

**A Comparative Study Between Laser Aided
Orthodontic Therapy and Conventional
Orthodontic Therapy in Alleviating
Mandibular Anterior Crowding**

A

Thesis

**Submitted to the Faculty of Dentistry,
Ain-Shams University**

**In partial fulfillment of the requirements for
Master's Degree in Orthodontics**

By

**Yasmine Khaled Abd El Ghaffar
B.D.S., (2009)**

**Faculty of Dentistry,
Ain-Shams University**

2017

Supervisors

Dr. Khaled Moustafa Fawzy

Professor of Orthodontics

Faculty of dentistry

Ain-Shams University

Dr. Ibrahim Mazen Negm

Assistant Professor of Orthodontics

Faculty of dentistry

Ain-Shams University

Dedication

*To my loving husband, for all your
patience, support and encouragement.*

*To my kids, Lana and Omar, for giving
me a pleasant distraction from writing
this thesis.*

&

*To my beloved family for their endless
help and support.*

Acknowledgment

I would like to express my sincere gratitude and appreciation to **Dr. Khaled Moustafa Fawzy**, Professor of Orthodontics, Faculty of Dentistry, Ain Shams University, for his generous support, faithful supervision and valuable guidance throughout this study.

I would also like to thank **Dr. Ibrahim Mazen Negm**, Assistant Professor of Orthodontics, Faculty of Dentistry, Ain Shams University, for his remarkable help, valuable advice, constant support and encouragement during the course of this study.

Last but not least, I would like to express my deep thanks to all my colleagues and staff members of the Orthodontic Department for their support, encouragement and cooperation.

Contents

Dedication

Acknowledgement

List of Contents i

List of Abbreviations ii

List of Figures..... v

List of Tables vii

Introduction 1

Review of Literature 3

Aim of the Study 44

Material and Methods 45

Results 74

Discussion 90

Summary and Conclusions 105

Recommendations 108

References 109

Appendix I (Consent Forms) ix

Appendix II (Diagnostic Sheet) xii

Appendix III (Patient Questionnaire) xvi

Appendix IV (Clinical Cases) xvii

Arabic Summary

List of Abbreviations

Abbreviation	Full Term
LLLT	Low Level Laser Therapy
PDL	Periodontal Ligament
RANKL	Receptor Activator of nuclear factor kappa B ligand
RANK	Receptor Activator of nuclear factor kappa B
OPG	Osteoprotegrin
M-CSF	Macrophage colony Stimulating Factor
NITI	Nickel Titanium
AAO	American Association of Orthodontics
PAOO	Periodontally accelerated osteogenic orthodontics
MOPs	Micro-Osteo Perforations
PRP	Platelet Rich Plasma
PTH	Parathyroid Hormone
PG	Prostaglandins
PEMF	Pulsed electromagnetic fields
LASER	Light Amplification by Stimulated Emission of Radiation

CO₂	Carbon Dioxide
Er	Erbium
YSGG	Yttrium Scandium Gallium Garnet
YAG	Yttrium Aluminum Garnet
TMDs	Temporomandibular joint Diseases
TENS	Transcutaneous Electrical Nerve Stimulation
LED	Light Emitting Diode
Nm	Nano Meter
J	Joules
H & E	Hematoxylin and Eosin
Ga-Al-As	Gallium Aluminum Arsenide
Cfms	A cell surface receptor
LELI	Low Energy Laser Irradiation
mCT	Micro Computed Tomography
MMP-9	Matrix Metalloproteinase 9
TRAP	Titrate Resistant Acid Phosphatase
LILT	Low Intensity Laser Therapy
CW	Continuous Wave

PW	Pulsed Wave
PCNA	Proliferating Cell Nuclear Antigen
In-Ga-As	Indium Gallium Arsenide
Cu-NiTi	Copper-Nickel Titanium
ALTSD	Arch Length Tooth Size Discrepancy
HLD index	Handicapping Labio-lingual Deviation
LII	Little's Irregularity Index
LAIP	Leveling & Alignment Improvement percentage
VAS	Visual Analogue Scale
CBCT	Cone Beam Computed Tomography
CONSORT	Consolidated Standards of Reporting Trials
Incisal edge	Ie
Root apex	Ra
ALARA	As Low As Reasonably Achieved

List of Figures

Figure number	Title	Page number
1	Consort Flow Chart	49
2	Extra-oral and Intra-oral Photographs	52
3	Orthodontic Study Models	53
4	Patient Positioned In The CBCT Unit	55
5	Biolase epic X console	59
6	(A&B) Whitening Hand Piece	59
7	Laser Application	60
8	Alginate Impression of Lower Arch	62
9	3-Shape R750 Scanner	64
10	Scanning the mandibular model	65
11	Scanned mandibular model	66
12	Scanned mandibular model rotated to the occlusal view	66
13	Little's Irregularity Index measured on scanned cast using ortho-analyzer software	67
14	Visual Analogue Scale to measure pain perception	68
15	Orienting the cursers on the axial and coronal view to pass through the center of the root	70
16	Measuring incisor length from incisal edge to root apex on the sagittal view	71
17	Bar chart representing mean time for leveling and alignment in the two groups	75