

## Permacol™ Paste – a New Dermal Substitute in Full-Thickness Wounds?

[R V Shevchenko](#)<sup>1</sup>, [J R Sharpe](#)<sup>1</sup>, [P D Sibbons](#)<sup>2</sup>, & [S E James](#)<sup>1</sup>

<sup>1</sup> [Blond McIndoe Centre](#), Queen Victoria Hospital, East Grinstead, RH19 3DZ, Sussex, UK.

<sup>2</sup> Northwick Park Institute for Medical Research, Harrow, HA1 3UJ, Middlesex, UK.

Tel: +44 (0) 1342 414295 Fax: +44 (0) 1342 414550

[liz.james@qvh.nhs.uk](mailto:liz.james@qvh.nhs.uk) [ross.shevchenko@qvh.nhs.uk](mailto:ross.shevchenko@qvh.nhs.uk) [www.blondmcindoe.com](http://www.blondmcindoe.com)

**INTRODUCTION:** Insufficient skin for autologous grafts often makes treatment of full-thickness extensive burns difficult. Although cultured epithelial sheet grafts or sprayed keratinocyte suspensions have been applied to such wounds, poor long-term results have been achieved in most cases. This is thought to be due to the absence of a dermal layer [1]. In this study a new formulation of the porcine collagen-based biomaterial, Permacol™, was investigated for its potential role as a dermal substitute in full-thickness wounds. Permacol™, in the form of a sheet, has been useful as a stable implant in reconstructive surgery [2]. However, its use as a dermal substitute has been hindered by slow cell penetration and vascularisation [3-4]. A paste formulation was tested in our experiments in order to encourage cellular infiltration.

**METHODS:** Permacol™ was applied as a paste to the wound bed and covered by a split-thickness skin graft in the biopsy model and a silicone dressing in the large wound-chamber model in the Large White pig. The biopsy wound model allowed 24 samples of 8mm diameter to be tested per pig and the wound chamber model allowed 6 samples of 4cm diameter per pig. Suitable control wounds, which included Integra®, were set up in parallel. Excision biopsies were taken from punch-biopsy model wounds, and intrachamber punch biopsies with final excision biopsies were taken at specific time points up to day 28. To assess biointegration and neovascularisation, histological and immuno-fluorescent analysis of frozen and paraffin-fixed tissues was undertaken.

**RESULTS:** Permacol™ paste was well penetrated by cells by day 2, unlike Permacol™ sheet, and was integrated into the host tissue without causing excessive inflammation. Cellular infiltration of Permacol™ paste was superior to Permacol™ sheet and similar to Integra®.

The structure of Permacol™ collagen appeared to be similar to native dermis. Permacol™ paste was visible and intact within the tissue samples up to

day 28, indicating the presence of a stable biomaterial.

Early neovascularisation in Permacol™ paste was noted at day 4, and functional newly-formed microvessels with circulating blood cells were discovered in some samples at day 7. Immunostaining for vascular endothelium confirmed early vascularisation of Permacol™ paste. This was similar when compared to Integra®.

**DISCUSSION & CONCLUSIONS:** This study indicates that a paste formulation of Permacol™ successfully bio-integrated into full-thickness wounds.

It was noted neovascularisation of Permacol™ paste at day 7 seemed to be superior to vascularisation of Integra®, which may be advantageous in the clinic for an earlier application of a thin split-thickness skin graft or sprayed keratinocyte suspension in heavily burned patients.

Paste formulation may have advantages in treating so-called “difficult” areas, where spreading a paste can allow for the variations in body contours as well as wound surface roughness, where sheet materials may fail to adhere and “take”.

Our findings suggest that Permacol™ in the form of a paste may act as a suitable alternative to current dermal substitutes for full-thickness wounds.

**REFERENCES:** <sup>1</sup> C.C. Compton, et al. (1993) *J.Burn Care Rehabil.* 14 (6):653-662. <sup>2</sup> S.H. Liyanage, et al. (2005) *Br.J.Plast.Surg.* Nov. 22. <sup>3</sup> T.M. Macleod, et al. (2004) *Burns* 30 (7):704-712. <sup>4</sup> M.L. Jarman-Smith et al. (2004) *J.Mater.Sci.Mater.Med.* 15 (8):925-932.