



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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By

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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

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A decorative border in brown and gold colors, featuring intricate scrollwork and floral motifs, framing the central text.

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	Food and Drug Administration
ROS	Reactive Oxygen Species
SEM-EDXA	Scanning Electron Microscope attached with Energy Dispersive X-ray Analyzer
HP	Hydrogen Peroxide
CP	Carbamide Peroxide
CO₂	Carbon dioxide
Nd:YAG	Neodymium-doped: Yttrium Aluminium Garnet ; Nd:Y ₃ Al ₅ O ₁₂
KTP	Potassium Titanyl Phosphate (KTiOPO ₄)
LED	Light Emitting Diodes
FT-RS	Fourier Transform -Raman Spectrometer
LASER	Light Amplification by Stimulated Emission of Radiation
MASER	Microwave Amplification by Stimulated Emission of Radiation
Er,Cr:YSGG	Erbium Chromium: Yttrium Scandium Gallium Garnet
pH	power of Hydrogen
nm	Nano-meter (wave length unit)

W	Watt (power unit)
s	seconds(time unit)
°C	Celsius degree (temperature unit)
CCS group	Control Chemical bleaching Surface Group
CLS group	Control LASER activated bleaching Surface Group
CCT group	Control Chemical bleaching Sub-surface Group
CLT group	Control LASER activated bleaching Sub-surface Group
ECS group	Experimental Chemical bleaching Surface Group
ELS group	Experimental LASER activated bleaching Surface Group
ECT group	Experimental Chemical bleaching Sub-surface Group
ELT group	Experimental LASER activated bleaching Sub-surface Group
SPSS	Statistical Package for Scientific Studies
ANOVA	Analysis of variance
P value	Probability value
Wt. %	Weight 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**).