



Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

MGH 258, Easel 187

11:00 AM to 1:00 PM

How Botox Affects the Masseter's Ability to Heal and Activate

Andrew David Manion, Junior, Pre-Sciences

Mentor: Susan Herring, Orthodontics

Mentor: Michael Baldwin, Oral Health Sciences

Botox (botulinum toxin) is commonly used to reduce facial wrinkles, but it is also injected into the masseter muscles, the main jaw closing muscles, for cosmetic reasons or pain reduction. Botox blocks neurotransmission, leading to partial muscle paralysis and atrophy. Although these effects are considered safe and temporary, we previously found that a single treatment of the rabbit masseter with Botox caused muscle atrophy persisting for at least 12 weeks. However, some muscle fibers were unaffected or even enlarged. The purpose of this study was to determine if the changes observed were more or less severe in specific regions of the masseter, and if differences in fiber size correlated with the regional electromyographic (EMG) response to nerve stimulation. Rabbit masseters were injected unilaterally. Regional EMG was recorded before euthanasia at either 4 (n=4) or 12 weeks (n=5) post-injection. The regions corresponded with the three sites of injection, anterior, middle and posterior in the inferior part of the muscle. Superior regions were also examined for the 12-week sample. Least fiber diameter was measured in histological sections (40-60 fibers/region). Linear regression was used to correlate EMG and fiber diameter. In general (6/9 treated muscles) the region with the largest fibers showed the highest EMG, but at 4 weeks there was no linear correlation; all regions showed both atrophied fibers and low EMG. At 12 weeks, all regions of treated muscles had larger average diameters and some also had increased EMG. Positive correlations between fiber size and EMG were seen anteriorly ($r^2=0.66$) and posteriorly ($r^2=0.43$) and in the muscle as a whole, both inferiorly ($r^2=0.36$) and superiorly ($r^2=0.76$). These results indicate that Botox injections have adverse effects long after the initial injection. Although no regions are consistently more affected than others, there is a general correlation between fiber recovery and signal strength.

POSTER SESSION 3

Commons East, Easel 49

2:30 PM to 4:00 PM

Respiratory Dynamics of Soft Palate in Obese OSA Minipigs

Jessica Lu, Senior, Speech & Hearing Sciences, Biochemistry

Mary Gates Scholar, Undergraduate Research Conference Travel Awardee

Mentor: Zi-Jun (Zee) Liu, Orthodontics

Obstructive sleep apnea (OSA) is the condition of repetitive stops of breathing during sleep due to complete or partial occlusion of the upper airway. OSA affects around 34% in men aged 30–70 years and is associated with significant cardiovascular morbidity. Studies have indicated that retro-palatal region is the most common site of upper airway collapse leading to OSA. However, few studies have addressed the respiratory dynamics of soft palate, tongue base, and epiglottis during sleep. The purpose of this study is to analyze the respiratory motions of soft palate and its relation to oropharyngeal structures during drug-induced sleep in verified obese/OSA and non-obese/non-OSA minipigs. The hypothesis is that obese/OSA minipigs would have larger variance of soft palate motions and altered motion pattern as compared to non-obese/non-OSA controls, which may contribute to OSA. Four obese and two non-obese minipigs were first revived live sleep monitoring using wireless BioRadio system to verify OSA, and all 4 obese showed different degrees of OSA by apnea/hyponea index (AHI) while 2 non-obese did not. Sleep videofluoroscopy was performed under sedation when subjects were placed in the prone and lateral positions. The ImageJ was used to trace the movements of soft palate tip in inhaling and exhaling phases. The static reference was defined to be the intersection of mesial surface and occlusal plane of upper second molar. The purpose of reference is to compare relative location of soft palate tip and its relation to other oropharyngeal structures. Dynamic movement of soft palatal tip presented significantly larger variance in obese/OSA than non-obese minipigs. Going forward, I will further map the dynamic shape changes of the soft palate and to define how spatial relationships between soft palate, tongue base and epiglottis lead to oropharyngeal airway patent or collapse during respiration.