ORIGINAL RESEARCH PAPER

Oral Pathology

KEY WORDS: tooth banking, deciduous teeth, SHED.

TOOTH BANKING - A REVIEW ARTICLE

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ABSTRACT

Both scientifically and commercially, the area of stem cells has advanced. It is simple and less disruptive to the body to acquire stem cells from teeth. All complex organisms contain the biological cells referred to as stem cells. They can reproduce, differentiate, and rejuvenate them to produce fresh stem cells. For stem cell research, human exfoliated deciduous teeth (SHED) can be acquired quickly and readily with little to no preparation stress. Dental stem cells, the gold standard for neural-crest-derived bone, can be applied as a low-risk autologous therapeutic approach to treat a variety of bodily defects. This study will discuss the banking and therapeutic applications of human exfoliated deciduous tooth stem cells.

INTRODUCTION

Not only do contemporary doctors change people's lives, but they also save them. Dentists have been relieving pain, enabling patients to consume properly, and restoring patients' faces to their previous beauty for hundreds of years. Dentists can now harvest stems cells and store them for a long time to be used therapeutically[1]. In order to be more precise, the dentist collects teeth, preserves the pulp, and uses stem cells for the patient's & future therapeutic reasons [2]. Postnatal stem cells are additionally present in the pulp of deciduous teeth, also known as baby or milk teeth, which are lost by all children between the ages of 6 and 12 and are typically available from the orthodontic excision of third molars in adults. [3].Stem cells are more significant in the field of medicine because they are undifferentiated primitive cells with the ability to proliferate and differentiate into specialized cells [4]. SHED can differentiate into a broader variety of body tissues than other types of stem cells, according to a recent study. This essay focuses on tooth banking in the framework of tissue engineering and regenerative medicine and its potential therapeutic application[5].

STEM CELLS FROM DECIDUOUS HUMAN EXFOLIATIVE TOOTH

In the embryonic stage of human development, SHED cells first appear at the sixth week. These immature, unspecialized cells have the potential to experience differentiation. SHED cells have a higher rate of cell division and a faster rate of growth than adult stem cells [6].The ability of human adult dental pulp stem cells (DPSC), human primary dentition stem cells from exfoliated deciduous teeth (SHED), and human periodontal ligament stem cells (PDLSC) to generate clonogenic cell groups in culture was examined by Shi S et al. (2005) [7]. They believe that dental stem cells have the ability to restore living oral tissues in humans.

THERAPEUTIC STEM CELLS

Unspecialized cells that can continue to divide, proliferate, and thus survive until they receive particular signals make up stem cell populations. Totipotent, Pluripotent, and Multipotent stem cells are the three types of stem cells. Totipotent cells can develop into any form of cell because they can carry out an entire organism's reproduction in utero. Some stem cells are referred to as "Pluripotent," such as early human embryonic stem cells. Which means that even though they have the capacity to differentiate into any type of cell, they are unable to recreate a full living organism on their own? Multipotent stem cells in the body have the ability to differentiate into various cell types, including blood, muscle, bone, and nerves, but they lack Pluripotent stem cells' full potential for regeneration [8,9].

The use of embryonic stem cell therapy, another thoroughly studied source of these cells, is restricted by society due to ethical worries about using them. This has caused division within the USA alone, with state-by-state variations ranging from allowing active research to outright bans. Human adult DPSCs and SHED, which come from tooth pulp, are examples of self-renewing MSCs (mesenchymal), which are cells that reside in the perivascular niche of the molar pulp. Dental pulp stem cells have the capacity to regenerate a variety of tissues due to the fact that they are produced from cranial neural crest cells, which additionally exhibit early markers for MSCs and neuroectodermal stem cells. Both ischemia brain and spinal cord damage can be treated with SHED[1].

DENTAL STEM CELLS HAVE POTENTIAL TO CURE THE FOLLOWING CONDITIONS

Angiogenesis and vasculogenesis
Bioengineered tooth
Regenerative endodontic therapy
Dentin regeneration
Diabetes mellitus
Therapeutic application in dentistry
Liver disease
Regenerative periodontal therapy
Neurological disorder
Regenerative ocular therapy
Bone tissue engineering

TOOTH BANKING:

Long before that, there were cell banks accepting dental pulp stem cells as well as placental and other types of stem cells, and some of these took teeth.

COLLECTION

According to BioEden, their collection and transportation method is designed for naturally exfoliated teeth; Teeth should be collected in a medium which should preserve the dental pulp e.g. pasteurized cow milk [3].

TRANSPORT

Hanks buffered saline solution (HBSS) and Phosphate buffered saline (PBS) are two examples of balanced salt solutions that are frequently used as a transfer medium. Bovine milk is the most suggested appropriate medium for tooth transportation in relation to unspecified nutrients. Notably, the Save-a-teeth is the teeth preservation kit, that the tooth repository uses, HBSS as the preservative material in tooth bank' Store-A-Tooth'[4].

ISOLATING AND PREPARING STEM CELLS

But since it's crucial to check for stem cells, the tooth banks that explain their procedures also mention viability testing and flow cytometry, which count the number of alive and dead cells in a cell population. The most important step is stem cell isolation, which is carried out by mechanically and enzymatically preparing pulp and enabling stem cells to naturally migrate from pulp to plastic culture medium (Store-a-Tooth)[5].

STEM CELL STORAGE

Cryopreservation

Liquid nitrogen must be used to quickly freeze and keep isolated teeth at a low temperature. The samples are put into special cryo-vials, which are frequently made of high-density polyethylene. The samples are frozen before being placed in liquid nitrogen-filled low-temperature storage receptacles. The samples are gradually or gradually frozen as part of the freezing and storage phase of the banking process, and then they are kept in liquid nitrogen for an extended length of time below 195.8 C/-320.5 F. Staged, gradual freezing at -1 C per minute is usually used for both cell storage and experimental cell culture.

Magnetic freezing

It is a cell-alive system, and the phenomenon of applying a weak magnetic field while the temperature drops by up to 6 degrees Celsius occurs in this water instead of colonies accumulating but remaining in smaller groups. Upon complete cooling of the item, the magnetic field can be removed. The Hiroshima University business is using this new technology for the first time. According to Hiroshima University, the use of CAS can increase dental cell survival rates to as much as 83%. Compared to this, only 21.5% of people use a personal freezer, 63% use liquid nitrogen (-196 degrees C), and 45% use ultra-cold freezing (-80 degrees C). (-20 degree C). Cryogenics are much more costly and unpredictable than CAS maintenance[14].

ADIPOCYTES, CHONDROCYTES, OSTEOBLASTS, AND MESENCHYMAL CELLS ARE AMONG THE STEM CELL VARIETIES IDENTIFIED IN THE PULP OF HUMAN TOOTH

Cardiac muscle damage from severe cardiac attacks has been successfully repaired using adipocytes [10]. Adipocytes can effectively treat conditions like Crohn's disease, congestive heart failure, orthopedic conditions of the spine and joints, cardiovascular disease, and plastic surgery. It has been possible to create transplantable bone and cartilage using chondrocytes and osteoblasts. Mesenchymal cells are used to treat paralysis and spinal nerve injuries[11,12].

ELIGIBILITY CRITERIA FOR TOOTH BANKING

Teeth eligible for tooth banking are primary anterior without pathology, and have at least 1/3 rd of root. Tooth-present distal canines are not suitable for tooth banking; they have a broad base and retain long term in oral cavity, primary molars extracted early for orthodontic considerations are used in tooth banking[13,14,&15].

COMMERCIAL ASPECT OF TOOTH BANKING

Tooth banked stem cells are used by their own persons or by their immediate blood relations .In tooth banking stem cells can be saved for decades for further therapeutic uses or regeneration . Norwegian collects nearly 1 lakh primary exfoliative teeth, under the Norwegian Mother and Child Cohort Study for tooth banking in 2008[16,17].

INTEREST IN TOOTH BANKING PROFITS:

The cost of keeping cord blood is less than one-third of that. For the purpose of saving teeth from natural harm, it provides autologous transplant graft. For parents and toddlers alike, it is simple and painless. Grandparents, parents, uncles, and siblings of the donor are just a few examples of close relations who might gain from SHED[4].

CONCLUSION

Due to the ease with which dental stem cells can be collected and processed quickly while causing the body the least amount of harm, tooth banking has become a potential therapeutic strategy for a number of medical conditions. In comparison to other kinds of stem cells, human exfoliated deciduous teeth (SHED) have been found to have higher potential in tissue engineering and regenerative medicine. In tooth banking, naturally exfoliated teeth are gathered, their dental pulp stem cells are prepared, and the cells are then stored for potential medicinal use. Dentin regeneration, regenerative endodontic therapy, regenerative periodontal therapy, and bioengineered teeth are all possible therapeutic uses for tooth banking. Dental stem cells can be collected and stored for future use using tooth banking services, which are secure and simple to use.

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