Scottish Government Health Directorates Chief Scientist Office

CHIEF SCIENTIST OFFICE

FOCUS ON RESEARCH

IDENTIFYING CELLS AND SCAFFOLDS TO GENERATE TISSUE ENGINEERED CARTILAGE FOR THE USE IN HUMAN EAR RECONSTRUCTION SURGERY

Researchers
Dr Christopher West

Aim

1 in every 4000 children are born missing one or both of their ears, and the surgical technique used to reconstruct missing ears requires plastic surgeons to remove ribs from the patient, and the cartilage from the ribs is used to carve a new ear. This operation has major risks and complications, all of which are due to the need to remove ribs, including pain, punctured lung and chest deformity. Therefore the ability to 'grow' an ear would be a major advancement. To engineer any solid tissue requires the appropriate type of cell, and a scaffold on which they will grow, and these were the aims of this project - to identify cells and scaffolds that can be used to generate cartilage for use in ear reconstruction surgery

Project Outline/Methodology

Adipose tissue has recently been identified as a source of stem cells, however the exact identity and location of these cells remains elusive. The first part of my project was to precisely identify these cells and to develop methods for their purification. Once this was achieved I used a special printer that printed tiny spots of a library of thousands of individual polymers onto a microscope slide. Using this method I hoped to identify specific polymers that the stem cells would attach and grow on. These polymers would be further investigated to see if they could act as scaffolds for the stem cells in tissue engineering.

Key Results

I demonstrated the precise identitiy and location of stem cells within human adipose tissue and developed methods to purify these cells from fat in sufficient numbers for many clinical applications. I also identifed specific synthetic polymers that support the attachment, growth and differentiation of these cells in to cartilage like cells.

Conclusions

Adipose tissue is an abundant and accesible source of cells for tissue engineering that can be purified in clinically relevent numbers. We identified synthetic polymer scaffolds that can support the stable growth and expansion of these cells whilst supporting their ultimate therapeutic action.

What does this study add to the field?

This study has added to our knowledge of the identiy and location of stem cells in adipose tissue and also to methods to allow their safe and efficient purification. Furthermore it has identified synthetic polymers that support the growth and action of these cells.

Implications for Practice or Policy

Patients undergoing ear reconstruction surgery typically spend 8 hours in the operating theatre followed by a week recovering in hospital with a cost to the NHS of £25,000 per ear. The data from this project has moved us much closer to being able to minimise the risks and costs associated with this procedure. However, we still have a long way to go!

Where to next?

The ultimate aim of this project is to translate this lab based research to human trials. To do this we need to ensure that the methods and protocols that we use to purfiy and proccess the cells conform to the standards required for human use. To achieve this we have applied for joint funding with the Scottish National Blood Transfusion Service to utilise their expertise on the production of clinical grade cells to adapt our protocols to meet these strict standards. Not only will this be of benefit for this project, but it will result in many other projects having access to clinical grade stem cells that can be used in a range of clinical trials.

Further details from:
Christopher West: c.c.west@doctors.net.uk