Integra®

NeuraGen® Nerve guide
NeuraWrap™ Nerve protector

Limit uncertainty with advanced collagen solutions for nerve repair and protection
"Competitive products by NCAs" designed structure

The underlying technology of the NeuraGen® Nerve guide and the NeuraWrap™ Nerve protector is based on the Ultra-Pure Collagen™ implant, specially designed to isolate and to provide an ideal environment for the growth of Schwann cells and the extension of axons, elements responsible for functional recovery following nerve injury.

The Integra's Ultra-Pure Collagen™ Technology minimizes pathogenic and immuno-rejection concerns to allow the success of nerve repair. A,B


Enables controlled resorption. Provides mechanical resistance to compression from surrounding tissue. 1

A porous outer layer

Provides for cellular ingrowth and appropriate nutrient diffusion. C,D 2

Nutrients

Neurotrophic Factors (BDNF, CNTF, NT3, NT4)

Growth Cone on Axon

A semi-permeable inner membrane

Allows passage of small molecules (i.e. water, ions, metabolites, nutrients) to support nerve regeneration 3 and prevents the escape of endogenous growth factors (i.e. Nerve Growth Factor). 4

Schwann cells

Nerve Growth Factor

Smooth inner membrane

Provides an environment for the organization of axonal growth. 4 Allows for easy insertion of the nerve stump into the tube.
Animal Study: Proven Positive Performance*

*Monkey median nerve repaired by nerve graft, direct suture or collagen nerve guide tube
Number of monkey treated: 8

Pre-clinical study demonstrates:

- Functional recovery (sensory and motor) equivalent to direct suture repair and short nerve grafting and stable over long time periods (3 to 4 years).
- Significantly faster rate of recovery than sutures (p<0.001).

Human Study: prospective randomized trial of 43 patients showed that the use of a collagen conduit like NeuraGen proved to be safe for nerve lacerations in the forearm compared to standard technique

Michel E. H. Boeckstyns, MD, Allan Ibsen Sørensen, MD, Joaquin Fores Viljeta, MD, Birgitta Rosén, PhD, Xavier Navarro, MD, Simon J. Archibald, PhD, Josep Valss-Solé, MD, Mihai Moldovan, MD, Christian Krarup, MD.

Collagen Conduit Versus Microsurgical Neuropraphy: 2-Year Follow-Up of a Prospective, Blinded Clinical and Electrophysiological Multicenter Randomized, Controlled Trial

Study design
Prospective randomized trial of 43 patients (44 nerve lacerations).
Nerve repairs were performed using a collagen tube (Neuragen) or conventional repair (direct fascicular repair or nerve grafting).
Nerve tissue losses of more than 20 mm were excluded.

Main results
Time for nerve repair was significantly longer in control group compared to Neuragen group (27 minutes ± 3 vs. 16 minutes ± 2 respectively, p<0.005).
Neurophysiological results at 12 months: distal motor latency significantly longer and compound muscle action potential significantly lower in the Neuragen group compared to control group (p<0.05).
Neurophysiological results at 24 months: no difference in the amplitudes, latencies, and conduction velocities between the 2 groups.
Rosen hand function at 12 months: motor domain significantly better recovered in control group than in Neuragen group (p<0.05).
Rosen hand function at 24 months: no significant difference.
Complications: no surgical complication of infection, extrusion of the conduit or other local adverse reaction, or development of a chronic regional pain syndrome.

Interest
Randomized controlled study.
No difference between the 2 repair techniques after 24 months, a further recovery is observed between 12 months and 24 months in the Neuragen group.
Application of NeuraGen® Nerve guide

The NeuraGen® Nerve guide is an absorbable collagen tube designed to be an interface between the nerve and the surrounding tissue and to create a conduit for axonal growth across a nerve gap.

The NeuraGen® Nerve guide offers a rapid method for rejoining severed peripheral nerves, in contrast to conventional microsurgical techniques.

**The NeuraGen® Nerve guide**

- Provides a protective environment and conduit for axonal regrowth across a nerve gap.
- Simple, rapid entubulation repair designed to minimize surgical procedure time and potential for scar formation and tissue ingrowth.
- Demonstrated functional recovery equivalent to nerve graft and direct suture.
- Replaces the need for short gap nerve graft and eliminates nerve harvest procedure and potential donor site complications.
- Readily available supply, extended shelf-life, dependable and precise sizing.

**Step 1**
Determine Neuragen® Nerve guide size and hydrate it.

**Step 2: First suture**
Recommendation: 7-0 to 10-0 monofilament, non resorbable suture.

**Step 3: Saline flush**

**Step 4: Second suture**

**Step 5: Final saline flush**

**Step 6: Completed repair**

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Removal of Schwannoma

**Diagnosis**
Surgical Removal of a Tibial Nerve Schwannoma.

**Surgical Treatment**
The procedure is performed with regional (spinal) anaesthesia. The patient is placed in the supine position to maximize exposure of the tumor. A skin incision is made over the course of the nerve on the left internal retro-malleolar.

**Patient case**
A 49-year old man suffering from a schwannoma on the left posterior tibial nerve**.

**Clinical case from Dr. Deleuze, hand surgeon, Clinique de la Basilique, Brussels, Belgium**

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1. **Step 1: Posterior tibial nerve schwannoma**
   Dissection continues on malleolar peroneal groove through subcutaneous fat and reveals a solid well-circumscribed mass involving the posterior tibial nerve.

2. **Step 2: Enucleation of schwannoma and involved fascicles**
   First dissection of the mass is done then a loop magnification is used to allow identification of the fascicles coursing over the tumor and dissection is continued along the nerve. The schwannoma is removed “en bloc”.

3. **Step 3: Nerve gap after neuroma excision, determination of the size of the NeuraGen® Nerve guide**
   The surgical removing of the tibial nerve schwannoma leads to the sacrifice of a part of the involved nerve fascicles to achieve total removal of the tumor.

4. **Step 4: Reconstructed tibial nerve - NeuraGen® Nerve guide fixed with sutures 8.0**
   The restoration of the nerve continuity is made with a NeuraGen® Nerve guide of 3 mm diameter and 3 cm length, fixated with sutures 8.0.

Wound closure is performed in layers and the patient is immobilized with a plaster cast.
Application of NeuraWrap™ Nerve protector

The NeuraWrap™ Nerve protector is an absorbable collagen implant that provides a non-constricting encasement for injured peripheral nerves for protection of the neural environment.

The wall of the conduit has a longitudinal slit that allows the NeuraWrap™ Nerve protector to be spread open for easy placement over the injured nerve.

**The NeuraWrap™ Nerve protector:**  
Designed to resist compression from surrounding tissues and to exclude scar tissue ingrowth.  
Aims at minimizing potential neuroma formation and subsequent nerve entrapment.  
Recovers and maintains closure once placed around nerve.  
Remains in place during active phase of tissue healing.  
Readily available supply, extended shelf-life, dependable and precise sizing.

**NeuraGen® Nerve guide & NeuraWrap™ Nerve protector are:**  
Composed of semi-permeable, porous, highly purified Type I Collagen.  
Biocompatible, completely absorbable via normal metabolic pathways.  
Flexible, pliable and compression resistant.  
With open structure to facilitate suture placement.

1. **Step 1**  
Determine nerve diameter and choose appropriate NeuraWrap™ Nerve protector size.

2. **Step 2**  
After hydrating, open wrap slit and place over the injured nerve.

3. **Step 3**  
Close slit with a running suture technique.

4. **Step 4**  
Rotate wrap so that the suture line is away from the injured soft tissue.

5. **Step 5**  
Additional stay suture(s) may be placed to prevent migration.

6. **Step 6**  
Completed repair.
Neurolysis of the medial dorsal cutaneous nerve

**Diagnosis**
Chronic pain on the right foot.

**Surgical Treatment**
Exploration of the nerve documented a voluminous neuroma in continuity.

1. **Step 1: Medial dorsal cutaneous nerve**
The neuroma is then removed with a part of the nerve.

2. **Step 2: NeuraWrap™ Nerve protector of 2 mm diameter and 3 cm length wraps the injured nerve.**
To help the recovery of the nerve and to avoid the recurrence of the neuroma, a NeuraWrap™ Nerve protector is added.

**Indications NeuraGen®**
NeuraGen® is indicated for the repair of peripheral nerve discontinuities where gap closure can be achieved by flexion of the extremity.

**Contraindications NeuraGen®**
NeuraGen® is not designed, sold or intended for use except as described in the indications for use and is contraindicated for patients with a known history of hypersensitivity to bovine derived materials.

**Indications Neurawrap™**
Neurawrap™ nerve protector is indicated for the management of peripheral nerve injuries in which there has been no substantial loss of nerve tissue.

**Contraindications Neurawrap™**
Neurawrap™ nerve protector is not designed, sold or intended for use except as described in the indications for use and is contraindicated for patients with a known history of hypersensitivity to bovine derived materials.
# NeuraGen® and NeuraWrap™ Ordering Information

## NeuraGen® Nerve guide

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Products available in the following lengths:
- 2 cm
- 3 cm

## NeuraWrap™ Nerve protector

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Products available in the following lengths:
- 2 cm
- 4 cm

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### Additional Information for EMEA Customers only:
- Products mentioned in this document are CE class III. Please contact Integra customer service should you need any additional information on devices classification. All the medical devices mentioned on this document are CE marked according to European council directive 93/42/EEC on medical devices and its relatives, unless specifically identified as “NOT CE MARKED.”

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- CE 0086

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