Pilot investigation into effect of an antimicrobial dressing on the cell migration effects of decellularized porcine placental extracellular matrix in viable wounded human skin *ex vivo*

Alicia Hughes BSc[1], Leyla Zilic PhD[1], Rocio Burgos-Amador PharmD[1], Daniel Metcalf PhD[1]

[1] *Advanced Wound Care R&D, Convatec Ltd, Deeside, UK*

Introduction

- Decellularized extracellular matrix (ECM) medical devices can facilitate healing of hard-to-heal wounds[1]
- Porcine placental ECM is an ECM scaffold containing collagen, fibronectin, laminin, elastin, hyaluronic acid, and glycosaminoglycans, while being largely free of cells, cell debris, and DNA[2]
- However, as hard-to-heal wounds are often compromised by microbial bioburden, so the use of an antimicrobial dressing over ECM products may be desired
- An advanced antimicrobial dressing* designed to manage wound bioburden, including surface-associated and aggregated microorganisms, has been shown to facilitate healing in hard-to heal wounds[3], and as the dressing component in Wound Hygiene[4]

STUDY OBJECTIVE

To examine the effects of a novel porcine placental decellularized ECM product* covered with an advanced antimicrobial wound dressing† on cell migration in a wounded human skin in a viable *ex vivo* model in a pilot study using immunolabeling techniques

Results

- Compared to the untreated control (**Figure 2**), Cytokeratin 17 was still observed in the antimicrobial dressing-treated wounded skin sample (**Figure 3**)
- Notably, increased upregulation of Cytokeratin 17 was observed in the porcine ECM-treated (**Figure 4**) and the construct-treated wounded skin samples (**Figure 5**)

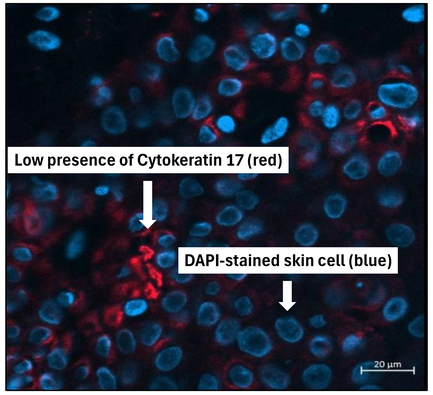

Figure 2. Untreated control wounded skin

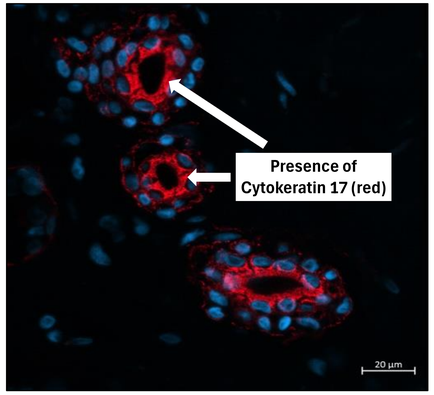

Figure 3. Antimicrobial dressing-treated skin

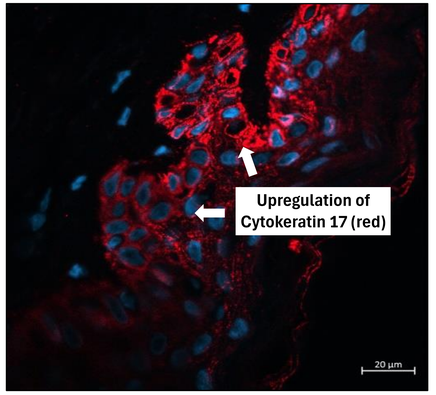

Figure 4. Porcine ECM-treated wounded skin

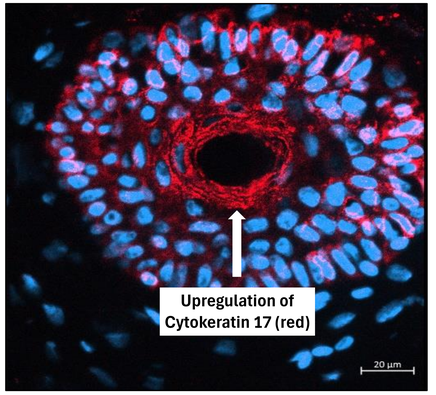

Figure 5. Construct-treated wounded skin

Methods

Test devices

- Porcine placental ECM*
- Non-adherent wound contact layer‡
- Carboxymethylcellulose dressing with ionic silver, surfactant, and chelator (antimicrobial dressing)§

Protocol

- Human *ex vivo* wounded skin models were treated with the ECM product alone, the antimicrobial dressing alone (fully hydrated with simulated wound fluid), or a combined construct (**Figure 1**) containing the ECM product, a non-adhesive wound contact layer‡, and the hydrated antimicrobial dressing)§
- Untreated control, antimicrobial dressing-treated, porcine ECM-treated, and construct-treated wounded skin samples were incubated for up to 6 days at 37°C. Skin samples were fixed and embedded before cross sectioning
- Histological slides were stained with Cytokeratin 17 primary antibody (1:200). Cytokeratin 17 was selected as a marker for wound healing as it is associated with cellular migration
- Primary antibody was removed, and fluorescently labelled with the secondary antibody, Alexa Fluor 647 (1:500) (λex = 650, λem = 671)
- Additionally, the slide was counterstained with DAPI (1:1000) (λex = 350, λem = 465) to visualize cell nuclei. Slides were observed under a LSM800 Zeiss Confocal Laser Scanning Microscope

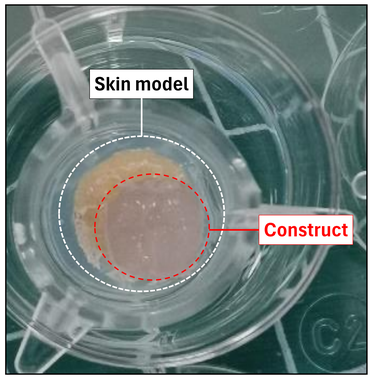

Figure 1. ECM-non-adherent antimicrobial dressing construct-treated human wounded skin model

Discussion

- This *ex vivo* pilot study suggests that the wound healing potential of the porcine placental decellularized ECM device is not impacted by the presence of an advanced antimicrobial dressing
- Furthermore, the antimicrobial and physical properties of a silver-containing antimicrobial dressing, when applied over a non-adherent layer, does not affect the ability of a porcine placental decellularized ECM device to encourage cell migration in a wounded human skin model
- Further studies in similarly complex models using a range of microscopic and immunological techniques, such as Ki67 (an antibody associated with cell proliferation), may help to confirm these pilot findings

CONCLUSION

These findings suggest that the wound healing potential of the porcine placental decellularized ECM device is not impacted by the presence of an advanced antimicrobial dressing

References & Footnotes

1. Cramer M, Badylak, SF. Extracellular Matrix-Based Biomaterials and their influence upon cell behavior. Ann Biomed Eng 2020; 48: 2132-2153.

2. FDA 510(k) summary K193552: www.accessdata.fda.gov/cdrh_docs/pdf21/K211902.pdf (accessed March 2024).

3. More Than Silver™ Made Easy. Wounds Intl 2019 (available to download at www.woundsinternational.com [accessed March 2024]).

4. Murphy et al. International consensus document. Defying hard-to-heal wounds with an early antibiofilm intervention strategy: wound hygiene. J Wound Care 2020; 29(Suppl 3b): S1-28.

*InnovaMatrix® AC (Convatec Inc)
‡Mepitel (Molnlycke)
§Aquacel® Ag Advantage dressing (Convatec Inc)

Editorial support was provided by Kenny Tran (Convatec Ltd.)

Presented at Symposium on Advanced Wound Care (SAWC) Spring 2024, May 14–18, Orlando, USA