduous teeth. *Proc Natl Acad Sci USA*. 2003; 100: 5807-5812.
4. Arora V et al. Banking stem cells from human exfoliated deciduous teeth (SHED): saving for the future. *J Clin Pediatr Dent*. 2009; 33 (4): 289-294.
5. Bluteau G et al. Stem cells for tooth engineering. *Eur Cell Mater*. 2008; 16: 1-9.
6. Yu J et al. Differentiation potential of STRO-1 + dental pulp stem cells changes during cell passaging. *BMC Cell Biology*. 2010; 11: 32. Disponible en: http://www.biomedcentral.com/1471-2121/11/32
7. Advierten bancos sobre uso a largo plazo. Dudan de almacenar las células dentales. *Periódico Reforma*. Lunes 8 de abril del 2013. Sección Nacional: 16.
8. Woods E et al. Optimized cryopreservation method for human dental pulp-derived stem cells and their tissues of origin for banking and clinical use. *Cryobiology*. 2009; 59: 150-157.
9. D'Aquino R et al. Dental pulp stem cells: a promising tool for bone regeneration. *Stem Cell Rev*. 2008; 4: 21-26.
10. Ying X et al. *Ex vivo* expansion and pluripotential differentiation of cryopreserved human bone marrow mesenchymal stem cells. *J Zhejiang Univ Sci B*. 2007; 8 (2): 136-146.
11. Papaccio G, Graziano A, d'Aquino R, Graziano MF, Pirozzi G, Menditti D et al. Long-term cryopreservation of dental pulp stem cells (SBP-DPSCs) and their differentiated osteoblasts: a cell source for tissue repair. *J Cell Physiol*. 2006; 208 (2): 319-325.
12. Laino G et al. A new population of human adult dental pulp stem cells: a useful source of living autologous fibrous bone tissue (LAB). *J Bone Miner Res*. 2005; 20 (8): 1394-1402.
13. Suchanek J et al. Dental pulp stem cells and their characterization. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub*. 2009; 153 (1): 31-36.
14. Huang GT et al. Mesenchymal stem cells derived from dental tissues *versus* those from other sources. Their biology and role in regenerative medicine. *J Dent Res*. 2009; 88 (9): 792-806.
15. Thirumala S et al. Clinical grade adult stem cell banking. *Organogenesis*. 2009; 5 (3): 143-154.
16. Ley General de Salud en materia del control sanitario para la disposición de órganos, tejidos y cadáveres de seres humanos. Art 3. Fracc XVIII., Art 90. Fracc II., Art 313. Fracc I.
17. ASBMT Position statement. Collection and preservation of cord blood for personal use. *Biology of blood and marrow transplantation*. 2008; 14: 364.
18. Jeong Y et al. Nuclear receptor regulation of stemness and stem cell differentiation. *Exp Mol Med*. 2009; 41 (8): 525-537.

Mailing address:
**Enrique Grageda Núñez**
E-mail: enriquegrageda@hotmail.com