Research Aid Award

Dr. Silvia Gianoni-Capenakas, *University of Alberta*

Biography:

Silvia Gianoni-Capenakas completed her DDS in Brazil (1997) as well as a specialty degree in Oral Medicine (2010). In 2017 she moved with her family to Canada and pursued a Master's degree in dentistry (2019). This was followed by getting accepted to pursue an Orthodontic combined clinical and PhD program at the University of Alberta, Canada. Her research focuses on the analysis of the upper airway and respiratory effort after maxillary expansion and mandibular advancement. She has been working with the segmentation of the upper airway using different software and the implementation of Artificial Intelligence to segment the upper airway. Her focus is not only in the upper airway dimensions but also in the respiratory resistance analysis. Since 2019 she has been acting as part time instructor in the undergraduate orthodontic clinic and lab at the University of Alberta. She is very passionate about research and translating the research findings to the community. She has attended and presented her work at several dental conferences. At a personal level, she is an easy-going person, enjoys traveling and spending time with her family.

Project Description:

Obstructive sleep apnea (OSA) is one type of sleep-disordered breathing. OSA affects adults and children worldwide but its impairment can lead to developmental, behavioral, and cognitive problems, stroke, diabetes, and cardiac diseases. A major concern in patients with OSA is the pharyngeal collapse occurring in hypopnea (reduction in ventilation) or apnea (complete respiratory cessation). Studies suggest a high correlation between sleep-disordered breathing and narrow maxilla and have shown that a change in the dimension of the upper airway after orthodontic treatment could improve breathing. Therefore, orthodontic treatment has shown the potential to be a coadjuvant in the treatment of OSA. The computational fluid dynamics (CFD) analysis provides values for airway resistance. If resistance is elevated, one of two things could happen: the subject increases their effort of breathing to maintain the same airflow rates (e.g. determined by tidal volume and breathing frequency) or the subject maintains their effort and airflow rates decrease. This research proposal aims (1) to develop a CFD approach to be used in geometries automatic segmented using deep learning in Cone Beam Computed Tomographies of orthodontic patients; and (2) to determine if an increase in the upper airway volume observed in the correction of transverse maxillary deficiencies can be related to a decreased respiratory effort and an improvement in breathing capacity in adult patients that underwent maxillary expansion using mini screw rapid palatal expansion.

Benefit to the Orthodontic Community:

The fluid dynamic analysis allows evaluating different breathing parameters related to the upper airway, such as air resistance. In general, the higher the air resistance, the higher the effort in breathing. In this way, fluid dynamic measurements can be correlated with anatomical values to understand better the direct effect of airway shape and dimensional changes after maxillary expansion. Moreover, our ultimate

goal is to provide tools for clinicians to evaluate the upper airway before and after orthodontic treatments and surgeries and have more realistic information about the breathing capability of their patients.

Importance of AAOF support:

Computational fluid analysis model development are time demanding and expensive. This award has permitted the usage of the engineering faculty in developing the logistics of the project. The provided AAOF grant funds are indispensable to support this project, this support has opened the possibilities of doing more interfaculty research with the inclusion of computational engineering to the project Also, we will be able to publish our findings thanks to this funding. This support is of utmost importance to advance our research and work.