

## Repair of Nerve Gaps with Acellular Nerve Grafts

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**Introduction:** Nerve gaps occur clinically after injury or surgical resection; there are limited options for reconstruction in these cases. Donor site morbidity limits the availability of nerve autografts to a few cutaneous sensory nerves. Nerve allografts necessitate the use of immunosuppressive therapy. Acellular nerve grafts, produced by a variety of techniques, have emerged as a possible alternative to these measures. We propose that acellular nerve grafts can support nerve regeneration across a small nerve gap in the rat hind limb model.

**Methods:** Peroneal nerves were harvested from several adult male rats and chemically acellularized using a technique developed in our lab. In twenty-one adult isogenetic rats, nerve gaps of 2- or 4-cm were created in the left peroneal nerve. In autograft groups (Auto), the gap was repaired using the excised native nerve segment. In acellular graft groups (Acell), an identical length of acellularized nerve was used for the repair. In both cases, epineurial coaptation with 10-0 nylon sutures was performed. The animals were evaluated with walking tracks preoperatively and at three-week intervals postoperatively. Fifteen weeks postoperatively, maximum tetanic force ( $F_0$ ) of the left extensor digitorum longus (EDL) muscle was measured, and specific force ( $sF_0$ ) was calculated.

**Results:** EDL muscle mass, intermediate toe spread (ITS) from preoperative and 15-week walking tracks,  $F_0$ , and  $sF_0$  for each group are shown below (preliminary data).

Group	n	EDL Mass (mg)	Preop ITS (mm)	15-wk ITS (mm)	$F_0$ (mN)	$sF_0$ (mN/mm <sup>2</sup> )
Auto 2-cm	5	113.9 ± 10.5	12.55 ± 1.62	12.66 ± 1.24	1792.6 ± 315.0	188.2 ± 33.8
Auto 4-cm	3	112.2 ± 8.0	12.13 ± 0.58	11.75 ± 0.69	1586.8 ± 355.9	169.4 ± 38.3
Acell 2-cm	4	72.8 ± 22.6*	12.24 ± 0.46	10.06 ± 2.79	726.3 ± 608.1*	105.9 ± 65.0
Acell 4-cm	2	34.3 ± 3.2 <sup>†</sup>	12.19 ± 0.87	8.92 ± 0.10	9.7 ± 8.9 <sup>†</sup>	3.6 ± 3.5 <sup>†</sup>

Data are displayed as mean ± standard deviation

\* $p < 0.005$  vs. Auto 2-cm group; <sup>†</sup> $p < 0.005$  vs. Auto 4-cm group; Two-way ANOVA

There were significant differences ( $p < 0.005$ ) in EDL mass and  $F_0$  between Auto and Acell rats at each gap length. Analysis of  $sF_0$ , however, revealed an interaction between the cellularity and the gap length variables, showing a significant difference at the 4-cm gap length, but no significant difference between the 2-cm groups. Differences in ITS at fifteen weeks parallels the trend in  $sF_0$ , but was not significant at these sample sizes.

**Conclusion:** The preliminary data support our hypothesis that acellular nerve grafts, prepared by our technique, can support nerve regeneration across short nerve gaps in the rat hind limb model.

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