

Use of CHECKPOINT NEUROSHIELD™ Chitosan Membrane in a nerve-protecting tenolysis

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Case Presentation

A 13-year-old right hand dominant male competitive tennis player sustained a palmar zone 2 laceration to the right index finger two days prior. Examination demonstrates the inability to actively flex the distal interphalangeal (DIP) and proximal interphalangeal (PIP) joints; however, joints have full passive range of motion without instability. There is decreased two-point discrimination on the ulnar border of the index finger. Allen's test of the digital arteries reveals no abnormalities. The patient underwent a 6-core repair of the flexor digitorum profundus (FDP) tendon, repair of the flexor digitorum superficialis (FDS) tendon to its insertion on the middle phalanx, and ulnar digital nerve six days after injury.

After nearly 9 months of extensive hand therapy, the patient had recovered 0-85 degrees of metacarpophalangeal (MP) joint active range of motion, 0-75 degrees of proximal interphalangeal (PIP) joint active range of motion, but only 0-25 degrees of distal interphalangeal (DIP) joint active range of motion. He had regained full passive range of motion of the MP and interphalangeal (IP) joints. The patient had 30 pounds (lbs.) of grip and 14 lbs. of lateral pinch strength. He had completely recovered two-point discrimination in the ulnar digital nerve. The patient also demonstrated soft, persistent palmar soft tissue swelling in the digit refractory to therapeutic techniques.

The patient's biggest difficulty at this time was an inability to return to competitive tennis due to the lack of active range of motion in the DIP and the persistent palmar soft tissue swelling in the digit.

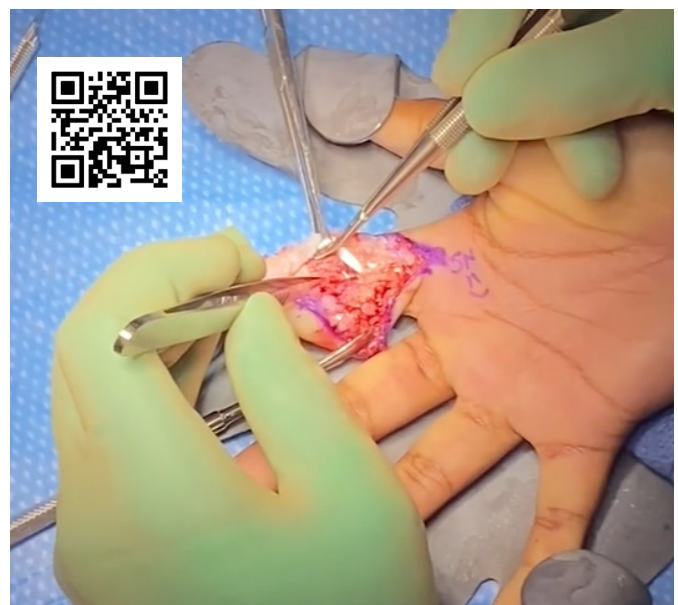
Preoperative Plan

Wound exploration, debulking of palmar soft tissues, and flexor tenolysis. Patient would then begin aggressive hand

therapy on post-operative day three. The goal of the surgery would be to identify an etiology for the persistent swelling of the digit; protect the digital nerve repair and surrounding tissue from further scar formation; and identify and treat adhesions that were preventing pull through of the FDP tendon.

Operative Findings and Approach

A midsagittal incision was made along the radial border of the index finger extending palmarly over the digit proximally and distally. Blunt dissection raised a full-thickness, ulnar based skin flap. A well-healed flexor tendon repair was noted for both the FDP and FDS tendons. There was found to be large areas of tenosynovitis at the FDS insertional repair that were the cause of the patient's persistent palmar soft tissue swelling. We examined the ulnar digital nerve repair, which was found to be intact.



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However, the nerve repair site was intimate with the suture tenosynovitis and had to be gently dissected. These were excised, and the suture knots from the FDS repair were removed, leaving the FDS repair intact.

The FDP had become scarred and adhered at the level of the tenosynovitis around the A4 and A5 pulleys, explaining the patient's inability to progress active range of motion of the DIP joint. A full tenolysis of the FDP tendon was performed resulting in unimpeded pull through of the tendon when tested.

It was at this point a 20 x 30 mm CHECKPOINT NEUROSHIELD™ Chitosan Membrane was trimmed and secured to the radial and ulnar phalangeal fibro-osseous sheath (e.g., the "ever present rim") over the palmar middle phalanx using 9-0 Nylon suture. This was done to protect neural structures and prevent scar tissue formation, resulting in recurrent disability. The FDP was then pulled and relaxed at the level of the A1 pulley to simulate active digital range of motion. The NeuroShield chitosan membrane did not bunch or displace, and the suture fixation to the "ever present rim" remained intact.

Follow-up

On post-operative day 3, the patient began aggressive hand therapy. At this appointment, the patient demonstrated 0-85 degrees of MP joint active range of motion, -11-65 degrees of PIP joint active range of motion, and -15-36 degrees of DIP joint active range of motion. Intact two-point discrimination and sensation to light touch.

At 12 weeks post-operatively, the patient demonstrated 0-85 degrees of MP joint active range of motion, 0-90 degrees of PIP joint active range of motion, and 0-50 degrees of DIP joint active range of motion. Intact two-point discrimination and sensation to light touch. The patient has returned to competitive tennis for the first time in nearly two years.

Discussion

The NeuroShield chitosan membrane provides key benefits in primary and revision digital nerve repair surgery as an interface between nerves and surrounding tissue, such as the flexor tendon. As demonstrated in preclinical and clinical evidence, multiple properties of chitosan membranes are beneficial when treating peripheral nerve injuries, including, but not limited to its anti-inflammatory properties, its ability to support tissue healing, its resorption profile, and, maybe most importantly in this case, its ability to inhibit fibroblast migration and proliferation. NeuroShield may aid in the prevention of adhesions and scar tissue formation that could necessitate a revision surgery and can also aid in revision surgeries as described in this case study to facilitate patient recovery and improve outcomes. This patient to date has had no complications or setbacks related to NeuroShield. It is an implant that is easy to use and may be beneficial for patients.

About the Author



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CHECKPOINT NEUROSHIELD™ is indicated for the repair of peripheral nerve injuries in which there is no gap or where a gap closure can be achieved by flexion of the extremity. Checkpoint NeuroShield nerve membranes are designed exclusively for single use. Allergic reactions to implanted products containing chitosan are not yet known. However, since chitosan is derived from shellfish, individuals with known shellfish allergies should exercise caution in the use of any product containing chitosan. As with all procedures carried out on peripheral nerves, there is a risk of the nerve not regenerating. Please see Instructions for Use for complete product specifications, indications, contraindications, precautions, and warnings at CheckpointSurgical.com/ifu.

Note: Case reports are company funded and not peer reviewed.