Effects of Low-Level Laser on Gamma-Irradiated Rats

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Dedication

I dedicate this work to Allah and my Family

And for all
My friends and those from whom I have
learned, whenever and wherever they are

Elbatoul Ahmed

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Abstract

Background: One inescapable feature of life on the earth is exposure to ionizing radiation. The thyroid gland is one of the most sensitive organs to gamma-radiation and endocrine disrupters. Since 1967, low level laser therapy (LLLT) has been used to stimulate tissue repair, and reduce inflammation. ***Objective:*** The aim of this study was to gauge the value of using Helium-Neon (He-Ne) laser to repair the damaged tissues of thyroid gland due to gamma-irradiation. ***Materials and methods:*** One hundred and forty four albino rats were used in this study and designed as control, gamma irradiated, and gamma plus laser groups where rats were irradiated with gamma radiation (6 Gy) and an external dose of He-Ne laser [Wavelength 632.8 nm, 12 mW, CW, Illuminated area 5.73 cm^2, 2.1 mW/cm^2, 120 sec, 1.4 J, 0.252 J/cm^2] twice weekly for a total of six sessions. The total dose per session was 0.252 J/cm^2 in both laser and gamma plus laser groups localized on thyroid region of the neck after shaving and sacrificed on six time intervals after each dose of He-Ne laser irradiation. Total triiodothyronine, total thyroxine and thyroid stimulating hormone, blood super oxide dismutase and catalase, glutathione, nitric oxide, liver malonaldhyde and blood picture,

serum alanine transaminase and aspartate transaminase activities were evaluated. In addition, histological analysis was performed. ***Results:*** Statistical analysis revealed significant differences in different parameters among experimental groups at different time intervals. ***Conclusion:*** He-Ne laser has a potential therapeutic performance to ameliorate the damaging effect of the γ **-**radiation whether at systematic or local levels.

I declare that this thesis has been composed by me and it has not been submitted for a degree at this or any other university.

Elbatoul Ahmed Mohamed

LIST OF Abbreviations

Abbreviations	Description
ALT	Alanine transaminase
AST	Aspartate transaminase
CAT	Catalase
CK	Creatine kinase
DIT	Diiodotyrosine
DNA	Deoxyribonucleic acid
ELISA	Enzyme-linked immunosorbent assay
eNOS	Endothelial NO synthase
GSH	Reduced glutathione
GSSG	Oxidized glutathione
Gy	Gray (radiation absorption dose unit = 1 joule/kg)
He-Ne	Helium Neon gas
iNOS	Induciable NO synthase
iNOS	Induciable NO synthase
J/cm^2	Unite of laser dose in joule
LASER	Light Amplification by Stimulated Emission of Radiation
LLLT	Low-level laser therapy
NADP	Nicotinamide- adenine dinucleuotide phosphate oxidized
NADPH	Nicotinamide- adenine dinucleuotide phosphate reduced
nNOS	Neurnal NO synthase
NO	Nitric oxide
$O_2^{\bullet -}$	Super oxide
$OH^{\bullet}$	Hydroxyl radical

$ONOO^-$	Peroxy nitrite
PLTs	Platelets
PUfA	polyunsaturated fatty acids
RNA	Ribonucleic acid
RNS	Reactive nitrogen species
ROS	Reactive oxygen species
SOD	Super oxide dismutase
SOD	Superoxide dismutase
Sv	Sievert (the effective dose = 1 Gy for γ-radiation)
TBA	Thiobarbituric acid
TPO	Thyroid microsomal peroxidase
TRH	Thyroid relesing hormone
TSH	Thyroid stimulating hormone
tT_3	Triiodothyronine
tT_4	Thyroxine

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