Dental pulp cell transplants help regenerate peripheral nerves

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Peripheral nerve injuries often are caused by trauma or surgical complications and can result in considerable disabilities. Regeneration of peripheral nerves can be accomplished effectively using autologous (self-donated) nerve grafts, but that procedure may sacrifice a functional nerve and cause loss of sensation in another part of the patient's body.

Searching for an alternative to autologous nerve grafts (autografts), researchers in Japan transplanted mobilized dental pulp stem cells (MDPSCs) into laboratory rats with sciatic nerve defects to investigate the regenerative capabilities of MDPSCs and to compare the effectiveness of this procedure to what has been called the "gold standard,"- autologous nerve grafts or collagen implants, that were provided to control groups with similar nerve damage. For this study, the dental pulp used was derived easily from discarded teeth following extraction.

The researchers found that the group receiving the MDPSCs demonstrated regeneration of myelinated axons that were significantly higher in density than those resulting for controls that received nerve grafts or collagen.

Their study will be published in a future issue of *Cell Transplantation* and is currently freely available on-line as an unedited early e-pub.

"The total number of myelinated axons was greatest in the autograft group, followed by the MDPSC group and the collagen group," said study co-author Dr. Misako Nakashima, DDS, PhD, Department of Dental Regenerative Medicine, Center of Advanced Medicine for Dental and Oral Diseases, National Center for Geriatrics and Gerontology Research Institute in Obu, Japan. "The MDPSC group showed increased blood vessel formation, yet there was no statistical difference between the results found in the MDPSC group and the autograft group."

The researchers speculated that the MDPSCs may have had a stimulatory effect on residual Schwann cells (cells involved in many important aspects of peripheral nerve cell biology) through their secretion of neurotrophic factors. In in vitro experiments, the researchers found that MDPSCs had a beneficial effect on Schwann cells. That effect was amplified in in vivo studies.

The researchers concluded that "MDPSCs can contribute to peripheral nerve regeneration by the secretion of neurotrophic and angiogenic factors (factors that promote the formation of new blood vessels) when in close proximity to newly migrated Schwann cells" by regulating their apoptosis (programmed cell death) capability and proliferation.

"We predict that in the near future dental pulp stem cell transplantation may become a possible candidate for taking the place of autologous nerve grafts in peripheral nerve repair and regeneration," said the researchers.

"DPSCs are derived from the neural crest, making them attractive candidates for neural therapy and repair," said Dr. John R. Sladek, Jr., Professor of Neurology, Pediatrics, and Neuroscience, Department of Neurology at the University of Colorado School of Medicine and section editor for *Cell Transplantation*. "The avoidance of potential ethical issues often associated with the derivation of stem cells is also commendable. In this study, although MDPSCs exceeded autografts in axon density, the autografts had the highest total number of myelinated axons. Thus, comparative effectiveness studies should be conducted to compare cells with different lineages that have been proposed for nerve regeneration in order to determine which cell type yields optimal results. In addition, this study focused on the biological effects of MDPSC transplantation. Further studies should be conducted to ascertain the functional outcomes of this cell therapy for peripheral nerve

regeneration."

More information: Yamamoto, T.; Osako, Y.; Ito, M.; Murakami, M.; Hayashi, Y.; Horibe, H.; Iohara, K.; Takeuchi, N.; Okui, N.; Hirata, H.; Nakayama, H.; Kurita, K.; Nakashima, M. Trophic Effects of Dental Pulp Stem Cells on Schwann Cells in Peripheral Nerve Regeneration. *Cell Transplant*. Appeared or available on-line: April 22, 2015. ingentaconnect.com/content/cog/ct/pre-prints/content-CT-1363_Yamamota_et_al

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