EFFICACY OF MATRIDERM AS A BIOACTIVE DERMAL MATRIX FOR SKIN REGENERATION IN PHOTOAGED TISSUE

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Background

Matriderm is a three-dimensional acellular dermal matrix composed of bovine collagen and elastin, designed to facilitate dermal regeneration and soft tissue integration. It is widely used in reconstructive and aesthetic surgery for wound coverage and tissue augmentation. However, its tissue remodeling capacity, particularly its regenerative potential in photoaged skin and soft tissue microdamage, has not been fully elucidated. In particular, its ability to restore extracellular matrix organization and improve dermal integrity under photoaged conditions remains unclear. Therefore, this study aimed to evaluate the regenerative efficacy of Matriderm in improving dermal architecture using a photoaged skin model.

Method

A photoaged model was established using SKH-1 hairless mice irradiated with ultraviolet light for 10 weeks to induce dermal damage and wrinkle formation. Following induction, animals were randomized to receive dorsal implantation of phosphate-buffered saline (PBS, negative control), Matriderm (1 mm or 3 mm, experimental groups), or AlloDerm (1 mm, positive control). AlloDerm, a human-derived acellular dermal matrix used for soft tissue augmentation, served as the positive control. Morphological evaluation was performed 4 weeks after implantation using high-resolution imaging to assess skin surface changes and wrinkle formation. Wrinkle parameters (area, number, and depth) were quantified from silicone replicas and analyzed statistically. Histological evaluation using hematoxylin and eosin staining assessed epidermal and dermal thickness and tissue architecture. Immunohistochemical analysis was conducted to evaluate angiogenic and proliferative markers, including VEGFA, PLGF, CD31, and PCNA, to investigate vascularization and proliferation. Enzyme-linked immunosorbent assay (ELISA) was performed to quantify extracellular matrix-related proteins, including COL1A1, COL3A1, and elastin, providing insight into matrix remodeling.

Results

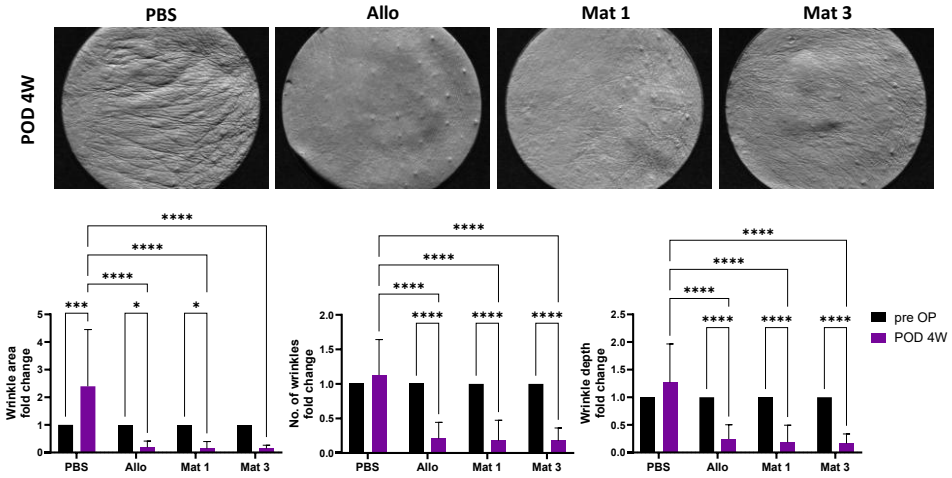
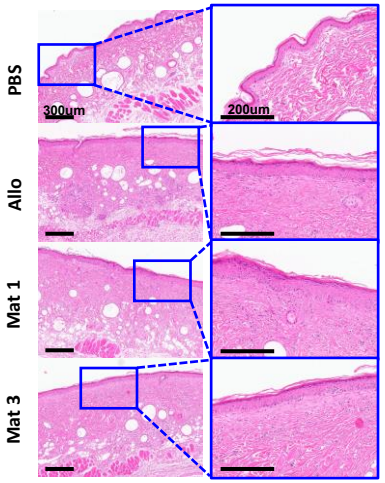


Fig. 1. Wrinkle analysis in a UV-induced photoaged mouse model. Silicone replica images at 4 weeks after implantation of PBS, Allo (AlloDerm), Mat 1 (Matriderm 1 mm), and Mat 3 (Matriderm 3 mm). Quantitative measurements of wrinkle area, number, and depth. Reduced wrinkle parameters in Matriderm- and AlloDerm-treated groups compared with PBS. *p < 0.05, ***p < 0.0005, ****p < 0.0001



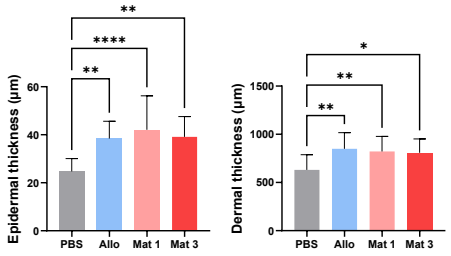


Fig. 2. Histological analysis of skin thickness. Hematoxylin and eosin staining. Representative histological images and quantitative measurements of epidermal and dermal thickness. Increased epidermal and dermal thickness in Matriderm- and AlloDerm-treated groups compared with PBS. *p < 0.05, **p < 0.01, ****p < 0.0001

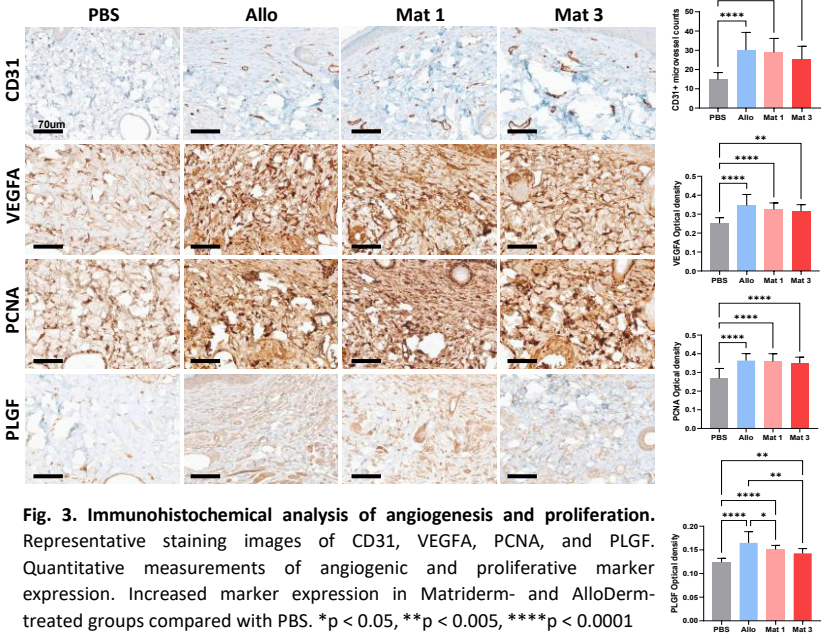


Fig. 3. Immunohistochemical analysis of angiogenesis and proliferation. Representative staining images of CD31, VEGFA, PCNA, and PLGF. Quantitative measurements of angiogenic and proliferative marker expression. Increased marker expression in Matriderm- and AlloDerm-treated groups compared with PBS. *p < 0.05, **p < 0.005, ****p < 0.0001

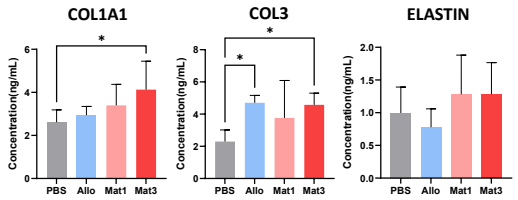


Fig. 4. ELISA analysis of extracellular matrix-related proteins. Quantitative measurements of COL1A1, COL3A1, and elastin levels. Increased COL1A1 and COL3A1 levels in Matriderm- and AlloDerm-treated groups compared with PBS, with no significant change in elastin levels. *p < 0.05

Discussion & Conclusion

Matriderm significantly enhanced dermal regeneration in a UV-induced photoaged mouse model, as evidenced by reduced wrinkle parameters and increased epidermal and dermal thickness. Furthermore, Matriderm promoted angiogenesis, cellular proliferation, and collagen deposition (COL1A1, COL3A1), indicating its potential as a therapeutic biomaterial for both dermal regeneration and aesthetic improvement in photoaged skin.