

Title

Transplanting nasal mucosa derived olfactory ensheathing cells into injured cervical spinal cord restores neurological hand function

Background

We previously reported that when at least four cervical dorsal roots were required to be severed for the rats develop permanent climbing deficit with the ipsilateral paw. We further reported that when nasal mucosa derived olfactory ensheathing cells (OECs) were transplanted into injured dorsal roots using standard cell culture method no restoration of neurology occurred. We have now developed an enhanced tissue culture method and report the outcome.

Research question

Can high yield, modified mucosal culture (MmOECs) containing around 20% OECs in collagen gel lead to functional recovery after dorsal root lesion.

Design

We used the same cervical spine injury model with the rats receiving MmOECS in collagen gel transplants. The functional improvement was assessed using behavioural test and immunohistology was performed to identify regenerating axons.

Methods

OECs were harvested from rat's olfactory mucosa and cultured until confluent. The cells were transduced to express ZsGreen fluorescent protein and then encapsulated into collagen. Unilateral transection of four dorsal roots (C6-T1) was carried out. The treated group (n=21) received MmOECs in collagen gel transplants.

The functional improvement was assessed using a forelimb proprioception assessment and an adhesive removal test. 6 weeks post-surgery the rats were perfused, and the spinal cords were dissected out and sectioned for histology. Sections were immunostained for neurofilament (NF) and biotinylated dextran amine (BDA).

Results

The forelimb proprioception assessment showed that 80% of the rats receiving the transplants had functional improvement over six weeks of the study. The adhesive removal test showed that the time taken for the rats to notice the adhesive label and remove it almost returned to the normal level after receiving the transplants. Transplanted cells were identified with the expression of green fluorescent protein.

Some regeneration fibres immunostained for neurofilament (NF) or traced by BDA in the injury area.

Discussion

The evidence in this study improves the prospect of clinical application using OECs from the olfactory mucosa to treat CNS injuries.