

# Salvage and Reconstruction of the Mangled Hand: A Case Study Utilizing a Multi-Composite Tissue Product Reconstructive Approach

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## Abstract

**Objective:** To evaluate the efficacy of a novel reconstructive approach utilizing Multiple Composite Tissue Products (MCTPs) in severe hand injuries with risk of amputation.

**Methods:** A comprehensive, single MCTP operation was performed at a single institution involving three tissue products to salvage the nerves, tendons, bone, and skin. This patient case study exemplifies the successful reconstruction of a mangled hand.

**Results:** The application of three tissue products resulted in securing the integrity of the mangled hand's structures and preservation of basic hand and wrist function, obviating the need for amputation. The patient regained significant restoration substantiating the safety and efficacy of this approach for structural, functional, and cosmetic outcomes.

**Discussion:** Preoperative assessment and multi-disciplinary coordination of care was imperative in optimizing the successful outcomes. The patient's medical history was complicated by diabetes mellitus, neuropathy, and osteonecrosis. Intensive postoperative rehabilitation, including Passive and Active Range of Motion (PROM, AROM), contributed to recovery and outcomes.

**Significance:** The MCTP reconstructive approach is a promising avenue for optimizing tissue viability to recover from mangled hand injuries. The amelioration of adhesion formation directs proper tissue recovery which conserves tissue that might otherwise necessitate further excision, and possibly amputation. Per patient centered outcomes, this strategy mitigated extensive pain and minimized scarring, which enhanced the cosmetic appeal of reconstructing the mangled hand. These findings underscore the reconstructive potential of a MCTP approach in complex hand salvage, contributing to the recovery of function and cosmetic appeal. Future research should aim to validate similar findings of this case study strategy in a larger cohort.

**Keywords:** Hand and Wrist, Salvage and Reconstruction, Tendon Repair, Nerve Regeneration, Tissue Product

## Introduction

Multiple composite tissue product reconstructive approach can result in increasing the opportunities for functional and cosmetic results. Patients with complex injury, tissue defects, and compromised by infection and vascularity are often faced with the potential for permanent disabling defect. [1-4]

## Method

The plan was to perform a reconstruction that combined the use of Collagen, Bilayer, Conduit, and Reinforced composite tissue product. Nerves, tendon, bone, and skin were all repaired during the same procedure using Multiple Composite Tissue Products. This presentation highlights a patient case study which is being implemented for other suitable candidates in the Katranji Hand Center of East Lansing, Michigan.

## Results

The approach resulted in recovery of basic hand and wrist function with prevention of amputation. The patient was able to regain significant amount of independent function as a result of this reconstructive approach. We conclude that a multiple composite tissue product approach is a safe and effective approach to be performed in a single procedure to regain functional and cosmetic result.

## Discussion

Critical assessment of tissue viability and reduction in degree of contamination allowed for preservation of vital structures. To reestablish function and cosmesis, expectations must be realistically outlined. Patient has to be mentally and emotionally competent to undertake the necessary therapeutic and wound care to allow for this approach to succeed. Constant coordination of care conferences was sealed to maintain ensure buy in from all care partners. A patient with diabetes mellitus and neuropathy was involved an MVA crushing injury to the left hand with resultant open wounds, tendon and bone injuries. The patient suffered other injuries. His recovery was complicated by a severe infection, osteonecrosis, multiple surgeries, and the determination that his left hand will be amputated. The patient transferred to our care from another state with a strategy of staged reconstruction of the left hand and wrist tissues. After negative cultures were obtained, Bone graft substitute was used to facilitate carpal fusion. Tendon grafts with re-enforcement using Neuragen<sup>2</sup> tubes and n-force, along with Tenoglide<sup>1</sup> was used to reconstruct the tendons. Biomatrix<sup>3</sup> Bilayer was used to close defects where flaps could not reach. Patient underwent an aggressive Passive Range of Motion (PROM) and Active Range of Motion (AROM) therapy protocol to maintain joint mobility. Serial Monitoring of the wound was carried out as well. The result was successful prevention of left hand and wrist amputation with basic claw function of the hand.



**Figure 1:** Tenoglide tendon protector sheet.



**Figure 2:** Neuragen Collagen Tube.



**Figure 3:** Intra Operative photo.



**Figure 4:** Post Operative photo.

## Conclusion

Multiple composite tissue reconstructive approach optimizes tissue recovery and healing. It facilitates reduction in adhesions and improved the degree of pain experienced. It increases the ability to recover tissue that would otherwise be excised, amputated, or irreversibly damaged. This patient regained the basic function of the hand while also possessing cosmetic appeal of the hand with minimal scarring.

## Biological Substitute References

Tenoglide<sup>1</sup>- "Engineered to shield and protect tendon injuries during the healing process. Tendon repair is often associated with excessive scarring in the form of tissue that bridges the tendon sheath and the tendon. The formation of this scar tissue is associated with increased resistance to motion and therefore greater mechanical force is required for movement of the tendon. TenoGlide® Tendon Protector Sheet is an advanced tendon protection device comprised of a porous matrix of cross-linked highly purified+ Type I collagen and glycosaminoglycan (GAG)."

Neuragen<sup>2</sup>- "NeuraGen® Nerve Guide is a biocompatible, semi-permeable, absorbable Type 1 collagen tube. It provides a protective environment across nerve discontinuities, as well as an isolated conduit environment guiding axonal regrowth, and is resorbed via normal metabolic pathways."

Biomatrix<sup>3</sup> - "Advanced BioMatrix manufacturers and distributes high quality collagen including PureCol® for cell culture, gels, coatings and other research uses."

## Statement of Ethics

This study does not require institutional review board approval because this study is based exclusively on the case presented at the Katranji Hand Center. Patient consent attained per this case study.

## Conflict of Interest Statement

The authors have no conflicts of interest to declare.

## References

1. "TenoGlide® Tendon Protector Sheet." *Integralife.com*, 2023, [www.integralife.com/tenoglide-tendon-protector-sheet/product/nerve-tendon-tenoglide-tendon-protector-sheet](http://www.integralife.com/tenoglide-tendon-protector-sheet/product/nerve-tendon-tenoglide-tendon-protector-sheet). Accessed 26 Aug. 2023.
2. *Integranerve.com*, 2023, [www.integranerve.com/nerve-guide](http://www.integranerve.com/nerve-guide).
3. "Advanced BioMatrix - Collagen." *Advancedbiomatrix.com*, [advancedbiomatrix.com/collagen/](http://advancedbiomatrix.com/collagen/). Accessed 26 Aug. 2023.
4. Odell, Tim. "Integra Life Sciences Launches TenoGlide™ Tendon Protector |." *Medgadget*, 14 Feb. 2007, [www.medgadget.com/2007/02/integra\\_life\\_sc.html](http://www.medgadget.com/2007/02/integra_life_sc.html). Accessed 26 Aug. 2023.

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