



AAO Foundation Final Report Form

Type of Award: **Biomedical Research Award**

Name of Principal Investigator: **Benjamin Pliska**

Institution: **University of British Columbia**

Title of Project: **Three-dimensional Facial Morphology and the Use of Non-Invasive Ventilation Therapy in Infants.**

Period of AAOF Support: **07/01/17 to 12/31/19**

Amount of Funding: **\$30,000**

Summary/Abstract

Objective: This project was a **prospective cohort study** with the overall objective to characterize the three-dimensional facial morphology of preterm infants over the course of the first 4.5 years of life, participating in the Neonatal Follow-up Program of B.C. Children's Hospital in Vancouver, BC. To achieve this goal, infants reporting for follow-up at 4, 8 and 18 months, and children reporting at 3 and 4.5 years of age were imaged with a 3dMD surface-imaging camera, and three-dimensional facial morphometric parameters were related to anthropometric data at birth and the specific characteristics of respiratory therapy received during the neonatal period.

The specific aims of the project are to:

1. Characterize the three-dimensional facial morphology of a cohort of preterm infants at 4, 8 and 18 months, as well as 3 and 4.5 years of age.
2. Determine the effects of the type of interface and duration of non-invasive ventilation (NIV) therapy on facial morphology over the same time period.
3. Study the primary occlusion, dental eruption, enamel defects, and caries risk of prematurely-born toddlers.

Methods: Potential participants were screened for eligibility criteria during their follow-up appointments. Enrolled infants aged 4, 8 and 18 months were imaged with a 3dMD three-dimensional surface-imaging camera and facial morphometrics were related to anthropometric birth data and NIV therapy received in the neonatal period. Subjects aged 3 and 4.5 years had medical histories collected, underwent a dental exam, and also had their facial features imaged

with a 3dMD camera. Dental and medical data were analyzed, and software was used to landmark features on the face, and perform traditional morphometric analyses. Linear facial distances were compared to normative data of age-matched controls.

Results: For the infant cohort a total 82 facial images on 74 patients were successfully obtained for analysis. Of the 82 images, 16 images were taken of the 4-month cohort, 31 of the 8-month cohort, and 35 of the 18-month cohort. The average gestation age was 26.4 weeks, birth weight of 852.7 grams, birth length of 33.0 cm and head circumference of 24.1 cm. The average NIV therapy duration was 49.2 days and the average NICU stay of 103.7 days. Detailed facial morphometric characteristics were calculated – providing novel “normative” data for future comparisons of this fragile population. Using traditional morphometric analysis and geometric morphometric analyses, the study found no statistically significant correlation between NIV therapy duration and anthropometric distances or face shape.

The cohort of older children aged 3 and 4.5 years had 27 facial images collected, including 23 patients who also underwent oral screenings. With regard to oral screenings, all subjects had a complete primary dentition, 87% received corticosteroids at the time of birth, 43.5% had enamel defects, and the mean dmfs score was 2.35. No significant associations were found between enamel defects, birth parameters, and medical therapies. For facial images, the mean gestational age was 26.3 weeks, and mean duration for non-invasive ventilation was 84.5 days. In comparison to published normative data from aged-matched children born full term, significant differences in facial distances were present in the midface and eye regions, generally relating to deficiencies in midface and projection of the nose. (Figure 1) No significant correlations were noted between these facial distances and birth parameters.

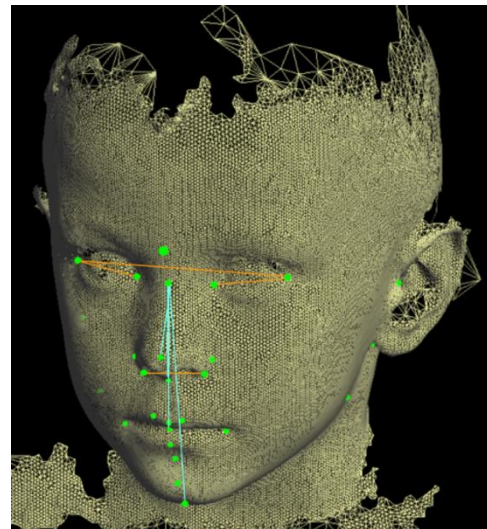


Figure 1: Significantly different linear anthropometric distances in the 4.5 year old cohort are highlighted with orange lines indicating an increased distance from normative data (Healthy children born full term) and blue lines indicating a decreased distance.

Conclusion: The study found that non-invasive ventilation therapy duration was not significantly correlated to any anthropometric distances. The results of this study may indicate that NIV therapy duration does not influence the facial shape of prematurely born children in a dose dependent manner during the timepoints of 4, 8 and 18-months corrected age; however, further research to obtain normative data of aged-matched infants born full-term is needed in order to assess if this cohort of prematurely born infants, as a group, have facial differences. Dental exams of this cohort of prematurely born children at the age of 3 and 4.5 years, found no significant delay in dental development or increased prevalence of enamel defects. When compared to healthy controls, the facial morphology of prematurely born children presented with significant differences in the area of the nose and midface at the age of 3 and 4.5 years.

Were the original, specific aims of the proposal realized?

Yes – the original aims of this project have been successfully realized. The results of this study have provided for the first time, facial morphometric data of a sample of prematurely born children, as well as the dental and orthodontic exam data of the complete primary dentition of this unique population. In order to maximize the funding received from the AAOF, the project was expanded in scope to include the children at the 3 and 4.5 year follow up time points of the NICU program at BC Children’s Hospital. In addition to adding the sample of older toddlers to the project, an additional specific aim (aim #3 above) was also included. To achieve this goal, an intra-oral examination in addition to the 3D facial photo was acquired for the older age groups. This increase in scope was made possible via the 0.2 FTE research coordinator accepting additional responsibilities within her funded workload, and by assigning an additional graduate student to the project. Upon completion, this BRA award has contributed to the MSc. thesis projects of three separate graduate residents at the UBC Faculty of Dentistry.

Were the results published or presented?

Not yet – the results of this study have yet to be published, beyond the MSc theses of the graduate residents involved. As the last of these thesis projects has just been completed in the summer term of 2020, the results will be prepared and written up for publication in the orthodontic literature in order to be disseminated to a wide audience. The AAOF will be recognized for the integral role the funding provided played in success of the projects.

Initially plans were in place to present the study results at the 2020 AAO annual session, and the 2020 American Thoracic Society meeting, however due to the Covid-19 pandemic these plans have been canceled. It is hoped that in addition to future publications, that the data can be shared at future orthodontic and respiratory care and sleep medicine conferences.

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

The funding from the AAOF was vitally important to this project, without which it is unlikely that it would have been initiated. The residency training of three separate graduate students benefited from the proceeds of the AAOF to make this project possible – demonstrating clearly the broad impact the AAOF can have in orthodontic education.

I have been fortunate to have benefited from direct support from the AAOF multiple times in my academic career, and each time this has allowed me to pursue projects of significant impact and interest to the field of orthodontics and affiliated health sciences. This project has been especially impactful at advancing my career, as it formed the basis for an ongoing exciting and productive collaborative relationship between the UBC Division of Orthodontics, and the Neonatology Department at BC Children’s Hospital in Vancouver.

Accounting for the Project:

All funds distributed for this project have been completely exhausted, and were used as planned and stipulated in the originally approved budget.