Effect of dental pulp stem cells in MPTP-induced old-aged mice model

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Abstract

Background

Parkinson's disease (PD) is a neurodegenerative disease caused by the loss of dopaminergic (DA-ergic) neurons in the substantia nigra (SN) and represented as a huge threat to the geriatric population. Cell replacement therapies (CRTs) have been proposed as a promising strategy to slow down or replace neuronal loss. Among the widely available cell sources, dental pulp stem cells (DPSCs) portray as an attractive source primarily due to their neural crest origin, ease of tissue procurement and less ethical hurdles.

Materials and methods

We first demonstrated the in vitro differentiation ability of DPSCs towards DA-ergic-like cells before evaluating their neuro-protection/neuro-restoration capacities in MPTP-induced mice. Transplantation via intrathecal was performed with behavioural assessments being evaluated every fortnight. Subsequent analysis investigating their immunomodulatory behaviour was conducted using neuronal and microglial cell lines.

Results

It was apparent that the behavioural parameters began to improve corresponding to tyrosine hydroxylase (TH), dopamine transporter (DAT) and dopamine decarboxylase (AADC) immunostaining in SN and striatum as early as 8-week post-transplantation ($P < 0.05$). About 60% restoration of DA-ergic neurons was observed at SN in MPTP-
treated mice after 12-week post-transplantation. Similarly, their ability to reduce toxic effects of MPTP (DNA damages, reactive oxygen species and nitric oxide release) and regulate cytokine levels was distinctly noted ($P < 0.05$) upon exposure in \textit{in vitro} model.

Conclusions

Our results suggest that DPSCs may provide a therapeutic benefit in the old-aged PD mice model and may be explored in stem cell-based CRTs especially in geriatric population as an attempt towards ‘personalized medicine’.

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