



Dr. Karla Crosara
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University of Western Ontario

1. Short Biography

My journey as a dentist started when I received a DDS degree from the University of Brasilia. Next, I completed my orthodontic training in Brazil under the supervision of Drs. Omar Gabriel da Silva Filho and Leopoldino Capelozza. I practiced in Brasilia for 12 years before moving to Canada. Although I always aspired for an academic career in the field of orthodontics, my goal was put on hold due to family responsibilities, as I married and started a family. Moving to Canada provided me with the opportunity to restart my career and pursue my dream. A few years after arriving in Canada, I focused on acquiring research experience and completed a PhD in Medical Biophysics at the University of Western Ontario. My research focused on the proteins present in saliva (salivary proteome), their secretion, and how they interact with each other. This experience allowed me to present my work at scientific conferences, interact with other researchers, participate in scientific publications, review scientific papers, and mentor younger researchers. I also received prestigious awards and scholarships during my graduate studies, including a 3-year NSERC Doctorate scholarship and a Queen Elizabeth II Graduate Scholarship in Science & Technology. These experiences were invaluable in shaping my academic and professional growth. Following my PhD, I expanded my teaching skills by working in Schulich Dentistry's Simulation Clinic, where I taught several courses to first and second-year dental students. This experience was incredibly fulfilling and earned me the CY Lung award for the greatest individual contribution to the Dentistry Undergraduate Program by an Adjunct Clinical Professor. Working closely with students, course directors, and colleagues solidified my passion for teaching. Lastly, I joined the Graduate Orthodontics program at the University of Western Ontario as a part-time faculty member and research associate. Reviewing basic concepts about the Biology of Tooth Movement, and Facial Growth and Development renewed my excitement for the scientific basis of orthodontics. Exploring the newest research topics in orthodontics has made me realize how much our specialty has evolved in the past decade. For that reason, I decided to renew my orthodontic residency training at the University of Western Ontario. Looking back at my clinical and academic journey, all my professional endeavours have prepared and equipped me to become a successful clinician-scientist in the discipline of orthodontics. I am confident that, with the support from the faculty, colleagues, and the AAOF, my residency at the University of Western Ontario will enable me to make meaningful contributions to the field of orthodontics.

2. Description of the project

From plastic bottles to synthetic clothing fabrics, humans are exposed daily to a variety of plastic materials. Plastics may contain carcinogens, endocrine disruptors, and/or neurotoxicants that can leach out, causing pollution and human exposure. If smaller than 5 mm, plastic particles are called microplastics (MPs). MPs can be found everywhere on Earth. MPs have been found in many human organs and body fluids, including saliva, placenta, and breast milk, and they can be detrimental to health. They can enter the human body through ingestion, inhalation, or contact. Orthodontic treatment using plastic trays, known as orthodontic clear aligners (OCAs), has emerged as an alternative to metallic and ceramic braces. Most OCAs are fabricated from thermoplastic materials and used for 20-22 hours/day for the duration of treatment. Studies outside

the mouth (in vitro) have shown that MPs can detach from OCAs in artificial saliva, suggesting that OCA treatment may expose patients to additional ingestion of these particles. Considering that the majority of patients seeking orthodontic treatment are either children, teenagers, or young adults; therefore, still presenting growth and development and/or in reproductive age, it is particularly important to know if the materials used to treat their malocclusions can be an additional source of MPs to the patients, and if such materials can disrupt the oral and systemic homeostasis of the patients increasing their risk for disease. The detachment and possible effects of MPs derived from OCAs are still being evaluated, and there are no specific guidelines to quantify safe exposure levels. Based on the growing percentage of orthodontic patients being treated with OCAs worldwide and the little information about the potential health risks of having plastic trays in their mouths for many months or years, the first goal of this study is to investigate the presence of MPs detached from OCAs in human saliva. Moreover, it has been demonstrated that OCAs from different manufacturers are made of different materials and can detach different amounts of MPs of various sizes and shapes. Therefore, we plan to test OCAs from different manufacturers currently approved by the FDA and Health Canada for clinical use. Additionally, OCAs from different materials will likely attract different proteins to their surface, forming a specific protein pellicle. If certain salivary proteins adhere to the surface of OCAs, this may change the protein composition of the saliva in the mouth and compromise saliva's ability to maintain oral health during orthodontic treatment. Therefore, this project will investigate the presence of MPs detached from OCAs from different manufacturers in human saliva, characterize the MPs according to their size, shape, and composition, identify which proteins bind to the surfaces of OCAs from the different manufacturers, and investigate if the composition of the salivary proteome of patients treated with OCA changes during treatment. To test this, we will collect saliva from our orthodontic patients before, during and after treatment with OCAs, as well as mouth rinses with filtered water, and we will study the salivary proteome of patients treated with OCAs and the composition of the protein pellicle formed on the surface of the patients' used OCA trays.

3. How orthodontic education will benefit from your award

Orthodontic treatment and education rely on the assurance that residents are being trained to provide the best and safest treatment to their patients. The concept of “doing no harm” is of high importance from treatment planning to its conclusion. The idea of having new orthodontists trained to prescribe a treatment that may put our patients at risk by increasing their exposure to microplastics is not acceptable, even if it happens due to our lack of scientific knowledge. Our investigation about the potential contribution of orthodontic clear aligners to an increased exposure of patients to microplastics, and how the composition and surface of the different aligners might modulate the salivary proteome, and the protein pellicle formed on the surface of the aligners, aims to provide educators, clinicians, and residents reliable clinical information about the potential risks involved in the clear aligner therapy, or its safety, so they can provide their patients the information needed for a clear consent for this therapy.

4. Why the Foundation is important to your project

The funding provided by the AAOF will play an invaluable role in enabling clinical projects like mine. In this multidisciplinary study, state-of-the-art techniques such as Raman spectroscopy and mass spectroscopy will certainly increase the costs of our analyses. The financial assistance from the AAOF will cover the cost of the extremely qualified personnel involved in some of the laboratory analyses proposed in this study. Our expected results will enable the dissemination of

knowledge through my participation in scientific conferences and in future publications. I am extremely grateful to AAOF for financially supporting my project and for giving visibility to our concerns about microplastic detachment from orthodontic clear aligners. I am certain that our results will exemplify AAOF's accomplishments in advancing the orthodontic specialty through exceptional research and excellent patient care.

5. How Foundation funding is expected to or has benefitted your career

The support from the AAO Foundation will have a transformative impact on my career. The funding provided for my research by the AAO Foundation will certainly strengthen our research study by assuring that state-of-the-art technology is applied to answer our research questions. Moreover, receiving the prestigious AAO Foundation Research Aid Award is a very important step towards my career as a clinician-scientist in Orthodontics. After concluding my Orthodontic training, I hope to remain in the university setting, teaching and mentoring orthodontic residents, and expanding my research umbrella by combining advances in the discipline of Orthodontics with their impacts on our patients' oral and systemic health.