

Dental Pulp Stem Cells

Introduction

Scientific study into cell-based therapies has identified tremendous potential for the use of stem cells to treat a number of diseases and disorders. As research has advanced, stem cell banking services, primarily umbilical cord blood banking, have sprung up around the country. More recently, researchers have discovered that stem cells harvested from deciduous teeth may be a source of tissue regeneration and repair. Like the marketing of umbilical cord banking to pregnant women, dental pulp stem cell tissue banks have begun to market to dentists and the public. Despite its exciting potential, experts agree it is premature to consider dental pulp stem cells a viable source of cells for replacing or regenerating tissue.

Background

Stem cells, generally harvested from umbilical cord blood or bone marrow, are unspecialized cells that have the potential to differentiate into other types of cells, with more specialized functions, such as blood or muscle cells, which can be used to repair the body. Stem cell therapy has shown promise for treating a number of conditions, including Parkinson's disease, diabetes, and brain and spinal cord injuries.

Scientists primarily work with embryonic stem cells and adult stem cells, which have unique functions and characteristics. Embryonic stem cells are pluripotent – they can differentiate into all cell types - whereas adult stem cell development is generally considered to be limited to the cell types of their tissue of origin. The stem cells extracted from teeth are adult stem cells, specifically, mesenchymal cells. Mesenchymal cells are responsible for forming tissues such as cartilage, bone and fat. Current research indicates that dental pulp stem cells may some day be used to regenerate bone, periodontal ligament, or perhaps even teeth, but can not be used in the lifesaving procedures that are currently associated with stem cell therapies.

Despite the nascent state of research on dental pulp stem cells, for-profit companies have begun to market their services to dentists and the public, making claims that are questionable, given current scientific evidence. One such company posts this advertisement to families on their web site: “Now you have an unprecedented and timely opportunity to secure and store your family’s own unique stem cells to treat future disease or injury;” and to dentists: “Protect your patients' future health with stem cell science. Enhance your care by offering your patients this life saving stem cell opportunity.”

Addressing this issue, the April 20, 2009 *ADA News* quotes Pamela Robey, Ph.D., Chief of the Craniofacial and Skeletal Diseases Branch of the National Institute of Dental and Craniofacial Research, urging caution when suggesting that dental pulp stem cells may provide life-saving options. “What we do know,” the *News* quotes Dr. Robey as saying, “is the cells from dental pulp in baby or wisdom teeth have the ability to make dentin and pulp and they might have the ability to make bone, but right now that’s all we really know for sure . . . we can’t say how useful for the future they’ll be.”

Dentistry's Actions

The field of dental pulp stem cell research is just emerging and both ADA and CDA are following the research to determine the opportunity to formulate appropriate policy. Relevant to this, ADA adopted a 2008-09 Research Agenda, which includes the following two objectives:

Objective 2-2: Investigate, develop and clinically evaluate therapies and therapeutic materials appropriate for prophylaxis, tissue engineering, healing and/or regeneration of diseased teeth and bone structures.

Objective 4-2: Investigate the uses of non-invasive oral diagnostics, including salivary and oral fluid diagnostics, and oral cell harvesting.

Most recently, the American Academy of Pediatric Dentistry adopted policy on stem cells, with the final paragraph summarizing their position as follows:

The American Academy of Pediatric Dentistry recognizes the emerging field of regenerative medicine and encourages dentists to follow future 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. 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.

Legislative or Regulatory Activity

In August 2001, due to concerns about the origin of embryonic stem cells, the federal government limited stem cell research funding to research utilizing the existing strains of stem cells. Since much of the funding for scientific research comes from the federal government, this action resulted in significantly limiting funding for stem cell research.

Californians took funding matters into their own hands in November 2004, when voters overwhelmingly approved Proposition 71, The Stem Cell Research and Cures Initiative. Proposition 71 allowed the state to borrow \$3 billion for research and created the California Institute for Regenerative Medicine (CIRM) to distribute grants and loans to individual researchers and research programs, as well as develop regulatory standards and create new research facilities.

More recently, on March 9, 2009, President Obama issued Executive Order 13505, entitled "Removing Barriers to Responsible Research Involving Human Stem Cells." This Executive Order changes the way National Institutes of Health (NIH) can support and conduct human stem cell research. The HHS Secretary, through the NIH Director, is required to review existing NIH and other widely-recognized guidelines on human stem cell research and issue new guidelines by June 9, 2009.

Other Relevant Action

In January 2007, the American Academy of Pediatrics (AAP) published a revised version of their Cord Blood Banking for Potential Future Transplantation policy. The policy notes that families are particularly vulnerable to marketing that suggests banking cord blood may prove to save their child's life in the future. The policy further notes that the use of autologous stem cells is controversial at this time, as there is no evidence of the safety or effectiveness of autologous cord blood stem cell transplantation. In fact, some evidence has shown DNA mutations in cord blood obtained from children who subsequently develop leukemia, which might contraindicate use of that blood. The following portions of AAP's policy may increase understanding of the limitations of banking embryonic stem cells and may help guide development of recommendations with regard to dental pulp stem cell banking:

- Cord blood donation should be discouraged when cord blood stored in a bank is to be directed for later personal or family use . . . Physicians should be aware of the unsubstantiated claims of private cord blood banks made to future parents that promise to insure infants or family members against serious illnesses in the future by use of the stem cells contained in cord blood.
- Cord blood donation should be encouraged when the blood is stored in a bank for public use. Parents should recognize that genetic and infectious disease testing is performed on the cord blood and that if abnormalities are identified, they will be notified. Further, cord blood banked in public programs may not be accessible for future private use.
- Because there are no scientific data at the present time to support autologous cord blood banking and given the difficulty of making an accurate estimate of the need for autologous transplantation and the ready availability of allogeneic transplantation, private storage of cord blood as "biological insurance" should be discouraged.

Conclusion

Research on stem-cell therapies utilizing cells of dental origin may some day progress to offer clear options for tissue repair and regeneration. At this time however, experts agree on the prematurity of claims regarding the future use of dental pulp stem cells for this purpose. It is important that dentists and the public have access to accurate and unbiased information. CDA, as the trusted source of information for oral health in California, can play a key role by providing current information on the CDA web site and in CDA publications.

Resources:

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