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## **AAO Foundation Final Report Form (a/o 6/30/2020)**

### Type of Award

Orthodontic Faculty Development Fellowship Award

### Name(s) of Principal Investigator(s)

Jennifer Caplin

### Institution

University of Illinois at Chicago

### Title of Project

Linking Malocclusion and Body Mass Via Genetic Variants Withing the Hippo Signaling Pathway and Dietary Factors

### Period of AAOF Support

07-01-18 to 12-31-20

### Amount of Funding

\$20,000

### Summary/Abstract

#### **Educational**

I attended the American Dental Education Association Annual Session in 2019 and the American Association of Orthodontists Annual Session in both 2019 and 2020 (remote session). I also attended the American Association of Orthodontists Leadership Summit in 2019.

#### **Research**

The purpose of this study was to evaluate for a correlation between malocclusion phenotypes and selected genes in the Hippo signaling pathway, body mass index (BMI), and diet. 117 subjects between the ages of 7 and 17 were included in this study. Digital dental models, cephalometric radiographs, height, weight, and saliva were collected from each subject. Each subject also

completed a Block Food Frequency Questionnaire (BFFQ).

DNA was extracted from each subject's saliva, and 39 single nucleotide polymorphisms (SNP) were identified via amplicon sequencing. These SNPs were located within genes of the Hippo signaling pathway and were selected because they have all shown a correlation with craniofacial morphology. De-identified BFFQ surveys were analyzed by NutritionQuest (Berkeley, CA), the producers of the survey. Dental models and cephs were landmarked to identify malocclusion phenotypes, including maxillary and mandibular size and shape, skeletal classification, vertical angulation of the maxilla and mandible, and arch shape.

Phenotypic analyses using Geometric Morphometrics were employed to measure shape variation in dental arch form and craniofacial morphology. Landmark data for each individual specimen was superimposed onto a group mean using Generalized Procrustes Analysis. BMI regression analysis and component variants analysis were performed. This process removes variation in landmark placement due to rotational, translational, and scale factors. The resulting landmark residuals are representative of dental and facial shape and were analyzed using standard statistical techniques.

Square lower arch forms were found to be significantly associated with high BMI, whereas ovoid lower arch forms were significantly associated with normal weight BMIs. No significant association was found between BMI and the upper arch. A more hyperdivergent pattern was found to be significantly associated with female subjects with high BMI, whereas a more hypodivergent pattern was found to be significantly associated with female subjects with low BMI. No significant association was found between BMI and male subjects.

The subjects were then divided into three genotypic groups for each SNP: homozygotes for the common allele, homozygotes for the recessive allele, and heterozygotes. Patterns were identified between the different genotypes and the phenotypes that had shown an association with BMI. The following SNPs showed a pattern of genetic variation that was associated with the significant BMI phenotypes:

- Lower arch form
  - BMI regression analysis
    - Two SNPs on LATS2
    - One SNP on both MST1 and LATS1
  - Component variants analysis
    - Two SNPs on FOXO6
    - One SNP on TEAD3
- Female facial form
  - BMI regression analysis
    - Three SNPs on TEAD3
    - One SNP on both FOXO6 and LATS2
  - Component variants analysis
    - One SNP each on MST1, TEAD3, and TEAD4

## **Teaching**

I taught extensively at the University of Illinois at Chicago, College of Dentistry, Department of Orthodontics. I was the course director for four courses and a component coordinator for seven courses. I lectured and presented seminars and lab sessions on a weekly basis. I was also a clinical instructor and supervised clinical cases with the orthodontic students two and a half days

a week. Beginning in June, 2020, I became the Program Director at the New York University, College of the Dentistry, Department of orthodontics, where I am the course director for five courses and continue to lecture, give regular seminars, and advise on cases.

### **Clinical Skills**

In addition to supervising cases in the student clinic, I also worked as an orthodontist in a private dental office three full days per month.

### Respond to the following questions:

1. Were the original, specific aims of the proposal realized?  
Yes
2. Were the results published?  
The results have not been published yet as the data is still undergoing analysis, but we have every intent of publishing. AAOF will be acknowledged in all publications.
3. Have the results of this proposal been presented?  
The results have not been presented yet as the data is still undergoing analysis, but we have every intent of publishing. AAOF will be acknowledged in all presentations.
4. To what extent have you used, or how do you intend to use, AAOF funding to further your career?  
This was the first time I used AAOF funding, but I plan on submitting future research projects to the AAOF for funding throughout my career.

### Accounting for Project

There are leftover funds as the DNA analysis was much less expensive than originally anticipated. All leftover funds are being returned to the AAOF.