ABSTRACT

The habilitation thesis **"Clinical and fundamental research on maxillary expansion in orthodontics: Evaluating oral and dental health at the end of orthodontic treatment"** includes in the first part the results of the scientific research activity, carried out since obtaining the title of doctor of medical sciences until now. Starting from these achievements, in the second part are presented the directions of professional, scientific and academic career development, which I want to approach in the future.

In the first part of the habilitation thesis, the main fundamental research carried out with the aim of evaluating the results of maxillary disjunction therapy, three-dimensional prints used in dentistry and dental health after orthodontic treatment are presented.

The first part of research involves the evaluation of skeletal changes in maxillary compressions in adults or young adults when mini-implant assisted palatal expansion (MARPE) are used. In these cases the applied force must be strong enough to overcome the areas of resistance in the midface region, such as the palatine suture and the zygomatic bone. Therefore, using a MARPE device, the force is applied directly to the center of resistance of the jaw via the mini-implants.

We conducted a study to evaluate treatment outcomes in adult patients with maxillary compression who underwent corticopuncture surgery. Corticopuncture was introduced as a surgical procedure to reduce orthodontic treatment time and favor the opening of the median suture. We have achieved positive results with minimal tooth movement and effective midline suture opening,wich is a predictable non-surgical expansion and is a viable alternative for transverse deficiency.

We presented the potential complications that could occur during the healing process after placement of a MARPE device in an observational study closely related to the first study. Evaluation of canine coronal CBCT sections showed a buccal tilt in fifteen cases (62.5%), with a mean tilt value of 4.10° ± 0.38 SD (95% CI). Changes in the occlusal plane were observed in ten cases (37%).

At the level of the first molar, a decrease in the buccal cortical bone level was observed in eleven patients (40.70%), with a mean value of 2.07 mm ± 0.40 SD (CI 95%).

The vertical distance from the tip of the canine cusp to the infraorbital foramen was shorter after treatment, with a mean difference of 0.64 mm ± 0.19 SD (95% CI), p = 0.004, thus confirming canine tipping.

Regarding the soft tissue changes related to the MARPE device, six patients (22.22%) had hypertrophy of the palatal mucosa. These observations of the changes occurring in the palatal mucosa led me to continue the investigations by studying the changes occurring in the mucosa also from a histological point of view.

The changes identified were specific to mechanical traumatic injuries, thus excluding hyperplasia from other causes (infectious, tumoral, non-mechanical traumatic). The examined fragments showed hyperplasia with widening of the spinous layer (acanthosis), without acantholysis and without hyperkeratosis. The epithelium was largely destroyed and partially replaced by granulation tissue. Around the large vessels, numerous granulocytes were observed penetrating from the outside to the middle of the vessel.

Trauma caused by the use of the expander in the oral cavity was considered the factor of the inflammatory reaction.

The second direction of research involved the study of three-dimensional printing methods and the accuracy of these processes influenced by different factors. In the first phase we evaluated the accuracy of 3D printing techniques, SLA and DLP by comparing 3D printed dental models based on ethylene dimethacrylate.

Due to the non-normal distribution of the data, non-parametric tests were performed. The results of the comparison showed that the SLA-printed models had lower accuracy in mesio-distal and bucal-lingual

directions, but similar accuracy for other measured characteristics (tooth height, arch curvature, interdental distances, and arch width).

On the other hand, models produced with the DLP method showed a significantly higher bias in tooth height and mesio-distal distances. Despite the fact that the DLP models were more accurate in some directions, they also showed deviations from the ideal values (bias).

In the other studies that had three-dimensional printing as a central theme, we compared three types of resins used for printing dental models and examined different impression materials that led to the creation of plaster models that were later digitized. These studies were carried out in collaboration with the Technical University of Cluj-Napoca.

The third direction of research included the evaluation of dental structures in patients wearing orthodontic appliances by studying the effect of composite resin on enamel after the removal of metal, respectively ceramic brackets and by analyzing the White Spot Lesions that appeared as a result of the use of fixed orthodontic appliances. Analyzing the results before and after treatment, no cracks were observed in the enamel, but only an increase in roughness in both types of brackets. The surface of the brackets showed no traces of calcium, indicating the loss of tooth substance. Although more fragile and prone to breakage, ceramic brackets did not promote enamel loss, the results being similar to metal brackets.

The use of toothpastes with a content of more than 1000 ppm fluorine in oral hygiene contributes to reducing the frequency of the appearance of lesions like White Spot Lesions. The regular application of fluorid varnishes in the dental office reduces the frequency of White Spot Lesions, but only under conditions of rigorous oral hygiene.

The second section of the habilitation thesis presents the proposals for professional, scientific and academic career development. Based on the research carried out and the experience gained, I intend to develop other research directions, some of them in connection with the personal research carried out, with the increased involvement of resident doctors, students and PhD students.

I would like to excel professionally, to develop a good academic career that ensures success and fulfillment on a professional level and an increased visibility of the Faculty of Dental Medicine, UMFST "George Emil Palade" from Târgu Mureş.

I intend to achieve as many of the scientific, academic and professional duties that are in my responsibility.