

Treatment Of Infraorbital Dark Circles Using Long-Pulsed 1,064-nm Neodymium- Doped Yttrium Aluminum Garnet Laser

A Thesis

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Presented by

DINA REDA MOHAMMED

M.B.B.Ch, Ain Shams University

Under Supervision of

Prof. Mohammed ABD El Naeem Sallam

Professor of Dermatology, Venereology and Andrology
Faculty of Medicine, Ain Shams University

Dr \ Mahmoud Abd El Rahim Abdallah

Associate Professor of Dermatology, Venereology and Andrology
Faculty of Medicine, Ain Shams University

Faculty of Medicine
Ain Shams University
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List of abbreviations

ACD:	Allergic contact dermatitis.
ACTH:	Adrenocorticotropic hormone.
AD:	Atopic dermatitis.
AHA:	Alpha hydroxy acid.
BaSo4:	Barium sulfate.
BFGF:	Basic fibroblast growth factor
B-MSH:	Beta melanin stimulating hormone.
Co2 :	Carbon dioxide.
CW co2:	Continuous wave carbon dioxide.
DA:	Deoxy-arbutin
DC:	Dark circles.
DCT:	Dihydroxy-L-phenylalanine chrome tautomerase.
DOPA:	Dihydroxyphenylalanine.
EGF:	Epithelial growth factor
ER:	Endoplasmic reticulum.
Er:YSGG:	Erbium: yttrium scandium gallium garnet laser.
ET-1:	Endothelin-1.
FDE:	Fixed drug eruption.
GM-CSF:	Granulocyte-macrophage colony-stimulating factor.
HGF:	Hepatocyte growth factor.
ICD:	Irritant contact dermatitis.
ICHOR:	Idiopathic cutaneous hyperchromia of the orbital region.
IOP:	Infraorbital pigmentation.
KA:	Kojic acid.

KTP:	Potassium-titanyl-phosphate.
LA:	Lactic acid.
LIF:	Leukemia inhibitory factor.
LP:	Long pulse.
MC1-R:	Melanocortin 1 receptor.
MgO:	Magnesium oxide.
MS:	Millisecond.
MSH:	Melanin stimulating hormone.
NGF:	Nerve growth factor.
ND: YAG:	Neodymium-doped yttrium aluminum garnet.
NS:	Nanosecond.
PABA:	Para-aminobenzoic acid.
PBC:	Primary biliary cirrhosis.
PDGF:	Platelet-derived growth factor
PG:	Prostaglandins.
PIH:	Post inflammatory hyperpigmentation.
PKC:	Protein kinase C.
POMC:	Proopiomelanocortin
POH:	Periocular hyperpigmentation.
PRP:	Platelets rich plasma.
QS:	Quality switched.
QSNY:	Quality-switched neodymium doped yttrium.
RA:	Retinoic acid.
TGF:	Transforming growth factor.
TiO2:	Titanium dioxide.
TYR:	Tyrosinase.
TYRP1:	Tyrosinase-related protein 1
VEGF:	Vascular endothelial growth factor.

ZnO:	Zinc oxide.
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**علاج الهالات السوداء تَحْتَ الحَجَاج باستخدام الليزر
البَجَادِيّ من الألومينيوم ذي الإتريوم القائم على شبه
موصل مطلي بالنيُوديميُوم (1,064 نانومتر) طويل النبض**

رسالة

**توطئة للحصول على درجة الماجستير
في الأمراض الجلدية والتناسلية وأمراض الذكورة**

مقدمه من

الطبيبة/ دينا رضا محمد

بكالوريوس الطب والجراحة - جامعة عين شمس

تحت إشراف

أ.د./ محمد عبد النعيم سلام

أستاذ الأمراض الجلدية والتناسلية وأمراض الذكورة

كلية الطب - جامعة عين شمس

د./ محمود عبد الرحيم عبد الله

أستاذ مساعد الأمراض الجلدية والتناسلية وأمراض الذكورة

كلية الطب - جامعة عين شمس

كلية الطب

جامعة عين شمس

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Introduction

Infraorbital dark circle refers to a condition that presents with relative darkness of the infraorbital eyelids. It can be a significant cosmetic problem, and many individuals seek treatment for this condition, but there have been few investigations regarding the cause and little research into the potential treatment of this condition, moreover it worsens with the aging process of skin sagging and altered subcutaneous fat distribution (*Yaar and Gilcrest, 2001*).

Possible causative factors of the dark circles include excessive pigmentation; thin, translucent lower eyelid skin overlying the orbicularis oculi muscle; and shadowing due to skin laxity and tear trough (*Lowe et al., 1995*).

In general, treatment with depigmenting agents must be continued for several months before cosmetic benefits are obtained. The action mechanisms of depigmenting agents are inhibition of tyrosinase activity, inhibition of DNA synthesis in hyperactive melanocytes, reduction of epidermal content of melanin, and thickening of the epidermis (granular layer)(*Prignano et al. , 2007*).

If infraorbital dark circles are due to thin and translucent lower eyelid skin, the prominence of the infraorbital veins makes them visible. In this case the use of sclerotherapy for the removal of periorcular veins is unsuitable because of the risk of ophthalmologic and neurologic complications (*Kersten et al., 2007*).

Dark circles due to excessive pigmentation have been successfully treated with various pigment lasers, including the Q-switched ruby (694-nm) laser (*Lowe et al.,1995*) , Q-switched alexandrite (755-nm) laser , and neodymium-

doped yttrium aluminium garnet (Nd:YAG) 1,064-nm laser (*Kovak et al.,1998*).

Variable-pulsed neodymium-doped yttrium aluminum garnet (Nd:YAG) lasers have been used for the effective removal of telangiectasias and leg veins (*Bevin et al.,2006*).

Long- pulsed 1,064 (Nd:YAG) laser was successfully used for the treatment of infraorbital dark circles due to visible prominent veins which found to be effective and safe (*Ma et al., 2012*)no control was used in this study.

Aim of the Work

To assess the effectiveness of Long-Pulsed 1,064-nm Neodymium-Doped Yttrium Aluminum Garnet Laser in the treatment of venous infraorbital dark circles.

Chapter 1

Causes of Infraorbital Dark Circles

1.1. Definition of dark circles:

Dark circle is not a formal medical term, but both patients and dermatologists use it to indicate periorbital hyperchromic macules and patches (***Balkrishnan et al., 2003***). Dark circles also known as idiopathic cutaneous hyperchromia of the orbital region (ICHOR), periorbital hyperpigmentation, periorbital melanosis or infraorbital pigmentation (***Epstein, 1999***).

Infraorbital dark circles interfere with the face appearance, giving the patient a tired, sad, or hung over look. Women tend to find this condition particularly problematic, and many urgently seek treatment for it (***Freitag and Cestari, 2007***). This condition is relatively common affecting individuals regardless age, sex, and race (***Roh and Chung, 2009***). Moreover, it worsens with the aging process of skin sagging and altered subcutaneous fat distribution (***Yaar and Gilchrest, 2001***).

Although dark circles is a condition that does not cause morbidity, it can influence the quality of life from the medical point of view (***Balkrishnan et al., 2003***).

1.2. Pathogenesis of Skin Pigmentation:

Cutaneous pigmentation is the outcome of two important events: the synthesis of melanin by melanocytes within melanosomes and the transfer of melanosomes via dendrites (membrane-bound organelles) to surrounding keratinocytes, where they play a critical role in photoprotection (*Costin and Hearing, 2007*).

The melanin content of human melanocytes is heterogeneous not only between different skin types which are highly regulated by gene expression, but also between different sites of the skin from the same individual for example; face, arms and shins (*James et al., 2006*). Variation in skin pigmentation is clearly a multifactorial trait with numerous intrinsic and extrinsic factors, including a number of major genetic determinants, gender effects, hormonal effects, age, stress, environmental effects such as exposure to ultra violet rays (UVR) and chemical exposure that modulate the amount, type, and distribution of melanin in the skin (*Schoen and Lazar, 1990*).

1.2.1. Melanin biosynthesis:

Melanin biosynthesis is a complex pathway that appears within melanosomes in melanocytes which are highly specialized cells (*Kanitakis, 2002*). Melanosomes are typically divided into four maturation stages (**Figure 1.1**) (I–IV) determined by their structure and the quantity, quality, and arrangement of the melanin produced (*Kushimoto et al., 2001*).