

# Use of Biodegradable Temporizing Matrix Dermal Template for Reconstruction of Upper Extremity Soft Tissue Defects with Associated Tendon Injury

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**Summary:** In cases of complex upper extremity soft tissue defects with exposed bone or tendon, the surgeon needs to consider both restoration of stable soft tissue coverage and functional outcomes, which requires early motion and a wound bed suitable for tendon gliding. Often, local, regional, or free flaps are necessary; however, good outcomes have also been reported after staged reconstruction with a dermal template and split-thickness skin grafting. To our knowledge, staged reconstruction with a dermal template has not been described for soft tissue defects with an associated underlying tendon injury requiring tenorrhaphy. We have previously reported our experience with a synthetic dermal template [Novosorb BTM (Biodegradable Temporizing Matrix), Polynovo North America LLC, Carlsbad, Calif.] for the reconstruction of complex upper extremity defects with exposed tendon and showed that it consistently and reliably integrates even when these patients were treated with an early, active therapy protocol. As a result of these findings, we hypothesized that BTM could potentially be used over a tendon repair site without compromising functional outcomes. Here, we report on clinical outcomes for two patients with upper extremity injury where BTM was applied directly over a tendon repair or transfer site and resulted in stable soft tissue coverage with excellent tendon gliding. These early results show that this approach might be considered as an alternative to autologous tissue reconstruction in these patients and could reduce donor site morbidity associated with flap harvest. (*Plast Reconstr Surg Glob Open* 2024; 12:e5560; doi: [10.1097/GOX.0000000000005560](https://doi.org/10.1097/GOX.0000000000005560); Published online 30 January 2024.)

## DERMAL TEMPLATE USE OVER TENDON INJURY

In cases of complex upper extremity soft tissue defects with exposed bone or tendon, the surgeon needs to consider both restoration of stable soft tissue coverage and functional outcomes, which requires early motion and a wound bed suitable for tendon gliding. Bilayer, biologic, acellular dermal matrices such as Integra (Integra LifeSciences, Princeton N.J.) have been used to successfully reconstruct soft tissue defects of the fingers and hand with exposed bone or tendon and can even heal without

skin grafting by re-epithelialization from the wound margins.<sup>1-4</sup> This is accomplished by vascularization of the matrix, which is composed of cross-linked bovine tendon collagen and glycosaminoglycans, creating a neodermis amenable to skin grafting.

Novosorb BTM (Biodegradable Temporizing Matrix) (Polynovo North America LLC, Carlsbad, Calif.) is an alternative synthetic bilayer template composed of a polyurethane matrix with an overlying sealing membrane. Like other dermal substitutes, the matrix allows for vascular ingrowth while the sealing layer limits moisture loss and acts as a barrier to outside contamination. We have previously reported our experience with Novosorb BTM for the reconstruction of complex upper extremity defects with exposed tendon, demonstrating consistent and reliable integration despite an early, active therapy protocol

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to maximize functional outcomes and movement of the tendons under the template.<sup>5,6</sup>

To our knowledge, reconstruction with a dermal template has not been described for reconstruction of hand or upper extremity soft tissue defects with an associated tendon injury requiring tenorrhaphy. Because of our previous experiences and outcomes, we hypothesized that Novosorb BTM could be used as an alternative to flap reconstruction for these injuries and minimize donor site morbidity without compromising functional outcomes. In this article, we present two cases demonstrating clinical outcomes.

### Case 1

A 40-year-old man sustained a complex dorsal hand injury during a motor vehicle crash. There was no associated fracture, and he underwent immediate washout and splint application in the emergency department before being discharged home on oral antibiotics. At surgery, after debridement of nonviable tissue, zone 6 lacerations of the extensor indicis proprius and all extensor digitorum communis tendons (EDC) were seen. These were devoid of peritenon and primarily repaired using interrupted figure of eight nonabsorbable sutures (Fig. 1) before Novosorb BTM was applied directly over the tendons and secured with staples. The proximal wound was closed primarily, and a nonadherent, lightly compressive dressing and splint were applied. The patient was discharged home on a 5-day course of oral antibiotics, and at his initial 1-week follow-up visit, he was referred to occupational therapy for thermoplastic splint fabrication and initiation of an early active range of motion protocol.

The sealing layer was removed in the clinic on postoperative day (POD) 36 and local wound care was continued with Vaseline and a nonadherent gauze that was changed daily. Split-thickness skin grafting was offered but deferred by the patient, who elected to continue with local wound care and allowed the skin to spontaneously re-epithelialize from the wound margins, which was complete on POD 113. There were no wound healing complications, and stable soft tissue coverage was achieved (Fig. 2). At follow-up



**Fig. 1.** Intraoperative photograph after debridement and direct tendon repair using nonresorbable figure of eight sutures.

### Takeaways

**Question:** Can a dermal template (BTM) be used to successfully reconstruct a soft tissue defect associated with exposed, repaired tendons?

**Findings:** Stable, soft tissue reconstruction with preserved tendon gliding and finger motion was achieved in two patients, using a dermal template (BTM).

**Meaning:** Dermal templates can be used instead of flap reconstruction for soft tissue reconstruction with exposed tendon repair in select patients.

on POD 176, clinical outcomes demonstrating near full finger flexion and extension with excellent tendon gliding under the dermal template could be seen. [See Video 1 (online), which displays final follow-up 442 days postoperatively, demonstrating near full finger range of motion through flexion and extension with stable soft tissue on the dorsal hand.]

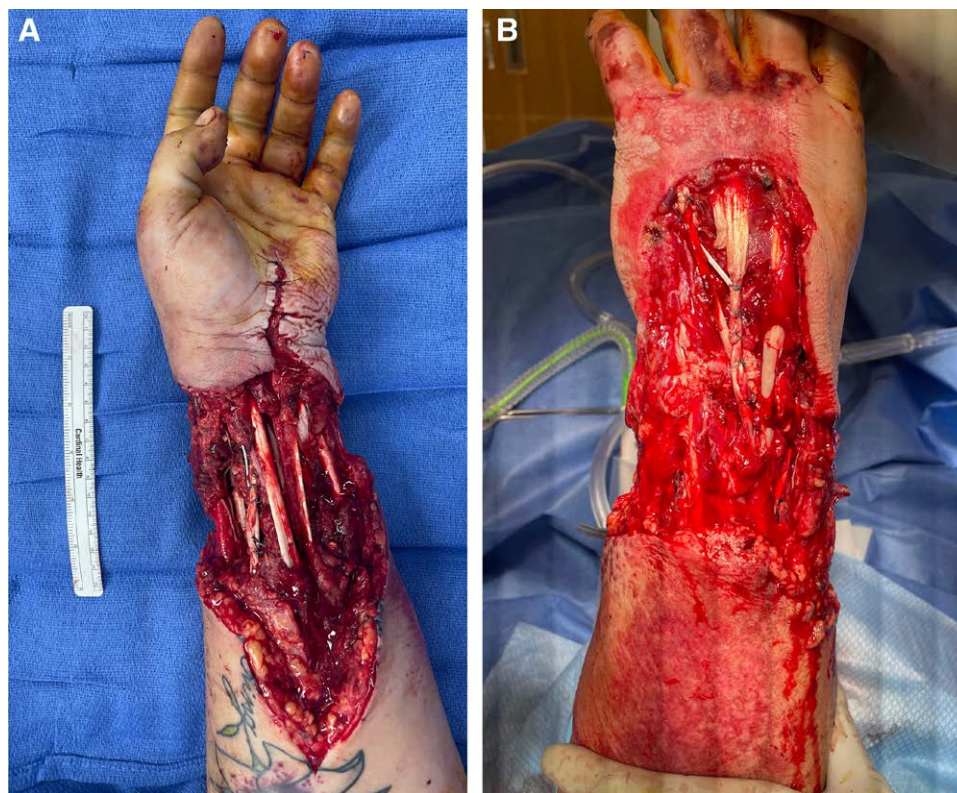
### Case 2

A 43-year-old female polytrauma patient presented with an open distal radius and ulna fracture with associated soft-tissue degloving from a motor vehicle crash. She underwent immediate washout and debridement with stabilization of the fracture and application of a negative pressure dressing. She was brought back to the operating room 48 hours later for further debridement, allograft bone grafting of the radius, brachioradialis to flexor pollicis longus and extensor digit minimi and EDC small to EDC ring finger tendon transfers (Fig. 3). Novosorb BTM (300 cm<sup>2</sup>) was applied directly over the exposed tendon transfer sites volarly and dorsally and bolstered with a negative pressure dressing because of the size of the wound. She was discharged from the hospital on POD 9 and seen as an outpatient on POD 15; at this time, therapy with an early, active range of motion protocol was initiated. The template demonstrated complete vascularization on POD 64; however, the patient was



**Fig. 2.** Stable soft tissue coverage of the dorsal hand at final follow-up 176 days postoperatively. Wound was allowed to spontaneously re-epithelialize without need for skin grafting.





**Fig. 3.** Postoperative day 2 at the time of volar (A) and dorsal (B) tendon transfer and application of Novosorb BTM. A small portion of the radius plate can be seen in the volar wound bed as well.

focused on therapy and comfortable with her wound care. She elected to delay split-thickness sheet grafting until POD 94. At final follow-up (POD 236), she demonstrated stable soft tissue coverage and excellent tendon gliding under the dermal template. Range of motion measurements were not recorded; however, clinical outcome demonstrating good finger range of motion was achieved. [See Video 2 (online), which displays postoperative day 236, showing pliability of the skin graft over the dermal template and good finger range of motion.]

### DISCUSSION

Complex upper extremity soft tissue defects with associated tendon injury are routinely reconstructed with autologous flaps to achieve stable soft tissue coverage and maximize tendon gliding. However, this often requires hospitalization, longer surgical times, and microsurgical capabilities and is associated with varying degrees of donor site morbidity. This can be appreciated in the patients shown above, who previously would have required reconstruction with a posterior interosseous artery flap with concomitant skin grafting of the donor site (case 1) and free latissimus muscle transfer with skin graft (case 2). We previously reported on outcomes after use of Novosorb BTM for complex upper extremity soft tissue defects with exposed bone and/or tendon.<sup>6</sup> As a result of these encouraging findings, we have further expanded our indications for soft tissue reconstruction using Novosorb BTM to include defects with associated tendon injury requiring tenorrhaphy.

This report demonstrates that excellent tendon gliding and functional outcomes comparable to what would be achieved with autologous flap reconstruction are possible with Novosorb BTM. One of the critical keys to success using this approach is an early, active postoperative therapy protocol, which should be the same as what would be used for a patient without an associated soft tissue injury. Despite these encouraging findings, further study comparing outcomes between Novosorb BTM and autologous reconstruction are needed to confirm our findings and better refine indications for this new approach.

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### DISCLOSURES

*Kyle Chepla is a paid consultant for Polynovo, the manufacturer of BTM. Christopher Jou has no financial interest to declare in relation to the content of this article.*

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