Regeneration after peripheral nerve repair with Nerbridge® in segmental sciatic nerve defects in rats

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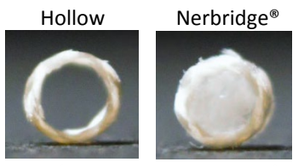
Introduction

Nerbridge®, artificial nerve graft that was put on the market in Japan recently, is polyglycolic acid (PGA) conduits filled with collagen matrix. However, no report has described motor function recovery after repair with Nerbridge® for a segmental defect model of a rat sciatic nerve. We compared outcomes treated with Nerbridge® and hollow Nerbridge®, which is processed with collagenase to get rid of inner collagen, for a rat segmental nerve defect model.

Materials and Methods

- 20 adult male Wistar rats; a mean weight of 200 g
- A unilateral 10-mm sciatic nerve defect was created.
- Nerbridge® is PGA conduit filled with collagen matrix.
- Four groups based on the type of repair:

1) Sham
2) Autograft; reversed autologous graft
3) Hollow Nerbridge® (Hollow);
   Collagenase treatment of Nerbridge®
4) Nerbridge®



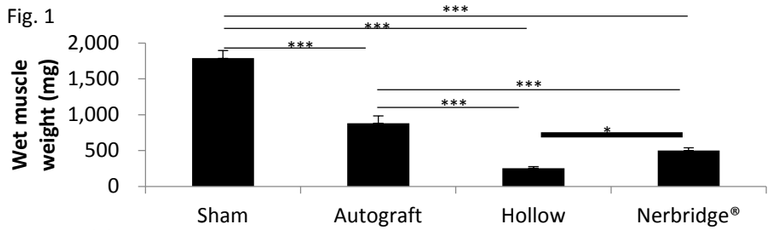
- Function recovery was evaluated at 12 weeks postoperatively

1) Wet weight of tibial anterior (TA) muscle
2) Compound muscle action potential (CMAP)
3) Terminal latency
4) Isometric tetanic force
   Shin RH et al. Microsurgery. 2008
5) Histological evaluation;
   Immunofluorescence for neurofilament 200 (NF200) and myelin basic protein (MBP).

Results

The mean wet muscle weight was two times greater in Nerbridge® group than that in hollow Nerbridge® group (Fig. 1).

Fig. 1



Terminal latency in Nerbridge® group was shortened compared to that in hollow Nerbridge® group (Fig. 2), whereas no difference in **CMAP** was observed between these two groups (Fig.3).

Fig. 2

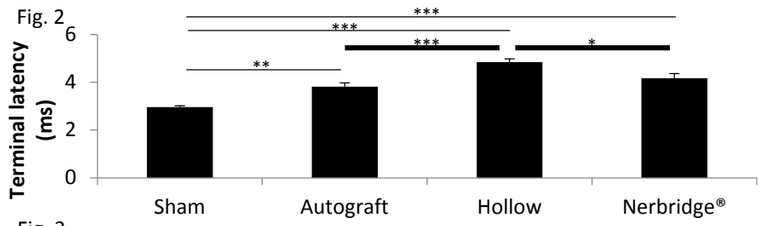
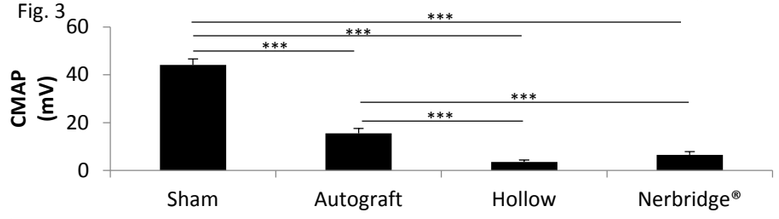
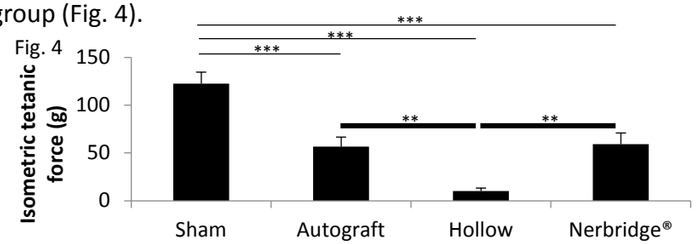


Fig. 3

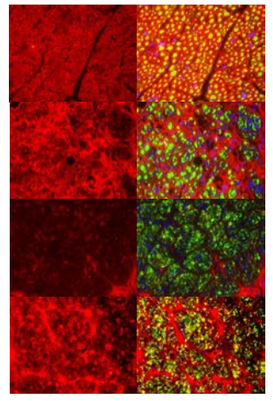


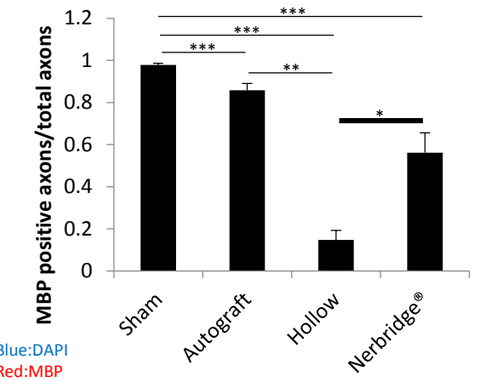
The isometric tetanic force in Nerbridge® group was six times greater than that in hollow group and almost the same as that in autograft group (Fig. 4).

Fig. 4



Histologically, Nerbridge® group showed the increasing number of MBP-positive axons by approximately four-fold compared with that in Nerbridge® group.





Conclusion

- The artificial nerve grafts available for clinical application so far have hollow structures except for allografts.
- In this study, we proposed that Nerbridge®, composed of outer PGA conduit and inner collagen, had the greater ability to regenerate after peripheral nerve injury than hollow Nerbridge®.
- Nerbridge® has a potential to bring more effective outcomes after peripheral nerve injury compared with artificial nerve grafts with hollow structures commercially available so far.