

GEORGE EMIL PALADE UNIVERSITY OF MEDICINE, PHARMACY, SCIENCE AND TECHNOLOGY
OF TÂRGU MUREŞ

DOCTORAL SCHOOL

PhD thesis - Summary

Clinical, statistical and experimental studies regarding non-extraction methods for obtaining space on dental arches

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Orthodontic therapy has experienced a constant dynamic in recent years, thanks to advancements in biomechanics, with the analysis of bone displacement parameters, as well as innovations in the field of materials used in the fabrication of orthodontic appliances, increasingly high-performance materials: ceramic brackets, self-ligating brackets, nickel-titanium wires, titanium molybdenum alloy (TMA) wires, and complex anchorage elements (mini-implants). In addition to these innovations, over the past decade, dental aligners for orthodontic corrections have become increasingly utilized and sought after. There is also a shift in concepts regarding the completion of orthodontic treatment, in the sense that occlusal paradigm is complemented by facial aesthetics and the harmony of the soft tissues of the stomatognathic system.

The past decades have brought considerable progress both in terms of refining investigation and diagnostic techniques and in the evolution of therapeutic options. Treatment techniques have advanced in a spectacular manner, both in terms of precision of use and the possibilities they offer to the practitioner, making dental extraction an increasingly controversial option.

Dental crowding represents the most commonly encountered clinical sign within dento-maxillary anomalies for which patients seek orthodontic treatment. The lack of space for proper dental alignment in the arches is the primary reason for the occurrence of crowding disharmonies, and achieving it remains a challenge for both the orthodontist and the patient.

The methods of obtaining space on dental arches can be differentiated into extraction and non-extraction methods. Tooth extraction has become, in recent times, with technological advancements, an option viewed with skepticism by both doctors and patients, making the extraction vs. non-extraction debate a current topic that will never lose its interest.

The studies presented in this scientific work make a valuable contribution and attempt to clarify the debate regarding tooth extraction or non-extraction in current orthodontic practice, weighing the therapeutic correction provided by both extraction and non-extraction methods and the secondary effects of them on various participating anatomical structures.

The first part of the thesis - **the general part** - includes 2 sections based on the actual scientific knowledge on the necessity of tooth extraction in various dento-maxillary anomalies, particularly the extraction of upper and lower premolars, lower incisors and upper and lower wisdom teeth. The therapeutic value of non-extraction methods and their long-term implications, such as dental stripping (IPR), dental expansion and proclination of the anterior segment, rapid maxillary expansion, osteodistraction and osteogenesis, distalization of lateral segments, derotation of posterior teeth, and uprighting of tilted teeth are also highlighted.

The debate regarding which of the two space-gaining methods provides greater benefits remains unresolved. The primary incentive for undertaking this extensive research is to address this uncertainty. This topic is extensively covered in the thesis's second part, showcasing my **personal contributions** through three distinct studies:

The initial study entitled "**Statistical study concerning extraction and non-extraction methods in orthodontic treatments**" was conducted using a survey, focusing on orthodontists' comparative views of the two space-gaining methods and their associated clinical characteristics based on each individual's practical experience. The questionnaire was distributed to the international orthodontics community by means of social media platforms: orthodontics study and discussion groups, International Orthodontics Associations pages, orthodontics specialists

online clubs. The inclusion criterion was orthodontics specialist status, regardless of clinical experience and it was stated before accessing the questions. The questionnaire was addressed solely to orthodontics specialists and the comprising questions were conceived so that they could only be answered by them.

The second study within the doctoral thesis titled **"Comparison of Enamel Surface Roughness Resulting from Different Methods of Interproximal Reduction: A Scanning Electron Microscopy and Atomic Force Microscopy Investigation"** focuses on evaluating the surface roughness of dental enamel obtained through the therapeutic procedure of stripping. Specifically, it investigates the microstructural and nanostructural changes occurring on dental surfaces following interproximal enamel reduction, utilizing scanning electron microscopy and atomic force microscopy.

In this study, 90 recently extracted human teeth were used, divided into 6 different groups, and subjected to the stripping procedure, employing a different method for each group (diamond burs, abrasive strips of 90 μm , 60 μm , 40 μm , 15 μm , and abrasive discs). Stripping was performed by a single operator, following the manufacturers' recommendations for the various systems used. One proximal surface of each tooth was subjected to IPR, while the other surface remained untreated for control.

Considering the primary characteristic of dental enamel, namely its hardness, the third study titled **"Comparative Evaluation of Dental Enamel Microhardness Following Different Methods of Interproximal Reduction: An Investigation Using the Vickers Hardness Tester"** examines the microhardness of enamel surfaces after interproximal reduction using the Vickers hardness tester, as indicated by the title.

In this context, 40 extracted permanent human teeth were divided into six different groups and subjected to the stripping procedure, using a different method for each group (i.e., diamond burs, abrasive strips of 90 μm , 60 μm , 40 μm , 15 μm , and abrasive discs). Stripping was performed by a single operator, adhering to the manufacturers' recommendations for the various systems used. One proximal surface of each tooth was subjected to IPR, while the other surface remained untreated for control. The hardness of the enamel surface, for both the stripped dental surfaces and the control group, was measured using the Vickers hardness tester. HV1 hardness values were measured with an indentation time of 8 seconds.

The results acquired from the statistical analysis were compared with data from scientific literature. The results were emphasized in all three sections and thoroughly examined. **The general conclusios** are stated in a separate chapter.

Zotero software was employed to generate a refined bibliography. **The references** are presented at the end of this thesis and are systematically arranged in a sequential manner.