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## AAO Foundation Final Report Form (a/o 2/9/2021)

*In an attempt to make things a little easier for the reviewer who will read this report, please consider these two questions before this is sent for review:*

- Is this an example of your very best work, in that it provides sufficient explanation and justification, and is something otherwise worthy of publication? (We do publish the Final Report on our website, so this does need to be complete and polished.)*
- Does this Final Report provide the level of detail, etc. that you would expect, if you were the reviewer?*

Please prepare a report that addresses the following:

Type of Award Research Aid Award

Name(s) of Principal Investigator(s): Kimberly Fluger

Institution: University at Buffalo

Title of Project Mandibular movement analysis during sleep following Class II correction with functional orthopedic appliances.

Period of AAOF Support (e.g. 07-01-2021 to 06-30-2022):

Amount of Funding: \$5000

Summary/Abstract

**Purpose:** Mandibular movement (MM) analysis during sleep is a simple and valid method to characterize respiratory effort and diagnose apneic sleep disorders, as it changes predictably with sleep progression. MM detection overcomes the primary limitation of radiographic airway since it assesses dynamic airway function during sleep.

**Objectives:** The primary aim was to evaluate changes in MM during sleep following Class II correction with a Herbst functional appliance. Changes in sleep-related breathing disorder (SRBD) symptoms, dentoskeletal measurements, and airway dimensions following treatment with a functional appliance were also analyzed.

**Methods:** This was a prospective cohort study of 20 growing orthodontic patients, 9-17 years old, with Class II malocclusion due to a retrognathic mandible, treated with a Herbst functional appliance at the University at Buffalo Orthodontics clinic and three private practices in Western New York. An inertial measurement device was used to report mandibular jaw acceleration and detect changes in spatial position of the mandible during a respiratory cycle at T<sub>1</sub>: initial records, T<sub>2</sub>: appliance in-situ, and T<sub>3</sub>: post-Herbst. MM was analyzed using MATLAB software to measure frequency and prominence of peak signal. Dominant frequency and its amplitude were determined using Fast Fourier Transformation. Data were processed by machine learning algorithms to extrapolate sleep outcomes including Arousal Index (ArI), Apnea-Hypopnea Index (AHI), Respiratory Disturbance Index (RDI), and Percentage of REM sleep. A Pediatric Sleep Questionnaire (PSQ) was given at all time points to evaluate changes in SRBD symptoms. Cone Beam Computed Tomography (CBCT) was used to compare changes in dentoskeletal and oropharyngeal airway dimensions pre- (T<sub>1</sub>) and post-treatment (T<sub>3</sub>).

**Results:** There were 10 male and 10 female orthodontic patients recruited, with an average age of  $13.7 \pm 1.61$  years, (range 11.4 – 16.8 years). There were some significant short-term (T<sub>1</sub> -T<sub>2</sub>) changes in MM variables, but no statistically significant findings when comparing T<sub>1</sub> -T<sub>3</sub>. There were no statistically significant differences found amongst any objective sleep variables when looking at annualized changes between T<sub>1</sub> -T<sub>2</sub>, T<sub>2</sub> -T<sub>3</sub>, or T<sub>1</sub> -T<sub>3</sub>. There was a significant improvement in PSQ score ( $p = 0.019$ ). Cephalometric analysis showed normalization of ANB (°) and significant increase in SNB (°), mandibular length ( $p = 0.016$ ), ramus height ( $p < 0.001$ ),

and corpus length ( $p = 0.014$ ). Dental changes included lower incisor proclination (IMPA[°],  $p = 0.007$  and L1-NB [°],  $p = 0.024$ ).

**Conclusions:** There are limited short-term changes in MM during sleep with the use of Herbst appliance in the pediatric orthodontic populations, and no significant changes in objective sleep outcome measures were observed. Correction of skeletal malocclusion with a Herbst functional appliance is supported by the findings of this study. The use of Herbst appliance is not indicated for the improvement of SRBD. Future studies are warranted in pediatric populations with more severe OSA.

Respond to the following questions:

**1. Were the original, specific aims of the proposal realized?**

Yes, all original, specific aims and objectives of the proposal were evaluated.

**2. Were the results published?**

This work has not yet been published. There are plans to publish and the manuscript is currently being prepared. AAOF support will be acknowledged.

**3. Have the results of this proposal been presented?**

Title:

Mandibular movement analysis during sleep following Class II correction with functional appliance

Authors:

Fluger K, DDS; Monegro A, MD; Tanberg W, MS; Warunek S, DDS MS; Al-Jewair T, DDS MS

Location:

AAO Annual Session 2022- Miami, Florida (William R. Proffit Resident Scholar Award).

a. Was AAOF support acknowledged?

Yes, AAOF support was acknowledged.

**4. To what extent have you used, or how do you intend to use, AAOF funding to further your career?**

AAOF funding was instrumental in the successful completion of this research project, which would not have been possible without it. The experience I gained from obtaining my Master's degree is the beginning of my career of contributions to science and orthodontics.