Faculty of Dentistry

The Effect of Diode LASER Activated Tooth Bleaching versus Chemical Tooth Bleaching on surface morphology and chemical profile of Human Maxillary Central Incisor's enamel

(in vitro study)

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بسم الله الرحمن الرحيم

((رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ))

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Dedication

This work is dedicated to

My ***parents***

for their endless prayers, guidance,

encouragement throughout my life

My husband ***Ayman El-Houssainy***

for being my inspiration to succeed and

motivation to continue.

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List of Abbreviations

F.D.A	**F**ood and **D**rug **A**dministration
ROS	**R**eactive **O**xygen **S**pecies
SEM-EDXA	**S**canning **E**lectron **M**icroscope attached with **E**nergy **Dispersive X**-ray **A**nalyzer
HP	**H**ydrogen **P**eroxide
CP	**C**arbamide **P**eroxide
CO_2	Carbon dioxide
Nd:YAG	**N**eodymium-**d**oped: **Y**ttrium **A**luminium **G**arnet; $Nd:Y_3Al_5O_{12}$
KTP	Potassium Titanyl Phosphate ($KTiOPO_4$)
LED	**L**ight **E**mitting **D**iodes
FT-RS	**F**ourier **T**ransform -**R**aman **S**pectrometer
LASER	**L**ight **A**mplification by **S**timulated **E**mission of **R**adiation
MASER	**M**icrowave **A**mplification by **S**timulated **E**mission of **R**adiation
Er,Cr:YSGG	Erbium Chromium: Yttrium Scandium Gallium Garnet
pH	**p**ower of **H**ydrogen
nm	Nano-meter (wave length unit)

W	Watt (power unit)
s	seconds(time unit)
°C	Celsius degree (temperature unit)
CCS group	**C**ontrol **C**hemical bleaching **S**urface Group
CLS group	**C**ontrol **L**ASER activated bleaching **S**urface Group
CCT group	**C**ontrol **C**hemical bleaching Sub-surface Group
CLT group	**C**ontrol **L**ASER activated bleaching Sub-surface Group
ECS group	**E**xperimental **C**hemical bleaching **S**urface Group
ELS group	**E**xperimental **L**ASER activated bleaching **S**urface Group
ECT group	**E**xperimental **C**hemical bleaching Sub-surface Group
ELT group	**E**xperimental **L**ASER activated bleaching Sub-surface Group
SPSS	**S**tatistical **P**ackage for **S**cientific **S**tudies
ANOVA	**An**alysis **o**f **va**riance
P value	**P**robability value
Wt. %	**W**eight percent

Introduction

Today the appearance of teeth is an important part of the smile and the image projected in general, so many people have begun to consider the possibility of using dental bleaching. LASER dental bleaching might be one of the most popular options on the market lately, due to its quick results and effectiveness **(Jiménez *et al.*, 2007).**

According to the Food and Drug Administration (F.D.A.), whitening restores natural tooth color whereas bleaching whitens the teeth beyond their natural color. In other words, whitening refers to the removal of stains on the surface of the tooth with the use of cleaning and polishing agents, whereas bleaching is concerned with doing away with colorants and discolorations in tooth substance by means of oxygen radicals. Unfortunately, the terms "whitening" and "bleaching" are often used interchangeably **(Fornaini *et al.*, 2013).**

Dental bleaching is achieved by an oxidation–reduction reaction in which reactive oxygen species (ROS) and some free radicals released from the dissociation of the bleaching agent attack the dark-colored chromophore molecules present in the dental tissues and split them into smaller and less colored molecules, producing the bleaching effect. Hydrogen Peroxide, due to its reactive properties, is the main active chemical component of most agents used in tooth bleaching therapies **(Fornaini *et al.*, 2013)**.

Some dentists and patients prefer in-office power bleaching, in which a high concentration of hydrogen peroxide is administered to the teeth with an activating or promoting method (e.g. heat, light or LASER) to expedite the whitening effect. The treatment is in complete control of the operator, but it has certain disadvantages **(Jaidev *et al.*, 2011)**. The patient population, always enthralled by LASER, was very keen to try LASER bleaching, which was promoted as a procedure superior to earlier bleaching methods **(Freedman *et al.*, 2012).**