

A Composite Application Technique of Single-stage Dermal Templates to Improve Handling and Ease of Use

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Summary: The “work horse” for the treatment of full-thickness defects of any etiology, including chronic nonhealing wounds and traumatic injuries, is generally autologous split-thickness skin grafts (STSGs), meshed, hand-fenestrated, or a sheet graft. Advancements in skin tissue engineering have allowed for the integration of dermal substitutes to be combined with autologous STSGs, adding valuable options for restoring the skin’s complex multilayered structure. Although dermal templates offer a promising avenue for more nuanced reconstruction in certain cases, their application is not without challenges, particularly when they are made from delicate materials. The following technique simplifies the application technique of single-stage dermal templates by using a composite approach. To demonstrate this technique, MatriDerm, a 1-mm-thick bovine collagen-elastin dermal template, is used to enable an STSG to be applied in a one-stage procedure. (*Plast Reconstr Surg Glob Open* 2024; 12:e6094; doi: [10.1097/GOX.0000000000006094](https://doi.org/10.1097/GOX.0000000000006094); Published online 23 August 2024.)

INTRODUCTION

The “work horse” for the treatment of full-thickness defects of any etiology, including chronic nonhealing wounds and traumatic injuries, is generally autologous split-thickness skin grafts (STSGs), meshed, hand-fenestrated, or a sheet graft. Advancements in skin tissue engineering have allowed for the integration of dermal substitutes to be combined with autologous STSGs, adding valuable options for restoring the skin’s complex multilayered structure.^{1,2}

Although dermal templates offer a promising avenue for more nuanced reconstruction in certain cases, their application is not without challenges, particularly when they are made from delicate materials. The following technique simplifies the application technique of single-stage dermal templates by using a composite approach. To demonstrate this technique, MatriDerm, a 1-mm-thick bovine collagen-elastin dermal template, is used to enable an STSG to be applied in a one-stage procedure.³⁻⁶

COMPOSITE DERMAL TEMPLATE: STSG APPLICATION TECHNIQUE

After harvesting of an STSG, it is placed in normal saline 0.9% and meshed on a plastic carrier, with the dermal side facing upward. Immediately after meshing, the STSG is slightly expanded on the carrier to open the pores. MatriDerm is then placed on the dermal side of the STSG (Fig. 1). At this stage, MatriDerm absorbs some of the moisture that is still present on the STSG and adheres naturally to the dermal side due to surface tension physiology. Subsequently, MatriDerm can be cut to the required size (Fig. 2). With complete hemostasis of the recipient wound bed, the MatriDerm STSG composite is overlaid on the wound bed directly (Fig. 3). At this stage, additional moistening can be achieved by applying a moist sponge

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Received for publication February 2, 2024; accepted July 2, 2024.

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The data supporting the findings of this case report are available upon reasonable request. Requests for access to the data should be directed to the corresponding author. The authors will consider all reasonable requests for data sharing, taking into account any ethical and legal considerations.

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DOI: [10.1097/GOX.0000000000006094](https://doi.org/10.1097/GOX.0000000000006094)

Disclosure statements are at the end of this article, following the correspondence information.

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with slight pressure over the composite MatriDerm STSG, with care not to dislodge or disrupt positioning. The sponge's moisture seeps through the meshed skin's fenestrations and provides the dermal template with additional moisture. In our experience, this is usually unnecessary, as the wound bed provides enough additional moisture to aid chemotaxis and a wound healing stimulatory effect. The composite MatriDerm STSG is then secured in place using staples, sutures, or histoacryl, followed by dressings or negative pressure wound therapy, as per unit protocol.

Direct contact between the well-vascularized wound bed and the MatriDerm STSG composite is essential for successful take and wound closure. In this method, the contact between the STSG and MatriDerm is direct because of the surface tension generated by water absorption from the STSG, achieving minimal ripples or air bubbles between the MatriDerm and the STSG. When applying the MatriDerm STSG composite to the wound bed, air bubbles between the wound bed and the MatriDerm STSG composite should be removed as much

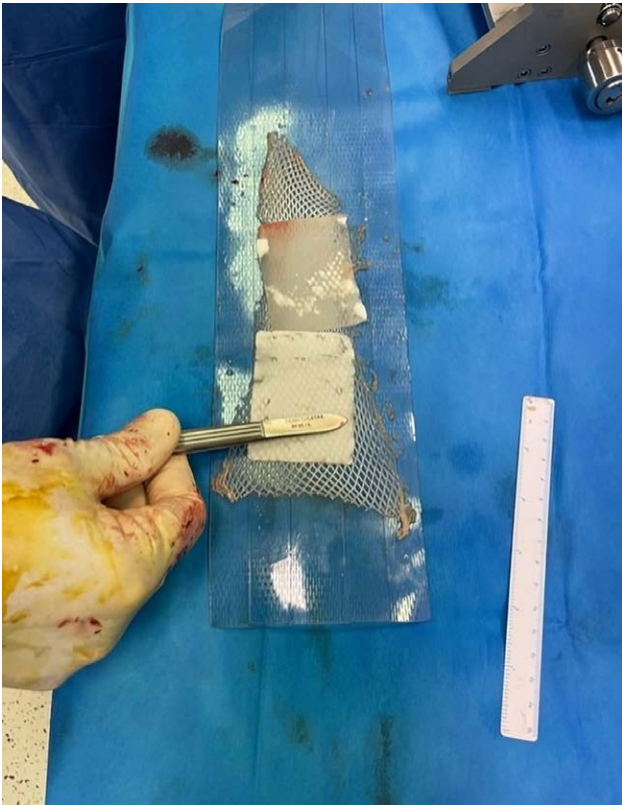


Fig. 1. Preparing composite MatriDerm STSG. Placement of MatriDerm on the dermal side of a meshed STSG that is resting on the carrier it was meshed on. The pores of the meshed STSG have been expanded slightly by spreading the STSG on the carrier before applying the MatriDerm. Another MatriDerm piece is already present on the STSG which has absorbed moisture from the STSG. As soon as MatriDerm is placed on the STSG, it starts to absorb the moisture from the STSG and will turn from a white construct into a translucent structure. Gentle pressure of the MatriDerm onto the STSG to assist moisture uptake of the MatriDerm can be applied using the back of a pair of forceps.

Takeaways

Question: How can we improve the way we apply single-stage dermal templates in the operating theater?

Findings: By applying MatriDerm onto the skin graft instead of directly onto the wound bed, we create a composite unified form which can easily be applied to the wound.

Meaning: Using MatriDerm in the order of the described composite application technique allows for more controlled, precise, and faster intraoperative applications of dermal templates.

as possible to achieve direct contact with the wound bed. Air bubbles are removed by applying a moist sponge and firmly pressing the MatriDerm STSG composite into the wound bed. Owing to the strong adherence of MatriDerm to the STSG due to the cohesion from water absorbance, the STSG is less prone to shear off the MatriDerm.

Once the MatriDerm STSG composite is placed on the well-vascularized wound bed, the excess can be trimmed. If MatriDerm alone or STSG alone is required for specific areas, the composite MatriDerm STSG can be soaked in normal saline 0.9%. Bathing the composite MatriDerm STSG will resolve the adherence between the two structures, and the MatriDerm will float off the STSG without any damage (Fig. 4).

This technique can also be used to cover large surface areas by laying multiple skin grafts out on the surgical table instead of keeping them on the carrier. [See figure, Supplemental Digital Content 1, which displays preparation of a composite MatriDerm STSG for large surface areas. Laying the STSG out on the meshing table

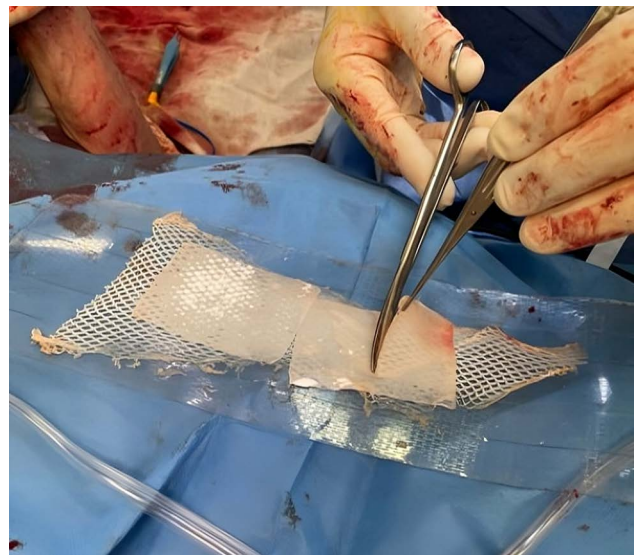


Fig. 2. Cutting to size of composite MatriDerm STSG. Cutting to size of composite MatriDerm STSG is easy, as the moisture uptake of the MatriDerm from the STSG generates a cohesive composite structure between the dermal template and STSG, where the MatriDerm becomes adherent to the STSG due to surface tension. Full moisture uptake of MatriDerm on both pieces. Handling of the composite MatriDerm STSG is the same as the handling of an STSG alone.



Fig. 3. Application of composite MatriDerm STSG to well-vascularized wound bed. Complete adherence of MatriDerm to STSG allows for ease of handling when applying it to the wound bed. Due to the high surface tension between the MatriDerm and the STSG, the risk of shearing MatriDerm or fragile dermal templates is reduced.

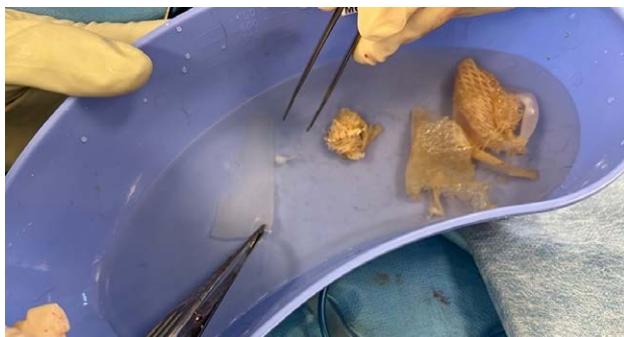


Fig. 4. Placement of MatriDerm STSG composite in normal saline 0.9% will allow detachment of MatriDerm from STSG, without any shear or damage to the MatriDerm or STSG.

and expanding meshed pores with the dermal side facing up. Laying MatriDerm (A4 size) over the STSG and gently pressing the MatriDerm into the STSG to absorb moisture. <http://links.lww.com/PRSGO/D457>.] (See figure, Supplemental Digital Content 2, which displays picking up the composite MatriDerm STSG structure at the top corners. This allows for easy transfer to the operating table and patient wound bed. Composite MatriDerm

STSG adheres together as one, and even the smaller areas of skin graft that are interlaid to fill any gaps between the two larger strips stay firmly adherent to the MatriDerm and allow for easy transfer and handling. <http://links.lww.com/PRSGO/D458>.) Using the full width of the Zimmer dermatome (10 cm), two strips of STSG can be harvested and meshed at a length of approximately 30 cm. The STSG is laid out on the meshing table with the dermal side upward, filling in any gaps with smaller off-cuts and expanding the meshed pores slightly. The largest piece available from MatriDerm, a 21×29.7cm² (A4 size), is placed on the STSG, and using gentle manual pressure, the MatriDerm is pressed into the STSG. MatriDerm slowly takes on the moisture of the STSG and forms a cohesive composite structure that allows for simple transfer to the recipient wound bed by picking it up at its corners.

DISCUSSION

Dermal matrices, such as MatriDerm, are skin substitutes developed to achieve the complete reconstruction of dermal-epidermal layers of skin to manage deep- and full-thickness defects.⁷ Although the use of STSGs effectively achieves wound closure, it is a “shortcut” in reconstructing all layers of human native skin. The small dermal components present in STSGs allow for take to a well-vascularized wound bed; however, they do not represent the entire thickness of the dermis required at the recipient site. Dermal matrices aim to improve skin reconstruction by providing the dermal layer in dermal-epidermal reconstruction. Although in some cases only 1 mm thick, it is an essential step forward in the field of skin tissue engineering, and the philosophy on which the dermal template–STSG composite application technique is based. Composite tissue principles are well established in reconstructive surgery, with composite flaps such as fasciocutaneous or myocutaneous flaps, whether regional, pedicled, or free, dominating the reconstructive ladder.⁸ The principle of composition between the epidermis, in this case, the STSG, and the dermis, in this case, MatriDerm, is highlighted with this technique. A complete composite skin structure is generated by overlaying the artificial “dermis” onto the STSG before it is applied to the wound bed. The moisture in the STSG is shared with the MatriDerm layer and both instantly adhere to each other. The direct contact between the two layers allows for a smooth interface without distortions or ripples, and the two layers move together as one. The MatriDerm becomes more robust, and the STSG is supported without the tendency to curl dermally or contract.

In conclusion, the composite dermal template–STSG application technique improves surgical precision and speed due to its enhanced handling capacity in composite form and allows for a simplified application directly onto the wound bed to formally reconstruct the bilayered framework of native human skin in a single-stage procedure.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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