Improving outcomes in immediate and delayed nerve grafting of peripheral nerve gaps using light-activated sealing of neorraphy sites with human amnion wraps

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Background

- Unsatisfactory outcomes following microsurgical peripheral nerve repair are linked with needle trauma, suture foreign body reaction, inflammation and scarring, axonal escape and neuroma formation
- Limitations more pronounced following nerve gap and grafting when regenerating axons must traverse 2 coaptation sites.
- Light-activated sealing of amnion nerve wraps around coaptation sites is superior to standard suture in rodent models of end-to-end repair (figure 1)
- Limited success when applied to nerve grafts due to proteolytic degradation of amnion during extended recovery
- Crosslinking amnion improves wrap durability resulting in superior outcomes in comparison to suture when applied to 15mm rodent isografts (PHASE 1 – unpublished data)
- Previous studies assessed light-activated repair when performed immediately after injury, a situation rarely encountered clinically
- Extended periods of delay are detrimental to recovery due to chronic axotomy and denervation

Hypothesis

- Light-activated sealing of nerve grafts remains efficacious following a clinically relevant delay and may reduce the detrimental impact of delay when compared to gold standard, immediate suturing

Experimental Approach

- 40 male inbred, Lewis rats, randomized 4 groups (n=10)
- 15mm left sciatic nerve gaps created and bridged with isografts
- Repairs performed either immediately or after a 30-day delay
- Isografts secured with either light activated sealing or conventional epineurial suture (figure 2)

Results

- Crosslinked amnion wraps still present after 5-months (figure 3A)
- On gross observation, photochemical repairs had less scar tissue formation (figure 3B+C)
- Crosslinked amnion wraps are efficacious following a clinically relevant delay and may reduce the detrimental impact of delay when compared to standard, immediate suturing

Conclusions

- Immediate light activated sealing of nerve ends is superior to standard suturing
- Following delayed repair, light activated sealing may help reduce the detrimental effects of chronic axotomy and denervation