Light Emitting Diode in Skin Rejuvenation

Thesis

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Presented by

Moataz Mohsen Nosseir

(M.B., B CH)

Faculty of Medicine - Ain Shams University

Under Supervision of

Prof. Adel Ahmed Halim Imam

Professor and Head of Dermatology, Venereology and Andrology Department-Ain Shams University

Dr. Mary Fikry Matta

Lecturer of Dermatology, Venereology and Andrology
Ain Shams University

Dr. Abeer Attia Tawfik

Assistant professor of Dermatology
National Institute of Laser Enhanced Sciences
Cairo University

Faculty of Medicine
Ain Shams University
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Moataz Nosseir

الديود الضوئى المشع فى إصباء البشرة

نزك ب

توطئة للحصول على درجة الماجستير
فى الأمراض الجلدية والتناسيلة والذكورة

قخلب لم

معتز محسن نصير
بكالوريوس الطب والجراحة
كلية الطب– جامعة عين شمس

قح ةؤسف .

أ.د/ عادل أحمد حليم إمام
أستاذ ورئيس قسم الأمراض الجلدية والتناسلية والذكورة
كلية الطب– جامعة عين شمس

د/ مارى فكرى متى
مدرس الأمراض الجلدية والتناسلية والذكورة
كلية الطب – جامعة عين شمس

د/ عبير عطية توفيق
أستاذ الأمراض الجلدية المساعد
المعهد القومى لعلوم الليزر
جامعة القاهرة

كلية الطب – جامعة عين شمس
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List of Abbreviations

AP1	Activator protein 1
ADP	Adenosine diphosphate
ALA-PDT	Amino levulinic acid- photodynamic therapy
ATP	Adenosine triphosphate
BTX	Botulinum toxin
CO	Carbon monoxide
CO2	Carbon dioxide
CW	Continuous wave
DEJ	Dermoepidermal junction
DNA	Deoxynucleic acid
ECM	Extracellular matrix
ELOS	Electro optical synergy
Er: YAG	Erbium: Yttrium – aluminum – garnet
FDA	Food and Drug Administration
GAG	Glycosaminolycans
GH	Growth hormone
Hb	Hemoglobin
IGF1	Insulin like growth factor 1
IL	Interleukin
IPL	Intense pulsed light
IU	International units
IR	Infrared
J/cm2	Joules/square centimeter
KCM	Keratinocyte conditioned medium

KTP	Potassium titanyl phosphate
LE	Lupus erythematosus
LED	Light emitting diode
LLLT	Low level laser therapy
mALA	Methyl ester amino levulinic acid
MMP	Matrix metalloproteinases
Mt DNA	Mitochondrial deoxynucleic acid
NADH	Nicotinamide Adenine Dinucleotide Dehydrogenase
NASA	National Aeronautics and Space Administration
NB	Narrow band
Nd: YAG	Neodynium : Ytrium-aluminum – garnet
NILES	National Institute of Laser Enhanced Sciences
NIR	Near infrared
NM	Nanometer
NO	Nitric oxide
PCR	Polymerase chain reaction
PDL	Pulsed dye laser
PDT	Photodynamic therapy
PGE	Prostaglandins E
PIH	Post inflammatory hyperpigmentation
PpIX	Protoporphyrin IX
PRP	Platelet rich plasma
RF	Radiofrequency
ROS	Reactive oxygen species
SPF	Sun protection factor
TGF-β	Transforming growth factor Beta
UV	Ultraviolet

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Introduction

Cutaneous aging is a complex biological phenomenon affecting the different constituents of the skin ***(Farage et al., 2008).*** There are two independent, clinically and biologically distinct processes affecting the skin simultaneously. The first is the innate or intrinsic aging, 'the biologic clock' that affects the skin by slow irreversible tissue degeneration. The second process is the extrinsic aging, which is the result of exposure to outdoor elements namely the photoaging ***(Sjerobabski-Masnec and Situm, 2010)***.

Aging skin presents various unpleasant looking morphological changes such as wrinkles, dyspigmentation, telangiectasia and loss of elasticity. Both chronological and environmental influences are involved in the aging process of the skin, among which photodamage is one of the most important components ***(Lee et al., 2007)***.

Various rejuvenation modalities have attempted to reverse the signs of photo-and chronological aging. At the center of these treatments have been ablative methods which remove the epidermis and induce a controlled form of skin wounding to promote collagen biosynthesis and dermal matrix remodeling such as dermabrasion, chemical peels and ablative laser resurfacing with carbon dioxide (Co2) or erbium: yttrium -aluminum - garnet (Er: YAG) lasers or a combination of these wavelengths ***(Airan and Hruzan, 2005)***

Non ablative skin rejuvenation aims to improve photoaged skin without destroying the epidermis (***Dierickx***

and Anderson, 2005). It has been arbitrarily classified into two types, type I and type II photorejuvenation. The former primarily targets irregular pigmentation and telengiectasia and includes intense pulsed light (IPL) sources, 532 nm potassium -titanyl-phosphate (KTP) lasers and 585/595nm pulsed dye lasers (PDL), while the latter aims for wrinkles reduction and skin lightening and utilizes 1064 and 1320nm neodymium: yttrium- aluminum - garnet (Nd: YAG) lasers, 1450nm diode lasers and 1540nm erbium glass lasers ***(Trelles et al., 2004).***

Light may promote rejuvenation process via non thermal light modulation ***(Ji et al., 2014)***.The light emitting diode (LED) is a novel light source for non ablative skin rejuvenation. It is considered to be effective for improving wrinkles and skin laxity, thus being classified under type II photorejuvenation ***(Russel et al., 2005).*** LED phototherapy is a treatment which stimulates cell activities and functions through a photobiomodulative effect. Photobiomodulation is the process where the incident photons are absorbed by chromophores to modulate various cell functions and is believed to result in new collagen synthesis leading to rejuvenation ***(Sauder, 2010)***.

Aim of the study:

Is to determine the clinical efficacy of LED phototherapy for skin rejuvenation.