

Developing neural transplant cell sprays for traumatic neurological injuries

William Woods¹, Chris Adams², Divya Chari¹

¹ School of Medicine, Keele University, ST5 5BG, UK

² School of Life Sciences, Keele University, ST5 5BG, UK

Background:

Traumatic neurological injuries to the brain and spinal cord can have devastating clinical consequences with high costs for healthcare systems. Enhancing regeneration following neurological injury represents a major clinical challenge. Neural cell transplantation therapies have been shown to have significant translational potential to promote regeneration following such injuries. However, current cell delivery methods for neural cell transplantation have major drawbacks, including clinical risks associated with surgical microinjection into neural tissue (e.g. embolism, haemorrhage), and high cell loss on microinjection through fine gauge needles into densely packed neural tissue.

Cell spray delivery can offer significant translational benefits in this regard, including rapid and homogenous delivery and the capacity to combine cell therapy with drugs/biomolecules whilst being minimally invasive. Such an approach has been proven efficacious for skin wounds but never been attempted for neural transplantation.

This study aims to investigate whether spray delivery of neural transplant cells is safe. To achieve this, we tested the effects of cell spraying on two major neural transplant populations, proven to have therapeutic potential in neurological injury. Post-spraying, cells were assessed for their viability and key cellular properties (proliferation and differentiation) which underpin their therapeutic potential.

Methods:

Primary rodent mixed glial cultures were used to generate oligodendrocyte precursor cell (OPC) and astrocyte populations which were spray delivered via a commercial spray bottle. Controls were standard delivery by pipetting. Cell viability was assessed using a live-dead assay and cell proliferation using an EdU assay. Immunohistochemical markers GFAP (astrocytes), NG2 (OPCs), and MBP (oligodendrocytes) were used to identify individual cell populations.

Results:

Post spraying, both transplant cell types could survive with high cell viability. They also showed evidence of normal proliferation and differentiation (OPCs), with retention of characteristic cellular markers following spray delivery.

Conclusions:

Our findings show that spray delivery technology could offer a novel clinical solution for cell delivery in transplantation therapies for traumatic neurological injuries. Further refinement requires the identification of optimal spray parameters for clinical delivery.