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The 3-Step Dressing System to Heal, Protect, and Restore Your C-section Wound

Cellular Remodeling under Expansible and Microporous Polyurethane Hydrophilic Foam for Wound Dressing

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01 Abstract

Wound management is a significant clinical and economic task.

Wound management is a significant clinical and economic task. Modern dressings are designed to facilitate functional regeneration rather than just to cover the wound. The ideal dressing should be easy to apply, painless to remove, require fewer changes, as well as haemostasis, absorption, and protection to support the regrowth of skin tissue.

We aim to investigate the dressing characteristic with different components and architecture of polyurethane (PU) porous wound dressings for cellular changes in wound healing.

The Motif multi-layer PU foam was produced in different manufacturing procedures to create multi-layer PU foam (multi-PU, T3 and T4), Silicon+PU (Si-PU), Microfiber+PU (fiber-PU), and glycerin+PU (G-PU).

All of these PU foams showed no cytotoxicity and showed good biocompatibility to human fibroblast cells (Hs68) as compared with the current common dressing material (opsite, Tegaderm®).

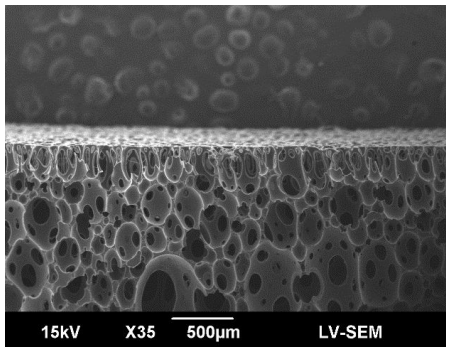
The tissue remodeling with different PU foams was studied by creating full-thickness wounds on the back of FVB mice. Anti-adhesion test was done during dressing changes on Day 3 post-wounding by skin pressure sensor. The cellular and extracellular matrix remodeling were investigated by histological assessments. The H&E staining revealed the multi-PU and improved a complete epidermal and dermal formation on Day 7.

Therefore, we demonstrated the architecture and composition of dressing is important to facilitate wound repair and regeneration.

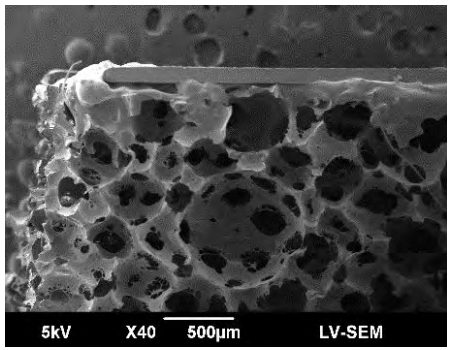
Material

Morphological assessment of foam dressing by scanning electron microscopy (SEM) (A) Multilayer structure PU foam dressing (Motif Medical), (B) PU foam dressing coating silicon (Mepilex®),(C) PU foam dressing with fiber layer (ConvaTec®) and (D) PU with glycerin foam dressing (PolyMem®) (Fig. 1).

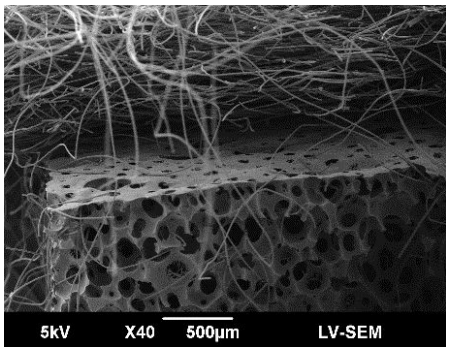
(A) multilayer structure of pu (multi-PU)



(B) PU with silison coating (Si-PU)



(C) PU with fiber (Fib-PU)



(D) PU with glycerin (G-PU)

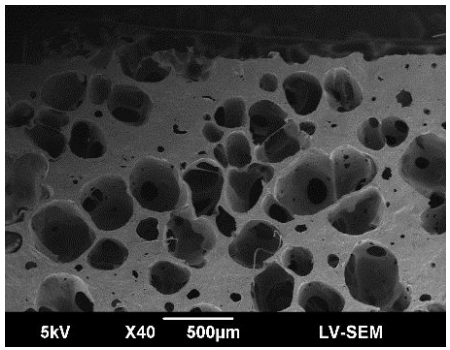
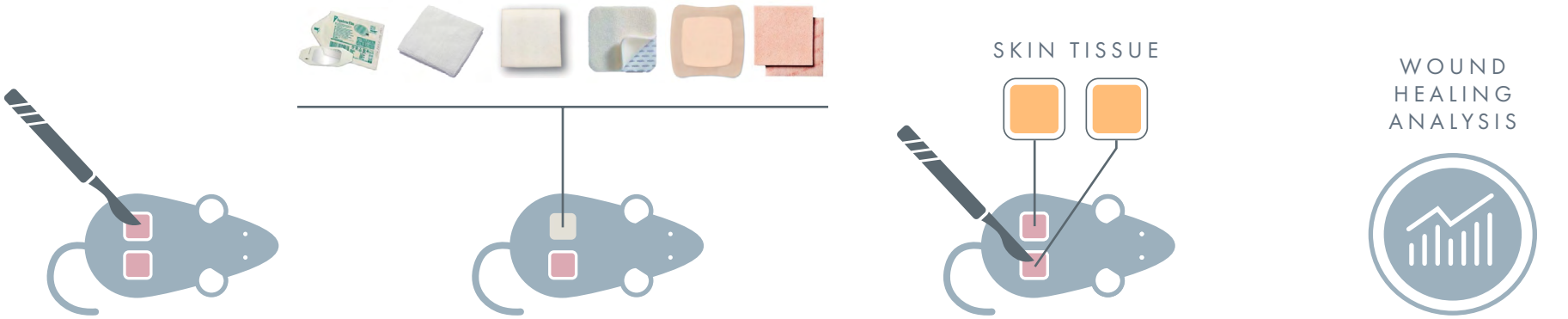


FIG. 1 MORPHOLOGY OF FOUR TYPES OF PU FOAM DRESSING.

Method

Using 9 eight week-aged FVB mice and created 1x1 cm^2 excision wound on each side of the posterior dorsum (Fig. 2). The time point was logged as Day 0 post-wound. Both wounds were then covered with different types of PU foam dressings. At each time point of interest, euthanized mice and harvested wound site skin. The date as described below, Day 3 inflammation phase, Day 7 proliferation phase and Day 14 remodeling phase.



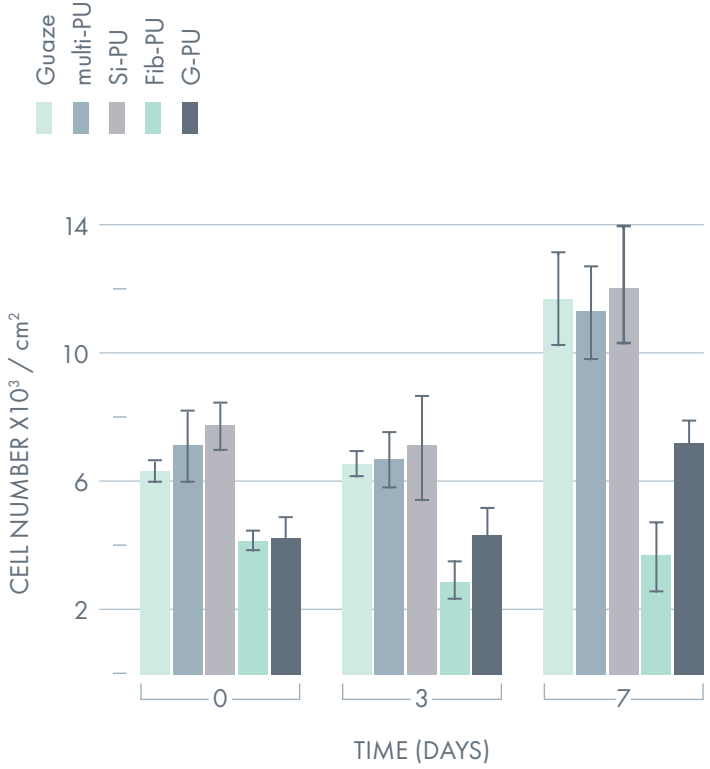
1. Created 1cm^2 excision wound

2. Covered with different consistent foam dressing

3. Euthanized and harvest the skin tissue

4. Histological assessments

FIG. 2 CREATION OF FULL THICKNESS SKIN EXCISION WOUND ANIMAL MODEL.



RESULT #1

Good Biocompatibility

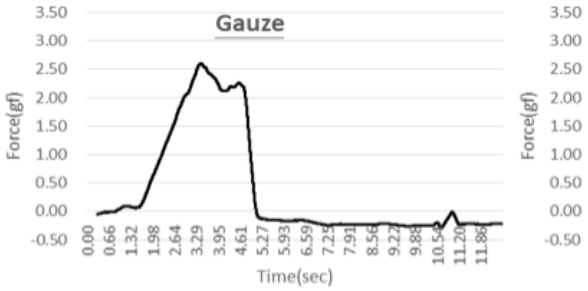
Using cell proliferation cytotoxicity assay, cells were incubated with CCK-8 kit. All of these PU foams showed no cytotoxicity and good biocompatibility to human fibroblast cells (Hs68) as compared with the current common dressing material. In addition, the multi-PU and Si-PU promoted higher cell proliferation than fiber-PU and G-PU.

03 Results

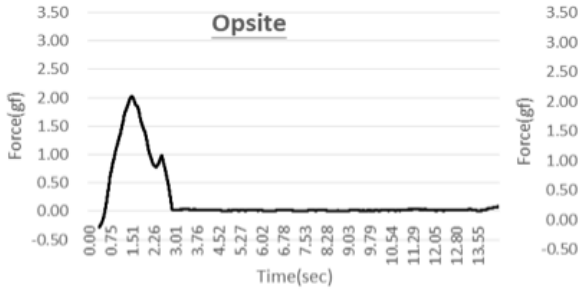
1. Good Biocompatibility
2. Anti-adhesion
3. Keep the wound bed clean
4. Wound healing quickly
5. Accelerate the healing rate

RESULT #2

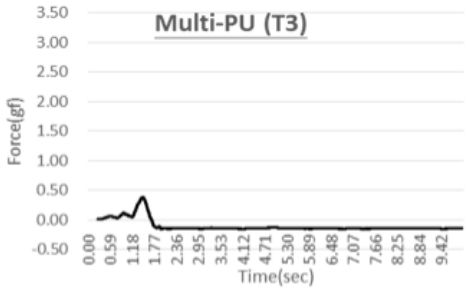
GAUZE



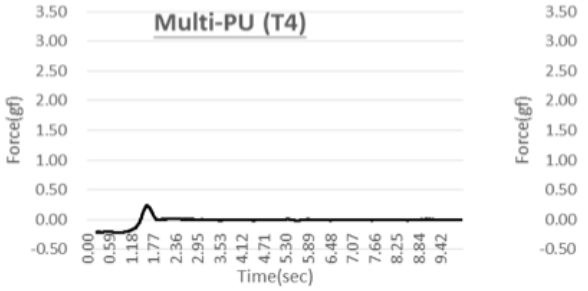
OPSITE



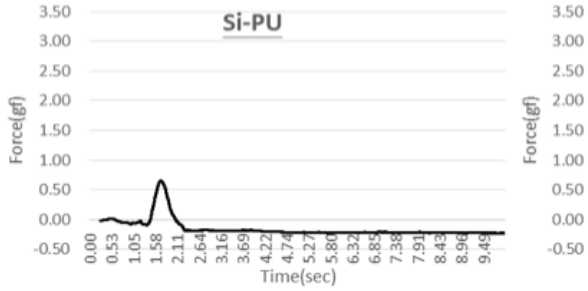
MOTIF MULTI-PU (T3)



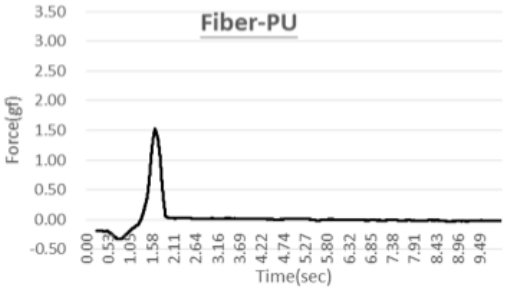
MOTIF MULTI-PU (T4)



Si-PU



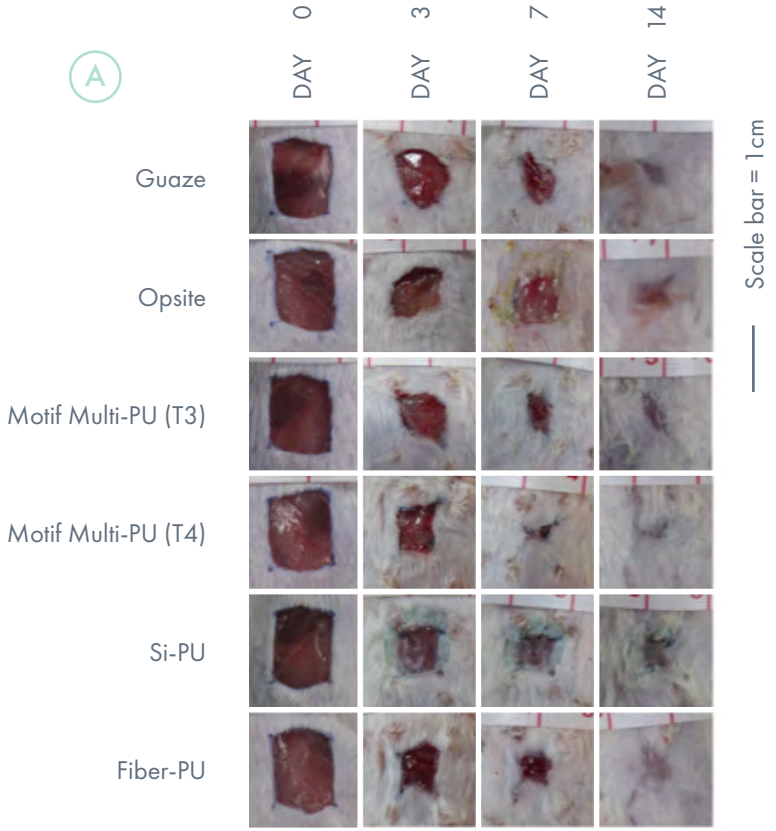
FIBER-PU



Anti-adhesion

Anti-adhesive test at dressing change on Day 3. T3 and T4 show good anti-adhesive performance.

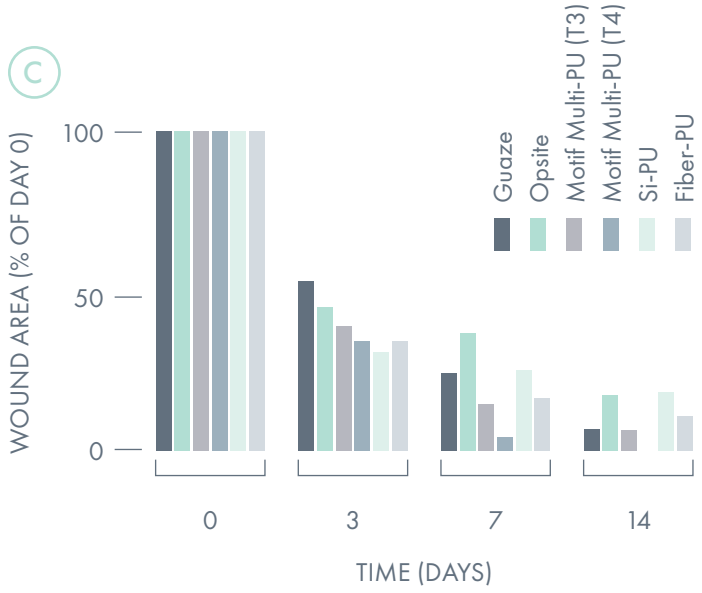
A



B

	DAY 0	DAY 3	DAY 7	DAY 14
Guaze	100%	52.57%	23.64%	6.31%
Opsite	100%	45.50%	36.15%	16.97%
Motif Multi-PU (T3)	100%	39.10%	13.79%	5.79%
Motif Multi-PU (T4)	100%	35.28%	4.11%	0.00%
Si-PU	100%	30.80%	24.45%	18.16%
Fiber-PU	100%	33.27%	15.85%	10.18%

C



RESULT #3

Keep the wound bed clean

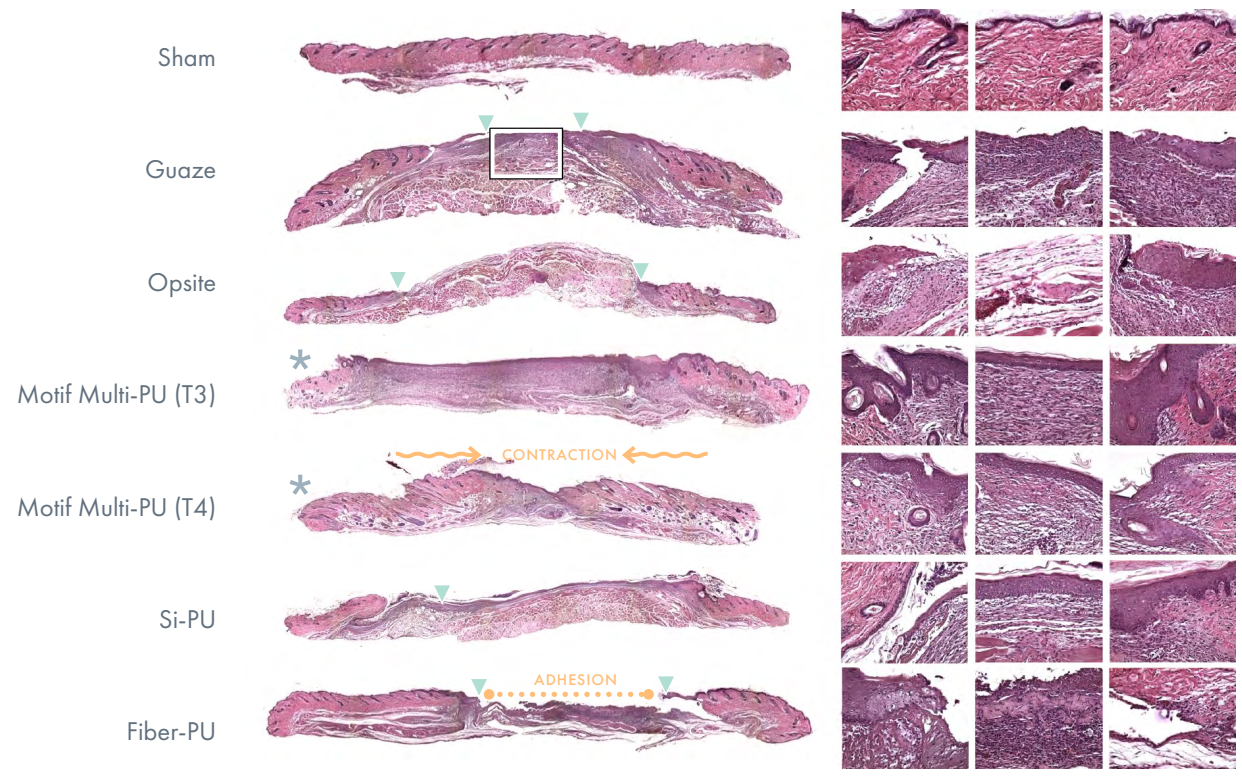
(A) Whole appearance of the wound and (B,C) Percentage of wound area from Day 0 to Day 14 for the different treatment groups. Creating a full-thickness wound on the back of FVB mice and covering with different PU foam dressing.

RESULT #4

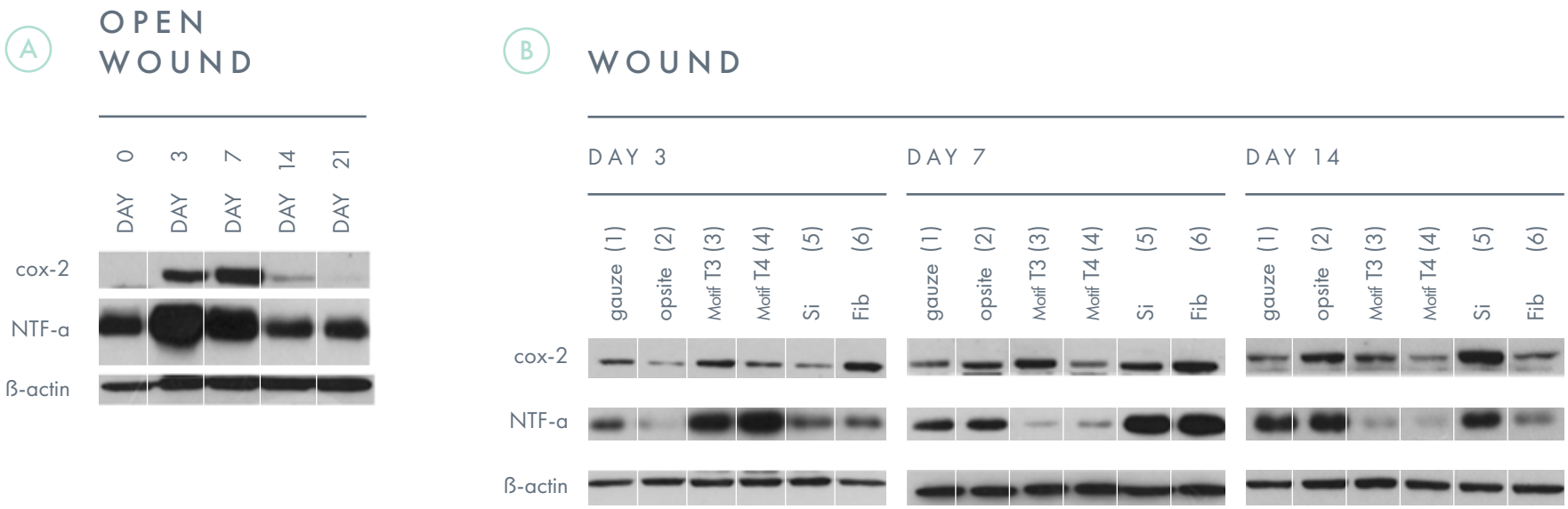
Wound healing quickly

H&E staining of the skin tissues surrounding wound sites showed wound re-epithelialization and contraction on Day 7 post wounding.

7 DAY POST WOUND



* Re-epithelialization ▼ Epithelial Tongue



RESULT #5

Accelerate the healing rate

Fig. 8 Western blot analysis of inflammatory cytokines in wound areas covered with various wound dressing on Days 3, 7 and 14. (A) Internal control (B) Post wounding

Conclusion

1. Four types of PU foam dressings showed no cytotoxicity and good biocompatibility.

2. In the animal wound model, the Motif multi-PU probability of healing was 90-96% after 7 Days. The Histological sections of H&E staining revealed that the Motif multi-PU (especially T4) can improve re-epithelialization and construction which is important to facilitate repair and regeneration.

3. In western blotting, Motif multi-PU provides a clean wound bed, shortening the inflammatory period. Accelerated wound healing.

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