Stem cells from dental tissue that are pancreatic beta cells

Daisuke Nanba*

Department of Stem Cell Biology, Medical Research Institute, Tokyo Medical and Dental University, 1-5-45, Yushima, Bunkyo-ku, Tokyo, 113-8510, Japan

Abstract

Despite recent advancements in the methods used to differentiate stem cells into the pancreatic beta cell lineage, the current protocols are not tailored for various cell types. This study compares and contrasts the ability of stem cells from periodontal ligament and dental pulp, two anatomically distinct dental tissues, to differentiate into pancreatic beta cells while determining the best protocol for each cell type. Two protocols were used to separate DPSCs and PDLSCs, characterize them morphologically and phenotypically, and then differentiate them into pancreatic beta cells. By using qRT-PCR, the expression of the pancreatic-related markers Foxa-2, Sox-17, PDX-1, Ngn-3, INS, and Gcg was evaluated in differentiated cells. Insulin release was measured using an ELISA to perform a functional assessment of differentiation. All tested genes had significantly higher levels of expression in DPSCs and PDLSCs after Protocol 2 with Geltrex was implemented. In comparison to undifferentiated cells, DPSCs and PDLSCs demonstrated improved response to increased glucose concentration. Additionally, under both protocols, DPSCs showed superior potency toward pancreatic lineage differentiation over PDLSCs. The current study concludes by highlighting the promising potential of dental-derived stem cells to differentiate into pancreatic lineage by choosing the appropriate protocol.

Keywords: Dental stem cells, Pancreatic beta cells, Differentiation, Insulin producing cells.

Introduction

Although Diabetes Mellitus (DM) is one of the most common diseases, there is currently no known cure In actuality, the majority of current DM treatment options are short-term and rely heavily on insulin injections to regulate blood glucose levels, especially in Type I DM. Such tactics, however, are ineffective because not always enough insulin is secreted, which could result in hyperglycemia and further complications. Islet transplantation is another long-term treatment option, but it has many drawbacks, including a shortage of cadaver donors, a risk of immune rejection, and lengthy periods of immunosuppression for the patients. In fact, over the past few years, it has been demonstrated that stem cells from various sources, including induced pluripotent stem cells (iPSCs), mesenchymal stem cells (MSCs), and embryonic stem cells (ESCs), can successfully differentiate into IPCs. However, due to their ability to be isolated from a variety of sources, as well as their viability for *in vitro* culture, plasticity, and exceptional immunological properties, MSCs are typically regarded as the cells of preference in the field of stem cell based therapies and regenerative medicine [1].

Bone marrow, adipose tissue, the umbilical cord, and dental tissues are just a few examples of the various sources of MSCs. One of the most accessible and widely used sources of MSCs is dental tissue, which poses no moral dilemmas and little risk to the donor. During routine dental visits, extracted molars or exfoliated deciduous teeth are typically thrown away. Dental-derived stem cells can differentiate into different cell types because they have neural crest origins. They are also qualified recipients of autologous stem cell transplants. These characteristics set them apart from other mesenchymal stem cells [2].

Differentiation protocols are typically created to mimic the normal development of the human pancreas by altering signalling pathways by giving various growth factors and small molecules over the course of a few days to several weeks. Nevertheless, despite the existence of numerous protocols, there is a lack of cell type-specific optimization of the differentiation protocols. To translate these protocols into clinical practise, such optimization should be carefully examined. Additionally, a thorough study should be done on the various cell types, differentiation protocols, and mechanisms [3].

In this study, we used stem cells isolated from two different dental tissues to apply two distinct and well-established protocols for the generation of pancreatic cells, originally designed for other MSC types. According to our hypothesis, differentiation protocols should be carefully chosen and tailored

***Correspondence to:** Daisuke Nanba, Department of Stem Cell Biology, Medical Research Institute, Tokyo Medical and Dental University, 1-5-45, Yushima, Bunkyo-ku, Tokyo, 113-8510, Japan. E- mail: nanbs@tmd.ac.jp

***Received:** 02-Sep-2022, Manuscript No. AAACSM-22-78026; **Editor assigned:** 05-Sep-2022, Pre QC No. AAACSM-22-78026 (PQ); **Reviewed:** 19-Sep-2022, QC No.AAACSM-22-78026; Revised: 21-Sep-2022, Manuscript No. AACSM-22-78026(R); Published: 28-Sep-2022, DOI:10.35841/aaacsm-6.5.123*

***Citation:** Nanba D. Stem cells from dental tissue that are pancreatic beta cells. J Cell Sci Mut. 2022;6(5):123*

to the cells being differentiated. Exendin-4, nicotinamide, and -mercaptoethanol concentrations were added to the first protocol of culture conditions for DPSCs and PDLSCs in order to test this hypothesis. The second protocol examined the impact of Geltrex, an extracellular matrix, along with other cell induction factors, on the development of IPCs from DPSCs and PDLSCs. Therefore, the goal of this study is to examine and contrast the capacity of stem cells derived from dental pulp (DPSCs) and While determining the best protocol for each cell type, periodontal ligament (PDLSCs) were used as two anatomically distinct dental tissues to differentiate into pancreatic beta cells [4-5].

Conclusion

Through careful analysis of the starting cell population and the applied protocol, the current study can thus be seen as a step toward considering optimized and well-validated protocols for differentiation of pancreatic beta cells. It is important to note, though, that this report's findings showed some limitations that will need to be addressed in follow-up studies. Despite showing that both DPSCs and PDLSCs could differentiate into IPCs in the current study, differentiated cells secreted little insulin in response to stimulation, compared to published data derived from healthy human pancreatic cells. This could be explained by the derived cells' insufficient maturation in vitro as a result of the absence of the mesenchymal epithelial interaction that occurs *in vivo* normally. Another facet of an *in vivo* action that is typically present. The final differentiated cell population's purification is another factor to take into account. The molecular markers' expression in our study indicated a fairly diverse cell population.

References

1. Ahmed HH, Aglan HA, Mahmoud NS, et al. Preconditioned human dental pulp stem cells with cerium and yttrium oxide nanoparticles effectively ameliorate diabetic hyperglycemia while combatting hypoxia. Tissue Cell. 2021;73:101661.
2. Aly RM, Aglan HA, Eldeen GN, et al. Optimization of differentiation protocols of dental tissues stem cells to pancreatic β-cells. BMC Cell Biology. 2022;23(1):1-1.
3. Chen Y, Huang H, Li G, et al. Dental-derived mesenchymal stem cell sheets: a prospective tissue engineering for regenerative medicine. Stem Cell Res Ther. 2022;13:1-15
4. De Luca M, Aiuti A, Cossu G, et al. Advances in stem cell research and therapeutic development. Nat Cell. 21(7), 801-11.
5. Kassem DH, Kamal MM, El-Kholy AELG, et al. Enhances the differentiation of Wharton's jelly mesenchymal stem cells into insulin-producing cells through activation of various β-cell markers. Stem Cell Res Ther. 2016;7:1-11.

Citation: *Nanba D. Stem cells from dental tissue that are pancreatic beta cells. Adv Cell Sci Tissue Cul. 2022;6(5):123*