

# Mechanobehavior & Autonomic Function in Adolescents of Two Facial Types

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*2019 Grants*

*Dr. Jeffrey Nickel*

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# FollowUp Form

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## ***Award Information***

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*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?*

## **Title of Project\***

Mechanobehavior & Autonomic Function in Adolescents of Two Facial Types

## **Award Type**

Biomedical Research Award (BRA)

## **Period of AAOF Support**

July 1, 2019 through December 31, 2022

## **Institution**

Oregon Health & Science University

## **Names of principal advisor(s) / mentor(s), co-investigator(s) and consultant(s)**

Dr. Jeff Nickel

## **Amount of Funding**

\$29,929.00

## **Abstract**

(add specific directions for each type here)

## ***Respond to the following questions:***

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### **Detailed results and inferences:\***

If the work has been published, please attach a pdf of manuscript below by clicking "Upload a file".

OR

Use the text box below to describe in detail the results of your study. The intent is to share the knowledge you have generated with the AAOF and orthodontic community specifically and other who may benefit from your study. Table, Figures, Statistical Analysis, and interpretation of results should also be attached by clicking "Upload a file".

Outcomes of the study have been presented at the COAST 2024 meeting at Arrowhead Lake Lodge. The manuscript has been reviewed for publication in Orthodontics and Craniofacial Research. Requested editing is underway. It is anticipated that the manuscript will be accepted for publication in a special 2025 issue of the journal.

Abstract

Objective: Mandibular growth is influenced by function. This study tested for correlation amongst nocturnal autonomic nervous system (ANS) and jaw muscle activities, and mandibular ramus height. Materials and Methods: According to Institutional Review Board oversight, children with skeletal Class II malocclusions were enrolled in this observational study. Subjects had cone-beam computed tomography images, participated in protocols to quantify jaw muscle activity per bite-force, and were trained to use portable recorders to collect jaw muscle and heart rate variability (HRV) data over four nights at home. Night-time ultradian cycling of ANS activity was characterized by fitting a polynomial to the HRV measures of sympathovagal tone (low/high frequency spectral powers, LF/HF). Twenty-minute windows around each inflection point of this polynomial were identified, within which HRV measures and jaw muscle activities (Duty Factor, DF) were quantified. DF versus HRV measures (DF/HRV) were plotted for each subject, and regression slopes calculated. Non-linear regression analysis was used to test for correlation between DF/HRV slopes, age (years), and ramus height (mm). Results: Thirteen (8 males, 5 females) of 15 children enrolled completed protocols. DF versus LF/HF had average R<sup>2</sup> values of 0.66±0.22 for masseter muscles (left and right), and 0.57±0.19 and 0.55±0.17 for left and right temporalis muscles, respectively. Regression analysis demonstrated that approximately 42% of the variance in mandibular ramus height could be explained by the combined effects of age and masseter muscle DF versus LF/HF. Conclusions: Mandibular ramus height may reflect the influence of sympathovagal tone on nocturnal jaw muscle activity in children.

### **Were the original, specific aims of the proposal realized?\***

Yes, we were able to show that autonomic nervous system activity was correlated with night-time masticatory muscle activity, and that this relationship together with age correlated with mandibular ramus linear measures.

### **Were the results published?\***

No

### **Have the results of this proposal been presented?\***

Yes

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

This project was fundamental to promote our work in the area of ANS function and growth, development, and degeneration of the TMJ. Furthermore, the project helped with advanced analysis of ANS nocturnal ultradian cycling. This has importance with respect to sensory processing.

## Accounting: Were there any leftover funds?

\$6,000.00

## *Not Published*

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### Are there plans to publish? If not, why not?\*

Yes, the manuscript has come back from reviewers. With minor edits we anticipate that it will be published in a special 2025 issue of Orthodontics and Craniofacial Research.

## *Presented*

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### Please list titles, author or co-authors of these presentation/s, year and locations:\*

1. Hamieh M, Iwasaki LR, Palmer E, Choi D, Nickel JC. Nocturnal Autonomic Nervous System and Masticatory Muscle Activities in Adolescents. Submitted to Orthodontics and Craniofacial Research (in review)
2. Tran E, Hamieh M, Liu H, Choi D, Iwasaki LR, Nickel JC. Masticatory muscle activity and mandibular ramus length. Submitted for presentation at the 2025 American Association for Dental, Oral, and Craniofacial Research Annual Session.
3. Nickel JC, Hamieh M, Palmer E, Iwasaki LR, Cho D, Liu H, Nocturnal ANS and Masticatory Muscle Activity in Children, Biannual COAST Meeting, UCLA Arrowhead Lake Lodge, California, October 2024.
4. Nickel JC, Hamieh M, Palmer E, Iwasaki LR, Cho D, Liu H, Autonomic Function and Masticatory Muscle Activity in Growing Adolescents, presented at the NW Angle Society Meeting, Seattle WA, February 2024.
5. M Hamieh, LR Iwasaki, JC Nickel, E Palmer, D Choi, Autonomic function and muscle activity in growing children, Poster presentation, PCSO Meeting, Anaheim CA, October 2023.

## Was AAOF support acknowledged?

If so, please describe:

Yes, AAOF support was acknowledged during our oral and poster presentations, and in the manuscript that will be submitted to the journal (Orthodontics and Craniofacial Research)

**Comment:** *The AAOF PARC commends you and your team for completing this important work, and we look forward to the publications that place your findings in the public domain of academic dentistry. We also encourage you to share additional results as an addendum to this final report so that we may make it available on our AAOF PARC website.*

## ***Internal Review***

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### **Reviewer Comments**

### **Reviewer Status\***

Approved

## File Attachment Summary

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### *Applicant File Uploads*

*No files were uploaded*