Creation of a Device for the Dynamic Treatment of Facial-Nerve Paralysis

Takisha Morancy,[1] Stephanie Tominaga,[2*] Hanan Yafei,[6] Jennifer Liang,[2] Mark Stewart,[3,4] Ofer Azoulay,[2] & Richard Kollmar[2,5]*

[1]College of Medicine; [2]Dpts. of Otolaryngology, [3]Physiology & Pharmacology, [4]Neurology, and [5]Cell Biology, SUNY Downstate Health Sciences University. [6]BP-ENDURE Program, Brooklyn College.

Facial nerve palsy is common—affecting one out of sixty people worldwide—and can create major functional, aesthetic, and psychological disability. Our long-term goal is a better treatment for chronic forms of unilateral facial paralysis. We are focussing on the most distressing aspects of this condition, the loss of symmetry of facial movements. Our plan is to branch out from the current surgical approaches, such as cross-face nerve grafting with highly-variable outcome, to a bionic implant that detects facial-nerve activity on the intact side of the face and accordingly applies electrical stimulation to the distal nerve stump on the paralyzed side. We are using the rat's vibrissae movement ("whisking"), a quantifiable behavior controlled by the facial nerve, as an animal model. We have developed a setup that detects action potentials in the intact facial nerve on one side of the rat's face and triggers constant-current stimuli to the distal stump of the transected facial nerve on the other side while recording vibrissae movement with a high-speed camera. Our pilot data demonstrate that after acute injury we can restore whisking on a paralyzed side that is synchronous with the intact side and that we may be able to shape the whisking trajectory by adjusting the timing parameters. If successful after nerve repair and regeneration, our animal study will serve as proof-of-principle and the basis for developing a bionic device that could improve the quality of life for countless patients with facial nerve paralysis.

Supported by the Alumni Association-College of Medicine (Research Scholarship to T.M.) and Dpt. of Otolaryngology (Dr. Frank E. Lucente Resident Research Grant to S.T.).