




Use of Biodegradable Temporizing Matrix for Pediatric Tendoachilles Exposure: A Novel Technique in Complex Traumatic Wound Management—A Case Report

Padmalakshmi Bharathi Mohan¹  RaviKumar Chittoria² Shanmugapriya Ramalingam¹
Bharath Prakash Reddy¹ Kanav Gupta¹ Jacob Antony Chakiath¹

¹ Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry, India

² Department of Plastic Surgery & Telemedicine, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry, India

Address for correspondence Padmalakshmi Bharathi Mohan, MS, DNB, M.Ch, Department of Plastic Surgery, JIPMER, Pondicherry 605006, India (e-mail: pebeyem@gmail.com).

Indian J Plast Surg

Abstract

Management of complex wounds in the pediatric population is a herculean task due to the decreased surface area available for flaps and the added scars from flap reconstruction. Biodegradable temporizing matrix (BTM) has proven useful, particularly in adult burns and complex wounds. Only a few have documented the use of BTM in complex wounds in children. A 2-year-old child presented with tendoachilles exposure of the right ankle due to a crush injury in the spokes of a motorcycle. The wound was debrided and covered with BTM. After 5 weeks, the same was delaminated, healthy granulation tissue was found covering the tendoachilles, and the raw area was grafted. BTM proved to be a versatile option for converting a complex wound to a superficial wound, and it abetted the drawbacks of a flap cover: extended hospital stay, discomfort, prolonged immobilization, and additional scars.

Keywords

- pediatric
- complex wound management
- biodegradable temporizing matrix

Introduction

Pediatric complex wound management has always been proved to be a challenge due to donor site morbidity, prolonged hospital stay, prolonged immobilization, and additional scars and wound infection. Research on a suitable alternative for flap covers for complex wounds has been ongoing for a few decades. The invention of artificial dermal matrices has been a cornerstone in the management of complex wounds. Novo-Sorb Biodegradable Temporizing Matrix (BTM; PolyNovo Ltd, Port Melbourne, Victoria, Australia) has been used to manage adult complex wounds since 2015.¹ BTM consists of two layers: an outer sealing membrane, which is a transparent

temporary layer that gives a physiological wound closure and limits evaporative loss,² and an inner 2-mm bioabsorbable matrix, allowing cellular infiltration while acting as a scaffold.³ It is a two-stage procedure where, after initial debridement of the wound, the BTM material is applied and allowed to integrate for 3 to 5 weeks. A blanchable tissue underneath the dressing material indicates the end of integration.¹ After ensuring adequate integration, the outer layer is removed under a sterile environment, and the underlying granulation tissue is grafted.

The use of BTM has been well documented in burns and complex wounds in adults.^{4–6} Only three documented case

DOI <https://doi.org/10.1055/s-0044-1789006>.
ISSN 0970-0358.

© 2024. Association of Plastic Surgeons of India. All rights reserved.
This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)
Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

reports⁷⁻⁹ and one 63-patient case series are available for the pediatric population, all out of the country.¹⁰ No reports are available in India regarding the use of BTM in a complex wound in a child younger than 5 years. We report a case of Achilles' tendon exposure in a 2-year-old child following trauma, which was successfully managed without a flap cover using a BTM.

Case Report

A previously healthy 2-year-old boy presented to our emergency department with an alleged history of sustaining an injury to his right heel when he accidentally put it in the spokes of a moving motorcycle wheel. The child had no other injuries except the one he presented with. The child had no other congenital anomalies. He was immunized to date and attained milestones for age. On examination, he had a 5 × 5 cm raw area in the right tendoachilles region, exposing the bare tendon. No bony injuries were noted clinically or radiologically. All investigations were within normal limits. The child was immediately taken up for debridement under general anesthesia (GA). The nonviable edges were trimmed, and the base scooped out and sent for tissue culture. The resultant wound was covered with a 5 × 5 cm BTM and was fixed with skin staples. The ankle was immobilized with a POP splint.

The first look dressing was done on day 5. No apparent infection was noted. The child was discharged and was on regular follow-up every 5 days. After adequate matrix adhesion at 2 weeks, the POP splint was removed, a crepe bandage was applied, and the child was encouraged to move his ankle. Satisfactory integration was identified by blanchable granulation tissue under the matrix—this was noted after 4 weeks. In the fifth week, the child was taken up under GA. Staples were removed, and the outer layer was delaminated. The tendoachilles was covered with granulation tissue, and there was no breakdown on moving the ankle. The underlying granulation tissue was superficially scraped to remove any biofilm, and the wound was grafted with intermediate-thickness split skin graft (SSG) harvested from the right thigh. The first dressing was done on day 3, followed by subsequent dressings on day 5, with staple removal on day 7. The child was discharged on day 8. After postoperative day 14, the child was encouraged to walk and has recovered fully.

Discussion

Wound healing is a complex process, and wound care products have evolved from simple gauze dressings to complex bioengineered tissue products. Various matrices have been developed to convert a complex wound into a graftable wound. Integra consists of a dermal component of bovine collagen type I and shark chondroitin-6-sulfate directed to the wound site and an outwardly directed silicone membrane. MatriDerm is a single-use three-dimensional matrix composed of native, structurally intact bovine collagen fibrils and elastin for supporting dermal regeneration. The development of BTM began at the Royal Adelaide Hospital in South Australia at the end of 2004¹¹ and has since been used in managing various wounds like burns and necrotizing fasciitis.¹² BTM carries the

advantage of not containing sensitizing proteins, reducing wound size, decreased scar formation, and delivering a better aesthetic outcome than by immediate SSG.¹³

Greenwood et al¹⁴ described using BTM in burns as providing a temporary skin cover postdebridement, reducing systemic and local infection, decreasing the metabolic need, and helping in wound bed preparation for grafting.

Although extensively used, literature on BTM application in the pediatric population is limited. Teelucksingh et al⁷ described the use of BTM in a 7-year-old child with a complex wound exposing the tibia and fibula, where the wound was grafted, and further bone fixation was done through the stable graft and BTM. Kelly et al⁸ used BTM in an 8-year-old boy with 86% burns and reported complete recovery but minimal hypopigmentation. Crowley et al⁹ reported the use of BTM in a 9-year-old child with extensive soft-tissue injuries to his groin, left and right thighs, and lower abdomen with penile degloving injury, exposed left iliac crest fracture, and avulsion of scrotum and bilateral testicle exposure. All the wounds were covered with skin graft.

The most extensive retrospective case series on the use of BTM in children was done by Storey et al¹⁰ on 63 children with various etiology of complex wounds. They reported that the median time for application of BTM was 7.5 days and 27 days from the time of application of BTM to SSG. They also concluded that BTM provided a satisfactory option for early wound coverage and could convert complex wounds to graftable ones.

Conclusion

BTM is a valuable addition to the plastic surgeon's reconstructive repertoire, particularly in the pediatric population, where there is a paucity of flaps to reconstruct large complex wounds. The limitation of our report is that it presents a single case, reporting only short-term outcome data. A multicenter study with long term follow up would help to extrapolate our results to the general population.

Funding

None.

Conflict of Interest

None declared.

Acknowledgments

The author would like to express her sincere gratitude to Dr. Chirra Likhitha Reddy, Associate Professor, Department of Plastic Surgery, AIIMS Mangalagiri, for her invaluable suggestions, which were instrumental in conceptualizing the use of BTM for the patient, forming the core of this study.

References

- 1 Wagstaff MJ, Schmitt BJ, Coghlan P, Finkemeyer JP, Caplash Y, Greenwood JE. A biodegradable polyurethane dermal matrix in reconstruction of free flap donor sites: a pilot study. *Eplasty* 2015; 15:e13
- 2 Greenwood JE, Dearman BL. Comparison of a sealed, polymer foam biodegradable temporizing matrix against Integra® dermal

- regeneration template in a porcine wound model. *J Burn Care Res* 2012;33(01):163–173
- 3 Dearman BL, Li A, Greenwood JE. Optimization of a polyurethane dermal matrix and experience with a polymer-based cultured composite skin. *J Burn Care Res* 2014;35(05):437–448
 - 4 Wagstaff MJ, Caplash Y, Greenwood JE. Reconstruction of an anterior cervical necrotising fasciitis defect using a biodegradable polyurethane dermal substitute. *Eplasty* 2017;17:e3
 - 5 Jennings M, Willet J, Coghlan P, Solanki NS, AM JE. Biodegradable temporising matrix in severe meningococcal septicaemia: a case report. *Australasian Journal of Plastic Surgery*. 2021;4(01):67–70
 - 6 Li H, Lim P, Stanley E, et al. Experience with NovoSorb® biodegradable temporising matrix in reconstruction of complex wounds. *ANZ J Surg* 2021;91(09):1744–1750
 - 7 Teelucksingh S, Chang C, Henton J, Lewis CJ. Immediate application of biodegradable temporising matrix to a muscle free flap for complex soft tissue reconstruction. *Eplasty* 2022;22:e29
 - 8 Kelly C, Wallace D, Moulin V, et al. Surviving an extensive burn injury using advanced skin replacement technologies. *J Burn Care Res* 2021;42(06):1288–1291
 - 9 Crowley K, Balaji S, Stalewski H, Carroll D, Mariyappa-Rathnamma B. Use of biodegradable temporising matrix (BTM) in large trauma induced soft tissue injury: a two stage repair. *J Pediatr Surg Case Rep* 2020;63:101652
 - 10 Storey K, Lalloz M, Choy KT, et al. The versatility of biodegradable temporising matrix: a 63 paediatric case series with complex wounds. *Burns Open* 2023;7(02):44–50
 - 11 Li A, Dearman BL, Crompton KE, Moore TG, Greenwood JE. Evaluation of a novel biodegradable polymer for the generation of a dermal matrix. *J Burn Care Res* 2009;30(04):717–728
 - 12 Wagstaff MJ, Salna IM, Caplash Y, Greenwood JE. Biodegradable temporising matrix (BTM) for the reconstruction of defects following serial debridement for necrotising fasciitis: a case series. *Burns Open* 2019;3(01):12–30
 - 13 Polynovo. NovoSorb™ BTM (Biodegradable Temporizing Matrix). 2021. Accessed July 31, 2024 at: <https://www.woundsource.com/product/novosorb-btm-biodegradable-temporizing-matrix>
 - 14 Greenwood JE. The evolution of acute burn care: retiring the split skin graft. *Ann R Coll Surg Engl* 2017;99(06):432–438