FINAL REPORT
Joint Surgical Research Fellowship RCSEng/HF
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Encouraging blood supply to laboratory-grown skin

One of the Healing Foundation's first awards has helped a research team at Sheffield University to develop new techniques to supply laboratory grown skin with its important blood supply, offering real hope for seriously burned patients.

The team, led by Professor Sheila McNeil, have worked to improve existing techniques in growing skin in the laboratory for burns patients. Currently, such treatments can be used for patients with extensive severe burns where all the layers of the skin have been lost. Normally, the burnt area is cut away and replaced by a thin layer of skin from an un-burnt area – a so-called 'skin graft'. Usually, these skin grafts will "take'' well with the patient's own blood vessels growing quickly through the graft. However, when the patient has lost most of their skin, there is not enough undamaged skin available for grafting of the burnt areas.

The management of a patient with extensive burns is complex for the surgeon. In major burns patients, skin is grown in the laboratory by taking a small piece of skin from the patient and separating it into its component parts – its cells. By the segregated growth of the different types of cells in the laboratory, cells can be grown in sufficient numbers, and brought together to make tissue-engineered skin sheets for grafting back onto the patient.

However, these tissue-engineered skin sheets lack the blood vessels that are normally present in skin and the process of regaining a blood supply (angiogenesis) can be very slow, often leading to the loss of the grafts. It is essential that a new blood supply is established in the graft material as quickly as possible by introducing cells that go onto make blood vessels (endothelial cells). The ultimate aim is to develop the material to contain the patients own endothelial cells to enhance performance of the graft.

This research has led to the development of a technique to grow these blood vessel cells from the same skin sample from which the other skin cells are grown. The endothelial cells have been incorporated into the laboratory-grown skin. Work continues on optimising the techniques for the incorporation of the blood vessel cells into the laboratory-grown skin.

It is hoped that this research will help both patients suffering from extensive burns and those requiring reconstructive surgery. It will also have relevance to conventional skin grafts enhancing knowledge about how to re-establish blood vessels in the skin.

Publications

Sahota PS, Burn JL, Heaton M, Freedlander E, Suvarna SK, Brown NJ, MacNeil S: Wound Rep Reg 2003; 11: 275-284 Development of a reconstructed human skin.
Sahota PS, Burn JL, Brown NJ, MacNeil S: Wound Rep Reg 2004; 12: 635-642 Approaches to improve angiogenesis in tissue-engineered skin.