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Stem cell therapy to treat diabetes mellitus

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Diabetes is a medical condition wherein the blood glucose shoots up to abnormally high levels. All cells require glucose for normal functioning, and the entry of glucose into the cells from the bloodstream usually occurs via glucose transporters, such as glucose transporter 1 (GLUT1). The glucose concentration in the blood is regulated by insulin which is a peptide hormone secreted by the β cells of the pancreatic islets, which functions to decrease the glucose level in the blood by increasing the glucose uptake by the cells. Under normal conditions, high blood glucose levels stimulate insulin secretion which returns the glucose level to the normal range. However, there are two major types of diabetes, type 1 diabetes and type 2 diabetes which affect the secretion of insulin. In the case of type 1 diabetes, the body’s immune cells react against distressed insulin-secreting β cells, destroying them and leading to a lack of insulin in the body; while in type 2 diabetes, insulin is produced but is ineffective in increasing cellular uptake. This has also been classified as insulin resistance. Novel methods using stem cells have been developed that can aid in the treatment of both types of diabetes. An ongoing clinical trial entails the transplantation of human embryonic stem cells (hESCs) derived from pancreatic endoderm cells in an attempt to treat type 1 diabetes. The stem cells are surgically placed at the implant site and over time are expected to mature and produce insulin. There have also been studies that have scrutinised islet transplantation and highlighted the significance of the characterisation of the non-beta cells within the pancreatic islet cells. Human pluripotent stem cells (hPSCs) derived beta cells and pancreatic progenitor cells appear to be promising candidates for replacement therapy for treating diabetes. There have been trials wherein haematopoietic stem cell infusion administration has displayed significant results in some; however, the inconsistency of the results between individuals points towards multiple other factors at play. In the case of type 2 diabetes, mesenchymal stem cells have displayed significant therapeutic effects but further trials and studies to standardise the procedure are required. Induced pluripotent stem cells (iPSCs) also provide another source of stem cells that can be utilised for the treatment of diabetes mellitus. Therefore, stem cells present as a great candidate for the treatment of diabetes for regeneration and replacement therapies. A prospective permanent cure for diabetes could be developed from stem cell therapy through further research and study.

Keywords: Stem cells, Diabetes mellitus, Glucose, Insulin, Human pluripotent stem cells, Induced pluripotent stem cells

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