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Evaluations of Brackets Effects on Enamel Adhesion, Stability and Coloration

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ABSTRACT

This PhD thesis deals with an interdisciplinary subject, with obvious practical applications, trying to quantify the role of the different adhesive systems in the brackets bonding and the adverse effects after removing the fixed dental braces. Orthodontics, as well as other specialties in Dentistry, has evolved over the last decades, both due to the development of biomechanical concepts and due to the appearance on the product market of various materials and performances designed to ease the work of the practitioner and to increase patient comfort. In this context, the present paper assessed the properties of different adhesive materials, from different companies, in order to send clinicians a practical message by validating the existing materials on the market.

The general part is a synthesis based on recent data from the literature on the various adhesive systems used over time in Orthodontics, with emphasis on the properties of adhesive materials and on the structure of the bracket base, essential elements in bonding. There are described various bonding techniques, light-curing systems, and the need for accuracy techniques both in bracketing and debracketing.

The three studies from the **Personal Research** part are focused on: the analysis of the adhesive systems used in the orthodontic practice, by means of questionnaires completed by both medical residents and specialists in Orthodontics and Dental Facial Orthopedics, the feedback being extremely realistic and very suggestive. The second study is a biochemical study, conducted at the Chemistry Department of the Babes Bolyai University in Cluj-Napoca, a study that analyses the adhesive capacity of two different bonding systems, Transbond and Opal Bond, commonly used in the bonding of brackets. The study was conducted using the universal traction machine, the Lloyd Testing Machine within the Chemistry Laboratory. The teeth used in the study were upper and lower premolars extracted for orthodontic purposes, without carious lesions or dystrophic spots.

We consider obvious the **correlation between SBS and the type of adhesive used**, and the ARI assessment represent an important step in analyzing the bonding correctness and the efficacy of bonding materials. Adhesive materials used in fixed orthodontics should have an increased coefficient of adhesion to prevent brackets from detaching from the dental surfaces but at the same time to be sufficiently elastic so that the ARI index (amount of residual material on the enamel surface after debracketing) should be small enough. We often witness the appearance of white frosty spots after debracketing and the stimulation of

enamel remineralisation is a desideratum of any fixed orthodontic treatment, focused on obtaining a stable occlusion but also a suitable aesthetics (macro and mini-aesthetics).

The latest personal research study is a study designed to quantify the adverse effects of adhesive systems on dental enamel using spectrophotometry, which measures the different dental enamel color shades before and after the application of the fixed appliance. The same adhesive systems were used, and the colorimetric values were evaluated according to the mean values in the presumption tables. The color variations followed Brightness and Chromatics (the chromatic parameters in the green-red axis and the yellow-blue axis), and after the statistical analysis, using the ANOVA test, we concluded that the dental enamel suffered color changes during the fixed orthodontic treatment, reversible changes, which, after the finishing stage and the support of the remineralization phenomenon, fade so that the aesthetic aspect and the enamel coloring are in line with the patients' wishes. If the color is not perfect, different bleaching techniques can be applied, with hydrogen peroxide and custom mouth guards.

The ARI (adhesive remnant index) evaluation is a simple method that analyzes the amount of adhesive remaining on the surface of the dental enamel, which should be removed without producing fractures of the enamel prisms with appropriate, good quality instruments. The use of an **'orthodontic package'** (material and brackets from the same company), along with rigorously respecting operating times in applying and removing the brackets, are some practical tips to help clinicians, recommendations that will obviously contribute to the increase in quality of fixed orthodontic treatment.

In the **Discussions** chapter, I have referred to other specialized studies similar to our research, and the **General Conclusions** chapter briefly presents the conclusions of the three studies. At the end, I attached the Bibliography, which contains 119 titles, in alphabetical order, all of them being quoted in the text.

During the elaboration of this thesis, I published three articles: two ISI, one of them as first author and one BDI article, all of them being annexed to this PhD thesis.