



# Intra-operative Nerve Stimulation as a Novel Assessment of Rat Median Nerve Function

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## Introduction

- Peripheral nerve injuries are common in orthopaedics
- Difficult to assess nerve integrity intra-operatively

### Aims

- To assess the use of handheld surgical nerve stimulators as a functional assessment of nerve damage

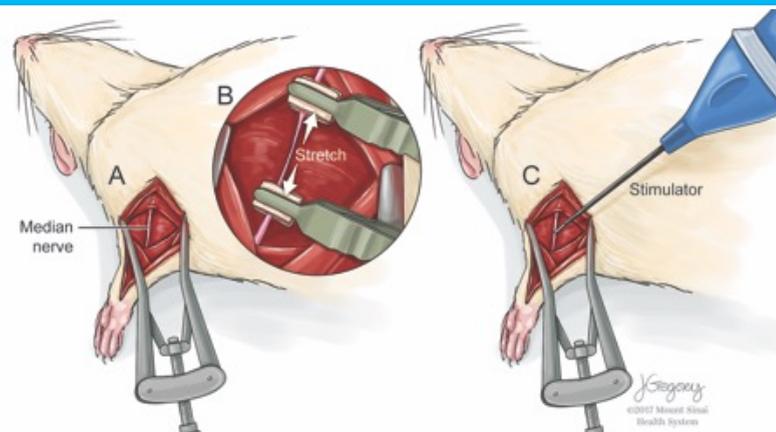
### Hypothesis

- We hypothesize that following a 20% strain injury, rat median nerves will require an increase in stimulation in order to observe paw movement

## Methods

- 17 right and left rat median nerves
- Right nerves experienced a 20% high strain injury
- Left nerves were sham control
- Nerves were probed before and after intervention using a checkpoint surgical nerve stimulator (Checkpoint Surgical, Cleveland Ohio)
- The Checkpoint stimulator is a disposable, bi-phasic hand held AC nerve stimulator with adjustable current (0.5mA, 2mA, 20mA) as well as gradually adjustable pulse width (50-200µS).

## Results

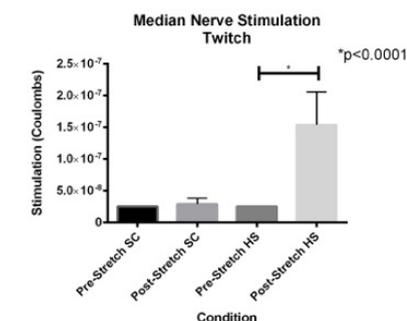


**Figure 1:** Specimens were placed in a supine position while FDS and FCR were gently separated to expose the underlying median nerve (A). Nerves were placed in a custom made stretch applicator while a 20% strain was applied over a period of 5 minutes (B). Before and after application of the stretch device, nerves were probed using a hand-held surgical nerve stimulator to assess the minimum stimulation required to induce both a twitch of paw movement (Twitch) as well as a full paw contraction (Contraction) (C)

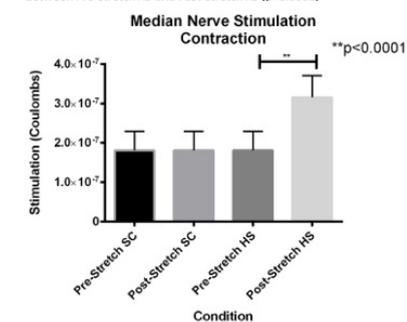
- Baseline pre-intervention stimulation values were obtained for both sham control (SC) and high strain (HS) nerves
- All nerves required a baseline of 0.025µC to induce a twitch (Fig. 2).
- Most HS nerves (11/13) exhibited baseline contraction values of 0.2 µC (one required 0.1 µC and one required 0.05 µC).
- Similarly, almost all SC nerves (11/13) exhibited a baseline value of 0.2µC required to induce a full paw contraction (one required 0.1µC and one required 0.05µC) (Fig. 3).
- An increase in stimulation was required to induce a twitch and a full paw contraction in all HS nerves following application of the stretch injury.
- An average increase of 0.1288 µC (p<0.0001) was required to induce a twitch, while an increase of 0.1346 µC (p<0.0001) was required to induce a full paw contraction.

## Discussion

- There are consistent baseline values of stimulation at which all nerves will cause a paw twitch and most will cause a paw contraction
- Following a stretch injury, it is possible to reliably detect functional deficits even when the nerve is macroscopically intact
- Handheld surgical nerve stimulators are not just helpful for nerve localization but also as a functional assessment
- We have demonstrated a reproducible in vivo neural stretch injury



**Figure 2:** Comparison between Pre- and Post-stretch values of stimulation (coulombs) required to induce a twitch. Post-stretch SC indicates the nerve was only placed in the stretch device clamps as a Sham Control with no stretch induced, whereas Post-stretch HS indicates a 20% strain was applied. A significance value of p<0.05 was selected. A significant difference was not observed between Pre-stretch SC and Post-stretch SC. While a significant increase was observed between Pre-stretch HS and Post-stretch HS (p<0.0001)



**Figure 3:** Comparison between Pre- and Post-stretch values of stimulation (coulombs) required to induce a contraction. Post-stretch SC indicates the nerve was only placed in the stretch device clamps as a Sham Control with no stretch induced, whereas Post-stretch HS indicates a 20% strain was applied. A significance value of p<0.05 was selected. A significant difference was not observed between Pre-stretch SC and Post-stretch SC. While a significant increase was observed between Pre-stretch HS and Post-stretch HS (p<0.0001)