

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

**Sudan University of Science and Technology**  
**Institute of Laser**  
**College of Post Graduate Studies**

**Use of Diode Laser 940nm in the  
Treatment of Dermatitis  
Papulosa Nigra**

**Study for:**

**A dissertation submitted for partial fulfillment of the  
requirement for the degree of post graduate diploma of  
laser application in medicine - dermatology**

**By**  
**Dr. Anhar Elamin Mohammed**  
**M.D dermatology**

**Supervisors**  
**Dr: Mubarak Elmahal Ahmed (Laser Physics )**  
**Dr: Mohammed Abd Allah Taha (Laser in Dermatology)**

**April 2009**



## Abstract

This study has been conducted at Sudan University of Science and Technology, institute of laser in the period from Feb to Apr 2009, on thirteen patients.

**Objective:** The objective of this study is to determine the effect of diode laser 940nm in the treatment of DPN patients.

**Method:** Thirteen patients diagnosed as DPN were selected and treated with diode laser Medilas D fibertom 940nm, standard mode, single pulse, 20 watt power, 0.2 second duration and bare fiber beam delivery system.

**Result:** This study revealed that all patients are females seek removal of lesions due to cosmetic cause. The total energy delivered to each patient is ranging from less than 60j in 15.4% of patients to more than 60J in 84.6% of patients, according to the total number of lesions.

The total exposure time was less than 10 seconds in 46.2% of patients and between 10-20 seconds in 23.1% of cases and more than 21 seconds in 30.8% of patients.

Almost all patients (92.3%) are completely cured without residual complications.

**Conclusion:** We can get that Diode laser 940nm is effective and safe in the treatment of Dermatosi papulosa nigra.



## مستخلص البحث

أجريت هذه الدراسة بجامعة السودان للعلوم والتكنولوجيا، معهد أشعة الليزر في الفترة من فبراير إلى أبريل 2009م على ثلاثة عشر مريضة.

### الهدف من الدراسة:

الهدف من هذه الدراسة هو تحديد أثر دايود ليزر 940 nm في معالجة مريض Dermatosis Papulosa Nigra.

### الطريقة:

تم تشخيص ثلاثة عشر مريضة كحالات DPN وتمت معالجته بليزر الدايدود نبض واحد 940 nm Fibertom وقوة 20 واط ولمدة 0.2 ثانية ونظام تسليط أشعة الألياف الضوئية بدون ملامسة الجسم.

### النتيجة:

أوضحت هذه الدراسة أن كل المريضات الإناث يسعين لإزالة بقع لأسباب تجميلية.

جملة الطاقة التي وجهت لكل مريضة هي أقل من 60 جول بنسبة 15.4 % من المريضات و أكثر من 60 جول بنسبة 84.6% من المريضات وفق العدد الكلي للبقع.

زمن تسليط الطاقة كان أقل من 10 ثواني في 46.2% من المريضات وبين عشرة إلى عشرين ثانية في 23.1% من المريضات، وأكثر من 21 ثانية في 30.8% من المريضات.

تمت معالجة 92.3% من كل المريضات معالجة كاملة دون تعقيدات متبقية وفي الختام نتوصل إلى أن الدايدود ليزر 940 nm فعال في معالجة مريض Dermatosis Papulosa Nigra.



## List of contents

Subject	Page No
الآية	I
Dedication	II
Acknowledgement	III
English abstract	IV
Arabic abstract	V
List of content	VI
List of tables	X
List of figures	XI
<b>Chapter One</b>	
Introduction & Literature Review	
1.1 Introduction	1
1.1.1 Preface to this study	1
1.1.2 Skin anatomy and function	2
1.1.2.1 Epidermis	3
1.1.2.1.1 Stratum corneum (horny layer)	3
1.1.2.1.2 Stratum lucidum	4
1.1.2.1.3 Stratum granulosum	4
1.1.2.1.5 Basal layer	4
1.1.2.2 Dermis	5
1.1.2.3 Subcutaneous fat layer	5
1.2 Dermatitis Papulosa Nigra	5
1.2.1 Aetiology and pathophysiology	5
1.2.2 Race and Sex	6
1.2.3 Age	6
1.2.4 Clinical features	6
1.2.4.1 History	6
1.2.4.2 Physical	7
1.2.4.3 Histologic findings	7
1.2.5 Differential diagnosis	7



1.2.6 Treatment	8
1.2.7 Prognosis	9
1.3 Laser Basics	9
1.3.1 History of Medical lasers	9
1.3.2 Laser basics	10
1.3.2.1- Coherence	10
1.3.2.2- Monochromaticity (temporal coherence)	11
1.3.2.3-Collimation	11
1.3.3 Lasing action	11
1.3.3.1 Absorption of light	12
1.3.3.2 Spontaneous emission	12
1.3.3.3 Stimulated emission	12
1.3.4 Common Components of all lasers	13
1.3.4.1 Active medium	13
1.3.4.2 Excitation mechanism	14
1.3.4.3 Feedback mechanism	14
1.3.4.4 Output coupler	14
1.3.5 Type of lasers	14
1.3.5.1 Gas lasers	15
1.3.5.2 Liquid dye lasers	15
1.3.5.3 Semiconductor lasers	15
1.3.5.4 Solid state lasers	17
1.3.6 Laser safety	17
1.3.6.1 Safety precautions	17
1.3.6.2 Laser safety classifications	19
1.3.6.3 Laser hazards	21
1.3.7 Laser tissue interaction	21
1.3.7.1 Photochemical interaction	22



1.3.7.1.1 Photodynamic therapy	22
1.3.7.1.2 Bio stimulation	23
1.3.7.1.3 Photochemical (bond breaking) ablation	23
1.3.7.2 Photo thermal interactions	23
1.3.7.3 Plasma induced ablation	25
1.3.7.4 Photo disruption	25
1.3.8 Selective Photothermolysis	26
1.3.9 Time of thermal relaxation	26
1.3.10 Medical Lasers	27
1.3.11 Complications of Dermatologic Laser Surgery	28
1.3.11.1 Laser safety complications:	28
1.3.11.1.1 Ocular complications	28
1.3.11.1.2 Fire and electric shock	29
1.3.11.1.3 Infection of personnel	29
1.3.11.2 Primary epidermal complications	30
1.3.11.2.1 Hyper pigmentations	30
1.3.11.2.2 Hypo pigmentation	30
1.3.11.2.3 Postoperative blistering	31
1.3.11.2.4 Postoperative crusting	31
1.3.11.2.5 Milia	31
1.3.11.3 Primary dermal complications	32
1.3.11.3.1 Purpura	32



1.3.11.3.2 Scarring	32
1.3.11.4 Other complications	33
1.3.11.4.1 Delayed wound healing	33
1.3.11.4.2 Wound infection	33
1.3.11.4.3 Darkening of flesh-colored cosmetic tattoos	34
1.3.11.4.4 Allergic reactions after laser treatment of tattoos	34
1.3.11.4.5 Postoperative erythema	34
1.3.12 Lasers used in Dermatology	35
<b>Chapter Two</b>	
Material & Method	
2.1 Material	37
2.1.1 Dornier Medilas D Fibertom application modes	37
2.1.1.3 Clinical application of diode laser in dermatology	40
2.1.1.4 The patients	40
2.1.1.5 Data collection tools and techniques:	40
2.1.1.6 Other materials	41
2.1.6.1 Disinfectants	41
2.2 Method	41
2.2.1 Ethical considerations	41
2.2.2 Laser parameters	41
2.2.3 Laser surgery	42
2.2.4 Post operative care	42
2.2.5 Data analysis	43
<b>Chapter Three</b>	
Results , Discussion & Conclusion	
3.1 Result & Discussion	44
3.2 Conclusion	55
References	56
Appendix	