

Branched nerve regeneration using non-tubular artificial nerve sheetsYoshihisa Suzuki^{1, 2}, Namiko Ishikawa¹, Junko Okano² and Tomonori Habuchi³¹Kitano Hospital, Japan²Shiga University of Medical Science, Japan³Akita University, Japan

Tubular artificial nerves are used to bridge the damaged peripheral nerves when end-to-end anastomosis is not possible. However, there are several limitations, including the need for a device of various diameters depending on the diameter of the nerve to be regenerated, and the inapplicability of the device to the damaged sites that are branched into a Y-shape. In order to overcome these limitations, we developed artificial nerve sheets made of alginate. Since they are sheets, they can be used with nerves of various diameters and with complex branches. Thus, we evaluated the use of the artificial nerve sheets in nerve regeneration. These sheets were created by covalent cross-linking of alginate, a polysaccharide derived from brown seaweed. First, we implanted the alginate sheet to bridge a 5-cm gap in the sciatic nerve of a cat and demonstrated nerve regeneration. In a clinical trial, we demonstrated that the sheets regenerated the human digital nerve. We then used the sheets to regenerate gaps in branched sites, which was not possible with the previous tubular artificial nerves. In this study, we used a rat model to create a nerve defect in the site where the sciatic nerve branched into the peroneal and tibial nerves. In this model, the alginate sponge-like sheets were implanted to bridge the nerve gap and led to nerve regeneration. Furthermore, we used a rat model of defects in the pelvic nerve plexus and cavernous plexus to evaluate the use of the sheets in defects in the nerve plexus where nerves form a network. In this experiment, we demonstrated that the implantation of the sheets improved urinary and erectile function of the rats. This finding suggested that the sheets may be used to prevent urinary dysfunction in patients undergoing uterine cancer surgery and erectile dysfunction in patients undergoing prostate cancer surgery.

Recent Publications

1. Suzuki Y, Ishikawa N, Tanihara M and Saito S (2016) Non-tubulation repair of peripheral nerve gap using heparin/alginate gel combined with b-FGF. *Plastic and Reconstructive Surgery Global Open* 4(1):e600.
2. Hashimoto T, Suzuki Y, Kitada M, Kataoka K, Wu S, Suzuki K, Endo K, Nishimura Y and Ide C (2002) Peripheral nerve regeneration through alginate gel -analysis of early outgrowth and late increase in diameter of regenerating axons. *Experimental Brain Research* 146:356-368.
3. Wu S, Suzuki Y, Tanihara M, Ohnishi K, Suzuki K, Endo K, Nishimura Y (2001) Sciatic nerve regeneration through alginate with tubulation or non-tubulation repair in cat. *Journal of Neurotrauma* 18:329-338.
4. Matsuura S, Obara T, Tsuchiya N, Suzuki Y and Habuchi T (2006) Cavernous nerve regeneration by biodegradable alginate gel sponge sheet placement without sutures. *Urology* 68:1366-1371.
5. Ishikawa N, Suzuki Y, Dezawa M, Kataoka K, Ohta M, Cho H and Ide C (2009) Peripheral nerve regeneration by transplantation of BMSC-derived Schwann cells as chitosan gel sponge scaffolds. *Journal of Biomedical Materials Research A* 89(4):1118-24.

Biography

Yoshihisa Suzuki obtained his MD and PhD degrees from Kyoto University, Faculty of Medicine, Kyoto, Japan during 1980-1986. Later he joined Kyoto University, Faculty of Medicine, Plastic Surgery Department as a Staff Member in June, 1986. In May 1987, he joined Osaka Red Cross Hospital as a Staff Member. He later held various positions as Staff Member (1990-1998), Assistant Professor (1998-1999) and Associate Professor (2000-2006) at Kyoto University, Faculty of Medicine, Plastic Surgery Department. From July 2006 to present, he is the Director, Department of Plastic Surgery at Kitano Hospital, Osaka. He is also a specially appointed Professor, Department of Plastic Surgery at Shiga University of Medical Science since 2015.

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