METHODS: Infraorbital nerve transection surgeries were performed on two groups (n=5 per group) of adult Lewis rats. In both groups, the infraorbital branch of the trigeminal nerve was transected. The transected nerve was then repaired primarily with 10-0 nylon suture with (treatment group) or without (no treatment group) the addition of a Poly(ester urethane) urea (PEUU) wrap impregnated with 20 mg of FK506. To evaluate neuroregeneration, trigeminal ganglion cell recordings, objective sensory testing, directional sensitivity, maximal response, and receptor compositions were analyzed from five rats in each group at four and six weeks postoperatively. Recordings from the trigeminal ganglion in naïve rats were taken for comparison. To assess local FK506 administration, blood and tissue samples (infraorbital nerve, muscle) were analyzed for FK506 concentration using liquid chromatography-mass spectrometry at four and six weeks postoperatively in the treatment group.

RESULTS: Data were analyzed using custom software written in Excel Visual Basic and the Excel add-on statistical package, Analyze-it (Analyse-it Software, LTD). Peri-stimulus time histograms (PSTHs) having 1 ms bins were constructed from spike times of individual single units. Responses to stimulus onsets (ON responses) were calculated during a 20 ms period beginning 1 ms after deflection onset; this epoch captures the initial, transient phase of the whisker evoked response. Rats within the treatment group (FK506 wraps) were found to have increased response magnitude at 4 weeks after implantation in the infraorbital cut and repair model in comparison to no treatment group (p<.013). FK506 blood levels at 4 and 6 weeks were close to the limit of quantification (<2 ng/ml), whereas concentration within the tissues of interest, the infraorbital nerve and muscle, were much higher.

CONCLUSION: This study investigates the use of an FK506-impregnated PEUU nerve wrap to improve functional recovery following peripheral nerve injury. Sensory testing provides objective data on the effects of these wraps in the treatment of peripheral nerve injuries and the FK wraps appear to accelerate nerve recovery at 4 weeks, with minimal systemic drug exposure. The findings from this study may translate into novel treatment systems and protocols to treat nerve injuries.

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Autologous Unpurified Adipose Tissue Enhances Peripheral Nerve Regeneration Through Long (30 + 40 mm) Autografts

Brian P. Cleary, BSc, Carrie A. Kubiak, MD, Scott W. Sabbagh, BSc, Vincent Thieu, BSc, Paul S. Cederna, MD, Stephen W. Kemp, PhD

University of Michigan, Ann Arbor, MI, USA

PURPOSE: Approximately 360,000 Americans suffer from upper extremity paralytic syndromes annually, leading to 8.6 million missed work days. The gold standard for peripheral nerve gap repair is autologous nerve grafting. Unfortunately, this approach yields suboptimal functional outcomes, often resulting in motor and sensory deficits and overall impaired quality of life. Adipose-derived stem cells (ASCs) have been previously shown to enhance peripheral nerve regeneration. However, ASC processing leads to both clinical and regulatory burdens. Unpurified fat is whole adipose tissue that is harvested without subsequent ASC isolation. In addition, harvesting of unpurified adipose tissue is currently approved by the FDA. The purpose of the present study was to investigate the effect of unpurified adipose tissue on nerve regeneration through long (30 + 40 mm) autografts in the rat.

METHODS: F344 rats were used in this study and were randomly assigned to one of four experimental groups: (1) 30 mm autograft; (2) 30 mm autograft + unpurified adipose tissue; (3) 40 mm autograft, and (4) 40 mm autograft + unpurified adipose tissue. All animals were tested at baseline, and were then followed serially for 12 weeks. Outcome measures included sensorimotor (ladder rung, walking track), and sensory pain assessments (von Frey). Terminal outcome muscle measures examined EMG (compound muscle action potentials, nerve conduction velocity) and muscle force parameters (twitch and tetanic forces).

RESULTS: Animals in both the 30 and 40 mm autograft + unpurified fat group displayed enhanced peripheral regeneration compared to the non-fat administered autograft groups. Specifically, these animals displayed increased EMG and muscle force parameters at study endpoint. Sensorimotor assessments were enhanced in these animals,
and histomorphometrical assessment showed differences between autograft and autograft + unpurified fat groups.

**CONCLUSION:** Unpurified fat enhanced peripheral nerve regeneration through long autografts. Harvesting of unpurified fat circumvents current FDA regulatory burdens, is easily obtainable, and has the potential to change current clinical management of traumatic peripheral nerve injuries. More specifically, this research can potentially lay the groundwork to change clinical practice of nerve injury.

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Macrophages are Integral to Neuromuscular Junction Reinnervation after Nerve Injury

**Katherine B. Santosa, MD, Alexandra M. Keane, BA, Bianca Vannucci, BA, Albina Jablonka-Shariff, PhD, Alison Snyder-Warwick, MD**

**Washington University, Saint Louis, MO, USA**

**PURPOSE:** Macrophages are well-known for their role in Wallerian degeneration following a nerve injury. Recent studies, however, have suggested additional macrophage roles such as response to hypoxia and angiogenesis propagation, both of which are necessary for nerve regeneration across an injury site. We hypothesize that similar mechanisms occur at the neuromuscular junction (NMJ), and we have previously shown that macrophages are not only recruited to the site of nerve injury, but also to the NMJ and end-target muscle after nerve injury. By utilizing Ccr2-/- mice, which have impaired monocyte-derived macrophage recruitment, have delayed reinnervation as compared to age-matched wildtype controls. These results suggest that macrophages are important for reinnervation of the NMJ following peripheral nerve injury. Further investigations to determine the functional consequences of the differences in reinnervation between the two groups are ongoing.

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Correlation Between Fellowship Applications and Work Hour Restrictions on Microsurgical Performance

**Edward I. Chang, MD, FACS1, Matthew M. Hanasono, MD1, Stefanos Boukovalas, MD2, Jun Liu, PhD1, Patrick B. Garvey, MD1, Charles E. Butler, MD1, Jesse C. Selber, MD1**

1The University of Texas MD Anderson Cancer Center, Houston, TX, USA, 2The University of Texas Medical Branch, Galveston, TX, USA

**PURPOSE:** While fellowship applications provide a broad overview of an applicant’s accomplishments, it is not clear if the solicited data correlate with clinical performance. The study aims to examine the correlation between microsurgical fellowship applications and work hours with microsurgical skills.