The Effect of two Different Enamel Bleaching Techniques on the Bond Strength of Orthodontic Brackets

(An In-Vitro Study)

A Thesis

Submitted to the Faculty of Dentistry

Ain Shams University

In partial fulfillment of the Requirements for Master Degree in **Orthodontics**

By

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(2014)

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I would like to express my deepest gratitude to ***Prof. Dr. Khaled Fawzy****, Professor of Orthodontics, Department of Orthodontics, Faculty of Dentistry, Ain Shams University for his great guidance and support, and also for giving me the chance to achieve my goal of becoming an orthodontist.*

Words fail to express my sincere thanks and appreciation to ***Dr. Ibrahim Mazen****, Lecturer of Orthodontics, Department of Orthodontics, Faculty of Dentistry, Ain Shams University for his valuable efforts in supervising my work.*

Rania Mohamed

To

My

Great

Family

Thank You

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List of Abbreviations

ANOVA	Analysis Of Variance
ARI	Adhesive Remnant Index
CP	Carbamide Peroxide
HP	Hydrogen Peroxide
m	Weibull modulus
MPa	Mega Pascal
NGVB	Nightguard Vital Bleaching
OTC	Over The Counter
PF	Potassium Fluoride
S_0	Characteristic strength
SBS	Shear bond strength
SEM	Scanning Electron Microscope
SD	Standard Deviation

Introduction

Enamel bleaching became one of the most popular patient requested procedures in dentistry. Teeth bleaching tend to improve self-image of both younger and older populations. After an increased demand for adult orthodontics, orthodontists faced patients who were not satisfied with proper occlusion only, but also asked for whiter teeth [1].

In-office and At-home vital bleaching techniques with various whitening agents gained a worldwide acceptance among clinicians and patients. Many orthodontic patients might have bleaching done at home or might be interested in having their teeth bleached in office at the time of orthodontic treatment.

Several controversies surrounded the exact nature of how bleaching products worked and their effect on both enamel surfaces and bond strength of orthodontic brackets. The variety of conclusions published concerning the bleaching effects on the bond strength of orthodontic brackets suggested the need for more work.

Review of Literature

The presented review of literature was divided to cover three main topics; teeth bleaching, bonding orthodontic brackets to bleached enamel surfaces and factors affecting in-vitro testing of the bond strength of orthodontic brackets.

I. Teeth bleaching

i. Evolution of teeth bleaching

ii. Bleaching chemistry and mechanism

a. Bleaching chemistry
b. Bleaching mechanism

iii. Factors affecting teeth bleaching outcomes

a. Type of the bleaching agent
b. Concentration and time
c. Heat and light
d. Other factors

iv. Bleaching techniques

a. At-home bleaching (Nightguard vital bleaching)
b. In-office bleaching
c. Over-The-Counter bleaching

II. Bonding orthodontic brackets to bleached enamel

i. Effect of bleaching techniques on bond strength of orthodontic brackets

a- In-office bleaching technique

b- At-home bleaching technique

ii. Theories explaining the effects of bleaching on the bond strength of orthodontic brackets

a. Changes in the enamel structure theory

b. Residual oxygen theory

III. Factors affecting in-vitro testing of the bond strength of orthodontic brackets

i. Enamel origin

ii. Storage medium and duration

iii. Orthodontic brackets

iv. Testing technique

a. Type of loading force

b. Force application method

c. Cross-head speed of the testing machine

I. Teeth Bleaching

i. Evolution of teeth bleaching

An attractive smile plays a major role in the overall perception of physical attractiveness. The increased demand for improved esthetics made teeth bleaching a popular and often requested dental procedure. Teeth bleaching offered a conservative treatment option for discolored teeth [2,3].

Before the evolution of teeth bleaching, difficult and potentially invasive dental solutions such as veneers and crowns were used to improve teeth esthetics. Recently, simple and fast bleaching procedures became popular and successful. However, teeth bleaching could not be considered a recent technique in dentistry [4].

In 1916, Adams [5] used hypochloric acid to treat fluorosis and improve teeth esthetics. Ames [6] in 1937 reported a technique that utilized a mixture of hydrogen peroxide and ethyl ether on cotton pellets. This mixture was applied for 30 minutes on teeth to treat mottled enamel in 5 to 25 visits.

In 1966, McInnes [7] utilized a mixture of hydrochloric acid and hydrogen peroxide to remove brown stains from mottled teeth. This technique was successful in improving the color of the mottled teeth.

Cohen and Parkins[8] in 1970 published a method for whitening tetracycline-discolored teeth of young adults treated for cystic fibrosis. They utilized 35% hydrogen peroxide and a heated instrument to accelerate the whitening process. The authors were the first to report the capability of hydrogen peroxide in chemically penetrating the enamel and dentin to whiten teeth.

Nutting and Poe [9] in 1976 introduced a bleaching technique that utilized 35% hydrogen peroxide and sodium perborate for whitening non vital teeth. This was the technique known as the "walking bleaching technique".

In 1989, Haywood and Heyman[10] were the first to introduce the Nightguard vital bleaching technique that was utilized by the patients at home. They published the first clinical study on teeth whitening using proxigel in vacuum-formed custom trays.

Haywood[11] in 1991 modified the regimen for take-home systems to involve the fabrication of a soft plastic nightguard to hold the whitening gel in contact with the teeth. The nightguard was fabricated from a model of the patient's teeth. However, he attributed the first description of successful home bleaching to Dr. Bill Klusmeier in late 1960s, when he reported a technique using gly-oxide; a 10% carbamide peroxide oral antiseptic. This oral antiseptic was inserted in the orthodontic positioners of some