Microscopic scaffolding offers a 'simple' solution to treating skin injuries

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A revolutionary dissolvable scaffold for growing new areas of skin could provide a safer, more effective way of treating burns, diabetic ulcers and similar injuries.

This ultra-fine, 3-dimensional scaffold, which is made from specially developed polymers, looks similar to tissue paper but has fibres 100 times finer. Before it is placed over a wound, the patient's skin cells (obtained via a biopsy) are introduced and attach themselves to the scaffold, multiplying until they eventually grow over it. When placed over the wound, the scaffold dissolves harmlessly over 6 to 8 weeks, leaving the patient's skin cells behind.

This new approach to skin reconstruction has been developed by a team of chemists, materials scientists and tissue engineers at the University of Sheffield, with funding from the Engineering and Physical Sciences Research Council. It is designed primarily for cases involving extensive burns where surgeons are unable to take enough skin grafts from elsewhere on the body to cover the damaged areas. Currently, bovine collagen or skin from human donors is used in these cases, but these approaches have potential health and rejection risks.

"Simplicity is the key," says Professor Tony Ryan, who is leading the team. "Previous attempts to find better ways of encouraging skin cell growth have used chemical additives and other elaborate techniques to produce scaffolds, but their success has been limited. We've found that skin cells are actually very 'smart' – it's in their DNA to sort themselves into the right arrangement. They just need a comparatively uncomplicated scaffold (and each other) to help them grow in a safe, natural way."

The polymers used in the scaffold are biodegradable materials already approved for medical applications. Because the team has recognised that skin cells are 'smart' and the scaffold can therefore be 'dumb' (i.e. not overly sophisticated), simple polymers can be used.

The process for making the scaffolds is based on the well-known technique of electrospinning. However, the team has made a key advance by developing a new method of making, from the same biodegradable polymers, aligned-fibre 'mats' of potential use in promoting nerve or tendon growth. This method is currently being patented.

The next step in the research is to develop the skin reconstruction technology for clinical use, hopefully in the next few years. The technology also offers possibilities for testing the toxicity of cosmetic and similar products, using materials grown in the laboratory that closely resemble natural skin.

"Ultimately, we can envisage treatment of burns victims and the undertaking of reconstructive surgery using the scaffold and the patient's own skin to produce bespoke skin for that patient," says Professor Ryan. "As an accident-prone mountain biker, I find that prospect very attractive!"

Source: Engineering and Physical Sciences Research Council

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