The objective of this study was to investigate longitudinal changes in Strabismus correction surgery. This is well documented in the literature. Prior to treatment, both monkeys showed a horizontal misalignment (exotropia) that varied depending on eye of fixation. Shortly after the surgery, contractility coefficient of the treated eye LR was reduced as might be expected following recession. An increase in the contractility coefficient of the treated eye MR was obtained, as might be expected following recession. Six months after the treatment, the MR muscle regained its pre-surgery contractility whereas the LR still showed reduced contractility compared to pre-surgery. Interestingly, similar trends were observed for the contractility coefficients of the yoked muscles in the untreated eye, although effects were smaller and not statistically significant. The change in neural drive of the MR of the treated eye suggests a significant neural adaptation that appears to be fighting the intent of surgical realignment; the unchanged ND to the treated eye LR immediately after surgery suggests no similar resistance to change following recession. Post-1 changes in the ND to the untreated eye LR and MR is likely a consequence of Hering’s law. The Post-6 month changes in the NDS to both treated eyes and untreated eyes LR and MR suggest a significant role of muscle remodeling in addition to neural adaptation. Analysis of muscle contractility also suggests a significant role of muscle remodeling in setting the steady state strabismus angle. Would bilateral recession be a preferred method to avoid neural adaptation?

## CONCLUSION

- The change in neural drive of the MR of the treated eye suggests a significant neural adaptation that appears to be fighting the intent of surgical realignment; the unchanged ND to the treated eye LR immediately after surgery suggests no similar resistance to change following recession.
- Post-1 changes in the ND to the untreated eye LR and MR is likely a consequence of Hering’s law.
- The Post-6 month changes in the NDS to both treated eyes and untreated eyes LR and MR suggest a significant role of muscle remodeling in addition to neural adaptation.
- Analysis of muscle contractility also suggests a significant role of muscle remodeling in setting the steady state strabismus angle.
- Could bilateral recession be a preferred method to avoid neural adaptation?

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### EXPERIMENTAL METHODS

- Behavioral and neurophysiological data were collected from two juvenile monkeys, M1 and M2 (Macaca mulatta; ~5yr old) with a sensory exotropia previously induced via an optical prism-rearing paradigm in the first 4 months of life.
- Strabismus correction surgery involved the recession of the LR and resection of the MR of one eye only.
- Single-cell neural activity of MNs in both abducens and oculomotor nuclei were acquired before surgery and over 6 months after treatment in a task where the animal performed monocular viewing sinusoidal smooth-pursuit of a horizontally or vertically moving target (0.3 Hz; ±15 deg).
- Averaged data from multiple cycles were used to identify eye position sensitivity (K), eye velocity sensitivity (R), and bias (C) of each MN in a first order model:
  \[ FR = K E_p + R E_v + C \]
  where \( E_p \) and \( E_v \) are ipsi eye position and eye velocity.
- Population neuronal drive to the MR of the deviated eye was calculated as:
  \[ ND = \sum (K E_{Strab} + C) / n \]
- Single-cell neural activity of MNs in both abducens and oculomotor nuclei to extraocular muscles in strabismic monkey models prior to and after undergoing surgical correction of strabismus.