

## Effect of laser treatment on thyroid gland hormones in female rabbits

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### Abstract

This study was designed to investigate the effect of laser treatment on thyroid functions and hormones in female rabbits. A total of 18 female rabbits were used in this investigation. Six rabbits were used for examining the thyroid gland location and dissected to be sure that laser therapy will be directed to this gland. Twelve female rabbits were used in this experiment to study the physiological effect of laser therapy ( $4J/cm^2$ ) on normal thyroid function they were divided into two equal groups, six used as control and the others were exposed to laser therapy at the thyroid gland region for three successive days for 5 minutes on each side. Then blood was collected for hormonal assay from ear vein at 1, 6, 12, 18, 24 and 30 days after the last dose of laser treatment. The results revealed a gradual decrease in serum  $T_3$  and  $T_4$  levels with a concomitant increase in TSH level at the first eighteen days of laser treatment, then normalization of hormones level were take place to be normal after thirty days. More work is needed on this subject to examine the specific role of laser on glands.

**Keywords:** Laser; Thyroid gland; Rabbits.

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### تأثير المعاملة بالليزر في أفراس هرمونات الغدة الدرقية في اناث الارانب

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### الخلاصة

صمم هذا البحث لدراسة تأثير اشعة الليزر على وظائف الغدة الدرقية والوظيفة الفسلجية لهرموناتها بالجسم. لتحقيق هذا الهدف تم استخدام ثمانية عشر ارنياً من الاناث. تم استخدام ستة ارناب للتشريح ومعرفة موقع الغدة وحجمها ولتحديد شكلها ومكانها في الرقبة. تم استخدام اثني عشر ارنياً من الاناث السليمة لمعرفة تأثير اشعة الليزر على الغدة الدرقية ومستوى الهرمونات بالدم. قسمت هذه الارانب الى مجموعتين متساويتين مجموعة سيطرة ومجموعة تعرضت لاشعة الليزر بجرعة (4 جول/سم<sup>2</sup>) على منطقة الغدة الدرقية لفترة ثلاث ايام متتالية وبواقع (5) دقائق للجرعة الواحدة على كل جهة من الغدة. تم سحب الدم بعد 1، 6، 12، 18، 24، 30 يوماً بعد الجرعة الاخيرة من الليزر وذلك لقياس مستوى هرمونات TSH،  $T_3$ ،  $T_4$  بالدم. اظهرت النتائج انخفاضاً تدريجياً في مستوى  $T_3$  و  $T_4$  مع ارتفاع في مستوى هرمون TSH في دم المجموعة المعرضة لاشعة الليزر لحد اليوم الثامن عشر بعد اخر جرعة، بعد هذا عادت الهرمونات لمستواها الطبيعي بعد اليوم الثلاثين من التجربة. المزيد من البحوث ضرورية لمعرفة دور الليزر على بقية الغدد.

### Introduction

LASER is an acronym for Light Amplification by Stimulation Emission of Radiation, the key to operation of laser in 1917 when Albert Einstein made the proposal that particles of light with energy of a particular frequency could stimulate electrons to emit radiation of the light at same frequency (1).

Since the last century the laser occupied a large degree of attention in the scientific and technological fields. Invention of laser causes a chain of important changes in science development, industrial, commercial, agricultural, specification and measurement, cosmetic surgery and medical therapy. It had been used for eye treatment, autoimmune thyroiditis, menopausal bleeding, fallopian tube opening and ovarian stimulation to produce estrogen (2).

Although, laser irradiation is now being considered a therapy of choice for many difficult pain management challenges and is becoming a common practice in medicine there is no clear understanding of its side effects from one side and its physiological actions on endocrine glands from the other side. Moreover, the available literature lacks the effect of laser on thyroid gland directly and their physiological changes in the body. Thus, this experiment was designed to study the effect of laser therapy on thyroid hormones in normal female rabbits.

**Materials and methods**

The study was conducted in the central health lab / Health ministry / Baghdad. A total number of eighteen female rabbits weighing (1-1.5) Kg and 6 months old were used in this study because many authors have reported that the females is more susceptible to thyroid diseases than males (3,4). They were housed in clean plastic cages and kept in conditioned room (28 -32 °C). All animals were left for two weeks for adaptation.

Six female rabbits were killed by intramuscular injection of Ketamine hydrochloride at a dose 5ml/rabbit and the thyroid gland was exposed and the location was noticed. Twelve female rabbits were divided into two groups; Control groups, these rabbits were kept without any medication or treatment. Laser therapy group, the thyroid gland of these animals was exposed to diode laser light for 5 minutes at each side of the gland for 3 successive days. The dose was 4J/cm<sup>2</sup> as mentioned by (5).

Clinical signs and symptoms were recorded and noted carefully throughout the experiment which lasted for 30 days. Blood samples were collected and serum was isolated at 1<sup>st</sup>, 6<sup>th</sup>, 12<sup>th</sup>, 18<sup>th</sup>, 24<sup>th</sup> and 30<sup>th</sup> days after the last dose of irradiation for the following hormonal assay parameters:

1. Total triiodothyronine (TT<sub>3</sub>) assay (nmol/L): T<sub>3</sub> was measured using standard assay (TT<sub>3</sub>-Kit) (6).
2. Total thyroxin (TT<sub>4</sub>) assay (nmol/L): The standard assay (TT<sub>4</sub>-Kit) was used (7).
3. Thyroid stimulating hormone (TSH) assay (mlu/L): The serum level of TSH was measured using standard assay (TSH-Kit) (8).

All data were statistically analyzed on the bases of two way analysis of variance (ANOVA) (9).

**Results**

Animals exposed to diode laser showed depression, fatigue, cold body, weakness, constipation and anxiety. Where as, no such symptoms were observed in control group.

The mean values of serum T<sub>3</sub>, T<sub>4</sub> and TSH levels±Se for female rabbits during 30 days after laser exposure at a dose

(4J/cm<sup>2</sup>) for 3 successive days are represented in tables 1-3 and figures 1-3.

Table 1: The physiological effect of laser therapy on serum T<sub>3</sub> (nmol/l) level of normal female rabbits as compared to control group at different times after the third dose of laser therapy at (4J/cm<sup>2</sup>).

Time	Group	
	Control	Laser therapy
1 day	2.00 ±0.10 Aa	1.88 ± 0.10 Aa
6 days	2.10 ±0.10 Aa	1.65 ± 0.10 Bab
12days	2.13 ±0.10 Aa	1.40 ± 0.04 Bc
18 days	2.03 ±0.05 Aa	1.02 ±0.04 Bd
24 days	2.13 ±0.20 Aa	1.53 ±0.04 Bb
30 days	2.17 ±0.04 Aa	1.88 ±0.10 Ba

Values = mean±SE (n=6 rabbits).

Capital Letters denote: the difference between groups.

Small Letters denote: the difference within group.

Table 2: The physiological effect of laser therapy on serum T<sub>4</sub> (nmol/l) level of normal female rabbits as compared to control group at different times after the third dose of laser therapy at (4J/cm<sup>2</sup>).

Time	Group	
	Control	Laser therapy
1 day	104.8 ± 2.20 Aa	102.2 ± 1.70 Aa
6 days	103.5 ± 2.40 Aa	82.5 ± 1.80 Bbc
12days	104.3 ± 2.50 Aa	76.8 ± 1.80 Bc
18 days	102 ± 2.30 Aa	50.8 ± 2.70 Bd
24 days	102.8 ± 1.40 Aa	77.3 ± 1.40 Bc
30 days	111.5 ± 0.70 Aa	96.5 ± 1.60 Bab

Values = mean±SE (n=6 rabbits).

Capital Letters denote: the difference between groups.

Small Letter denote: the difference within group.

Table 3: The physiological effect of laser therapy on serum TSH (mlu/l) level of normal female rabbits as compared to control group at different times after the third dose of laser therapy at (4J/cm<sup>2</sup>).

Time	Group	
	Control	Laser therapy
1 day	2.42 ± 0.10 Ba	3.78 ± 0.20 Acd
6 days	2.33 ± 0.10 Ba	4.48 ± 0.20 Ac
12days	2.33 ± 0.10 Ba	5.48 ± 0.20 Ab
18 days	2.21 ± 0.10 Ba	6.50 ± 0.20 Aa
24 days	2.31 ± 0.10 Ba	4.23 ± 0.10 Ac
30 days	2.35 ± 0.10 Ba	2.88 ± 0.10 Ae

Values = mean±SE (n=6 rabbits).

Capital Letters denote: the difference between groups.

Small Letters denote: the difference within group.

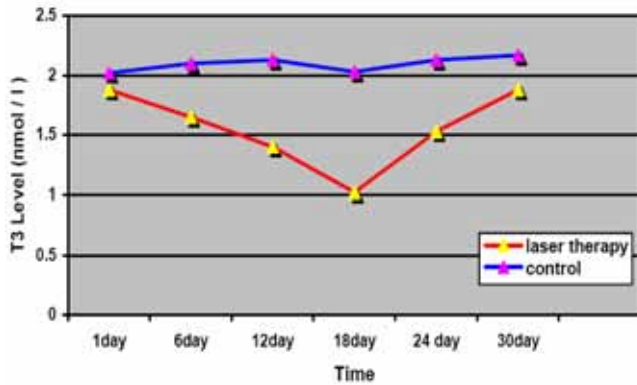


Figure 1: The physiological effect of laser therapy on serum T<sub>3</sub> (nmol/l) level of normal female rabbits as compared to control group at different times after the third dose of laser therapy at (4J/cm<sup>2</sup>).

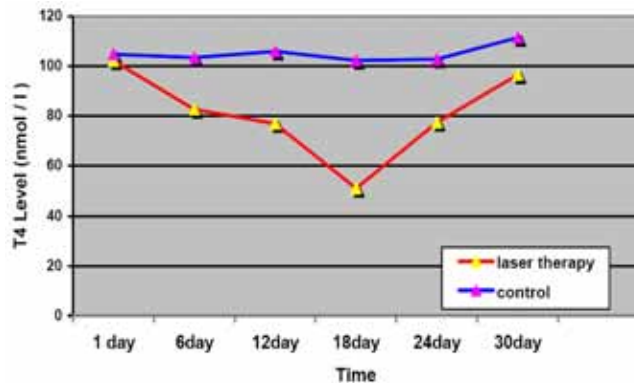


Figure 2: The physiological effect of laser therapy on serum T<sub>4</sub> (nmol/l) level of normal female rabbits as compared to control group at different times after the third dose of laser therapy at (4J/cm<sup>2</sup>).

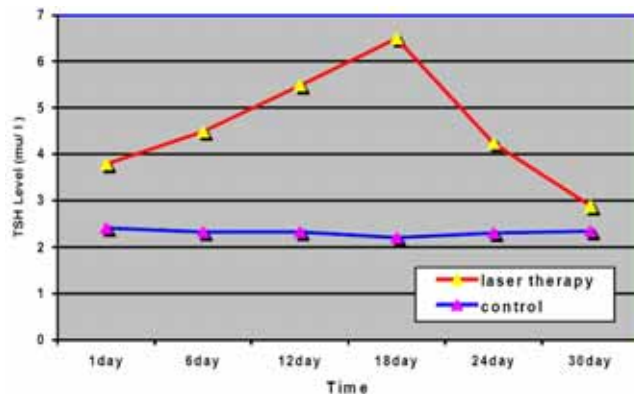


Figure 3: The physiological effect of laser therapy on serum TSH (mIU/l) level of normal female rabbits as compared to control group at different times of the third dose of laser therapy at (4J/cm<sup>2</sup>).

T<sub>3</sub> assay (nmol/L): Table (1) shows that exposure of thyroid gland to laser therapy produce a significant gradual decrease ( $P>0.05$ ) in T<sub>3</sub> as compared to control group. The minimal value was observed at the 18<sup>th</sup> day after exposure (Figure 1) and then it increases gradually.

T<sub>4</sub> assay (nmol/L): There is a significant gradual decrease in T<sub>4</sub> level in rabbits exposed to laser therapy (table 2). This depression becomes highly significant after 18<sup>th</sup> days (figure 2) as compared to control group. Although T<sub>4</sub> level increases after that in laser group it still significantly less than control group ( $P<0.05$ ).

TSH assay (mIU/L): Depending on the results in table (3), it is obvious that laser exposure on thyroid gland of normal female rabbits induced a significant gradual increase in TSH level ( $P<0.05$ ). At the mean time, the results indicate that the maximal level of TSH is being at the 18<sup>th</sup> day after the last dose of laser therapy (figure 3) in comparison with the days before and after that.

## Discussion

The results of this experiment revealed that thyroid irradiation by laser induce a case of hypothyroidism which was characterized by decrease T<sub>3</sub> and T<sub>4</sub> levels and increase TSH secretion from anterior pituitary gland. Primary hypothyroidism is manifested by elevated TSH and depression of plasma T<sub>3</sub> and T<sub>4</sub> (10). Although, there is no clear explanation for the effect of laser on thyroid gland the mechanism by which laser exert its biological effect remains to be elucidated. The decrease in thyroid hormones secreting in our experiment could be attributed to some changes in thyroid gland organelles which in turn modify thyroid hormones synthesis and secretion processes. An increase in colloid droplets and lysosomes, dilation of rough endoplasmic reticulum and reduction of Golgi apparatus of thyroid gland have been noticed after infrared laser irradiation to rat (11).

Many investigators had reported that measurement of serum TSH is the single best indicator of thyroid function because of its sensitivity to any change in serum T<sub>3</sub> and T<sub>4</sub> levels (12). This explains the increase of TSH secretion in our experiment. TSH the most reliable explanation for the normalization of hormones level after 18<sup>th</sup> day is due to the function performed by laser irradiation. It has been reported that laser mediated vasodilation by histamine, nitric oxide which enhances the transport of nutrients and oxygen to facilitate repair of damaged tissues (13). It has been clinically documented that laser significantly increases the number and regeneration of blood and lymphatic vessels (14,15).

It has been reported for that laser therapy to hyperthyroid rabbits treated the case of hyperthyroidism by normalizing the levels of hormones and the related parameters (cholesterol, total protein, glucose and calcium

ions, inorganic phosphorus in serum) (16). Finally, our findings serve as proof-of-principle that laser therapy could be used in treatment of goiter, hyperthyroidism and other thyroid diseases.

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