2024 BRA
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Dr. Mohammed Elnagar is an Assistant Professor in the Department of Orthodontics at the University of Illinois Chicago (UIC). He received his DDS graduating with honors as class Valedictorian, followed by a General Practice Residency, Master of Dental Science. Dr. Elnagar completed a Certificate of Specialty in Orthodontics and a joint PhD program in oral health sciences at University of Illinois Chicago. In 2022 he obtained a certificate in Artificial Intelligence applications in health care from the Massachusetts Institute of Technology (MIT).

Dr. Elnagar practices orthodontics in Chicago with a focus on Digital orthodontics, dentofacial orthopedics with skeletal anchorage, and surgical orthodontics. Furthermore, he is the Director of the digital and AI Laboratory at UIC Orthodontics; his Research Interests are 3D Imaging, 3D printing TADs, Artificial intelligence applications in Health Care, and Clinical and Transitional research. Dr. Elnagar received the Robert Ricketts Award and Albert Westfall Award from the American Association of Orthodontists Foundation.

The AAO also appointed him to be the recipient of the AAO Academy of Academic Leadership Sponsorship Program Award for 2019. In addition, Dr.Elnagar was elected as secretary for the American Association for Dental Research Chicago section in 2020. And the Society of Educators of the American Association of Orthodontists editor in 2021. More recently in 2023, for his work on emerging technologies, he received Burstone-Indiana Biomechanics Award Designated as a Burstone Fellow in Biomechanics.

Dr Elnagar has published more than 35 articles and 5 book chapters; he gave more than 40 invited talks\lectures in at national and international meetings.

Project Synopsis

The primary motivation for seeking orthodontic treatment is often the improvement of facial aesthetics. Numerous studies have examined the impact of dentofacial deformities on a patient's self-esteem and self-image. Researchers consistently find that the reactions of others to an individual with a facial deformity significantly affect that person's self-image. Additionally, many authors have noted that facial appearance plays a crucial role in shaping social interactions in contemporary society. When a patient presents with a dentofacial deformity that cannot be corrected by orthodontics alone, a combination of orthodontics and orthognathic surgery may be the only viable treatment option to achieve acceptable occlusion and facial balance. This combined approach is fundamental to dentoskeletal modifications, allowing for both functional harmony and aesthetic improvements. The way soft tissues conform to the intended dentoskeletal adjustments further enhances the final aesthetic outcome. It is essential for orthodontists and surgeons to understand the impact of dentoskeletal changes on soft tissues

and to incorporate this understanding into comprehensive treatment planning. Analyzing treatment predictions can enhance clinical communication between the orthodontist, surgeon, and patient, improve clinical decision-making, and help patients better understand the proposed treatment outcomes. Predicting the exact changes in facial skeleton and soft tissue resulting from orthodontic treatment and orthognathic surgery can be challenging. Extensive literature describes various cephalometric analysis methods, planning techniques, and prediction models based on the repositioning of specific landmarks to accommodate skeletal adjustments. The computer-assisted technique employs software programs to generate soft-tissue prediction profile tracings from lateral cephalometric radiographs. Currently, many algorithms used in commercially available software programs for 2-D profile prediction are based on the incorrect assumption that the movement of hard tissue and soft tissue has a proportional relationship. The value of the proportionality constant depends on the operator, and there is little evidence regarding the validity of the prediction results. Moreover, the specific algorithms used in pattern matching technology have not been clarified, making it uncertain whether valid predictions have been made.

The objective of this proposal is to develop an AI system designed to predict changes in a patient's facial appearance following a combination of orthognathic surgery and orthodontic treatment. To enhance the accuracy and realism of these predictions, the system will take into account key factors such as the patient's age, gender, ethnicity, and specific dentofacial features. Additionally, it will incorporate considerations for surgical and dental changes.

The funding from the AAOF is crucial for our project, to support our interdisciplinary team, and to obtain primary data for Federal grant. Furthermore, it will assist in the development of my career as an Educator, Clinician, and Scientist.