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Human dental pulp stem cells attenuate streptozotocin-induced parotid gland injury in rats

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Abstract

Objective: Diabetes mellitus causes deterioration in the body, including serious damage of the oral cavity related to salivary gland dysfunction, characterised by hyposalivation and xerostomia. Human dental pulp stem cells (hDPSCs) represent a promising therapy source, due to the easy, minimally invasive surgical access to these cells and their high proliferative capacity. It was previously reported that the trophic support mediated by these cells can rescue the functional and structural alterations of damaged salivary glands. However, potential differentiation and paracrine effects of hDPSCs in diabetic-induced parotid gland damage have not been investigated. Our study aimed to investigate the therapeutic effects of intravenous transplantation of hDPSCs on parotid gland injury in a rat model of streptozotocin (STZ)-induced type 1 diabetes.Methods: Thirty Sprague-Dawley male rats were randomly categorised into three groups: control, diabetic (STZ), and transplanted (STZ + hDPSCs). The hDPSCs or the vehicles were injected into the rats' tail veins, 7 days after STZ injection. Fasting blood glucose levels were monitored weekly. A glucose tolerance test was performed, and the parotid gland weight, salivary flow rate, oxidative stress indices, parotid gland histology, and caspase-3, vascular endothelial growth factor, proliferating cell nuclear antigen, neuronal nitric oxide synthase, endothelial nitric oxide synthase, and tetrahydrobiopterin biosynthetic enzyme expression levels in parotid tissues were assessed 28 days post-transplantation.Results: Transplantation of hDPSCs decreased blood glucose, improved parotid gland weight and salivary flow rate, and reduced oxidative stress. The cells migrated to the STZ-injured parotid gland and differentiated into acinar, ductal, and myoepithelial cells. Moreover, hDPSCs downregulated the expression of caspase-3 and upregulated the expression of vascular endothelial growth factor and proliferating cell nuclear antigen, likely exerting pro-angiogenic and anti-apoptotic effects and promoting endogenous regeneration. In addition, the transplanted cells enhanced the parotid nitric oxide-tetrahydrobiopterin pathway.Conclusions: Our results showed that hDPSCs migrated to and survived within the STZ-injured parotid gland, where functional and morphological damage was prevented due to the restoration of normal glucose levels, differentiation into parotid cell populations, and stimulation of paracrine-mediated regeneration. Thus, hDPSCs may have potential in the treatment of diabetes-induced parotid gland injury.

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Biography

Gehan is an associate professor of Human Anatomy who earned a MBBch, a MSCs in anatomy (Faculty of Medicine, Menoufia University, Egypt) and a PhD in neuroanatomy (King's College London, UK). She has over 25 years of experience in teaching human anatomy for medical colleges as well as other health colleges. Her main interest in research lies in stem cell regenerative therapy. She established the stem cell unit in her faculty in Egypt. She supervised more than 10 MSCs and PhDs graduates. She published dozens of publications in the stem cell field.

