Effect of laser treatment on thyroid gland hormones in female rabbits

N. S. AL-Mustawfi¹, T. S. Al- Azawi² and I. F. R.Mohammed³

¹ Health Ministry, ² College of Veterinary Medicine, ³ College of AL-Kindy Medicine, Baghdad, Iraq

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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/cm² 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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Tأثير المعاملة بالليزر في أفزاز هرمونات الغدة الدرقية في اناث الارانب

نهى صاحب المستوفي¹، تهاني سلمان العزاوي² و احسان فتح الله محمد³

وزارة الصحة،¹ كلية الطب البيطري،³ كلية طب الكنيدي، بغداد، العراق

الخلاصة

صمم هذا البحث لدراسة تأثير اشعه الليزر على وظائف الغدة الدرقية والوظائف الفضائية لهرموناتها بالجسم. لتحقيق هذا الهدف تم استخدام ثمانية عشر ارنبًا من الإناث. تم استخدام ستة أرانب لتلقي الجرعة ونوعية موضع الهدف وتحديد موقعها ومكانها في الراهبة. تم استخدام اثني عشر أرنبًا من الإناث السلسة لمعارضة اشعه الليزر على الغدة الدرقية ومستوى الهرمونات بالدم. قسمت هذه الأرانب إلى مجموعتين متساويتين مجموعات مسيطرة ومجموعات تعرضت لاشعة الليزر بجرعة (4جول/ سم²) على منطقة الغدة الدرقية لفترة ثلاثة أيام متتابعة وواقع (5) دقائق للجرعة الواحدة على كل جهزة من الغدة. تم سحب الدم بعد 1, 6, 12, 18, 24, 30 يوماً بعد الجرعة الأخيرة من الليزر وذلك لقياس مستويات هرمونات T4، T3، TSH بالدم. أظهرت النتائج انخفاضاً تدريجياً في مستوى T4 و T3 مع ارتفاع TSH في مستوى الهرمونات في ذوي الهرمونات، في مستوى الهرمونات في ذوي الهرمونات لفترة ثلاثة أيام مع تدهور درجة عمل الليزر على الغدة. Parking
**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 therapy of choice for many difficult pain management. 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/cm² 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 1st, 6th, 12th, 18th, 24th and 30th days after the last dose of irradiation for the following hormonal assay parameters:

1. Total triiodothyronine (TT₃) assay (nmol/L): The standard assay (TT₃-Kit) was used (6).
2. Total thyroxin (TT₄) assay (nmol/L): The standard assay (TT₄-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 T₃, T₄ and TSH levels±SE for female rabbits during 30 days after laser exposure at a dose (4J/cm²) for 3 successive days are represented in tables 1-3 and figures 1-3.

Table 1: The physiological effect of laser therapy on serum T₃ (nmol/l) level of normal female rabbits as compared to control group at different times after the third dose of laser therapy at (4J/cm²).

<table>
<thead>
<tr>
<th>Time</th>
<th>Control</th>
<th>Laser therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>2.00 ±0.10 Aa</td>
<td>1.88 ± 0.10 Aa</td>
</tr>
<tr>
<td>6 days</td>
<td>2.10 ±0.10 Aa</td>
<td>1.65 ± 0.10 Bab</td>
</tr>
<tr>
<td>12days</td>
<td>2.13 ±0.10 Aa</td>
<td>1.40 ± 0.04 Bc</td>
</tr>
<tr>
<td>18 days</td>
<td>2.03 ±0.05 Aa</td>
<td>1.02 ±0.04 Bc</td>
</tr>
<tr>
<td>24 days</td>
<td>2.13 ±0.20 Aa</td>
<td>1.53 ±0.04 Bb</td>
</tr>
<tr>
<td>30 days</td>
<td>2.17 ±0.04 Aa</td>
<td>1.88 ±0.10 Ba</td>
</tr>
</tbody>
</table>

Values = mean±SE (n=6 rabbits). Capital Letters denote: the difference between groups. Small Letters denote: the difference within group.

T₃ assay (nmol/L): Table (1) shows that exposure of thyroid gland to laser therapy produce a significant gradual decrease (P>0.05) in T₃ as compared to control group. The minimal value was observed at the 18th day after exposure (Figure 1) and then it increases gradually.

T₄ assay (nmol/L): There is a significant gradual decrease in T₄ level in rabbits exposed to laser therapy (table 2). This depression becomes highly significant after 18th days (figure 2) as compared to control group. Although T₄ level increases after that in laser group it still significantly less than control group (P<0.05).

TSH assay (mlu/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 18th day after the last dose of laser therapy (figure 3) in comparison with the days before and after that.

Table 2: The physiological effect of laser therapy on serum T4 (nmol/l) level of normal female rabbits as compared to control group at different times after the third dose of laser therapy at (4J/cm²).

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

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/cm²).

<table>
<thead>
<tr>
<th>Time</th>
<th>Control</th>
<th>Laser therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>2.42 ± 0.10 Ba</td>
<td>3.78 ± 0.20 Acd</td>
</tr>
<tr>
<td>6 days</td>
<td>2.33 ± 0.10 Ba</td>
<td>4.48 ± 0.20 Ac</td>
</tr>
<tr>
<td>12 days</td>
<td>2.33 ± 0.10 Ba</td>
<td>5.48 ± 0.20 Ab</td>
</tr>
<tr>
<td>18 days</td>
<td>2.21 ± 0.10 Ba</td>
<td>6.50 ± 0.20 Aa</td>
</tr>
<tr>
<td>24 days</td>
<td>2.31 ± 0.10 Ba</td>
<td>4.23 ± 0.10 Aa</td>
</tr>
<tr>
<td>30 days</td>
<td>2.35 ± 0.10 Ba</td>
<td>2.88 ± 0.10 Ae</td>
</tr>
</tbody>
</table>

Values = mean±SE (n=6 rabbits).
Capital Letters denote: the difference between groups.
Small Letters denote: the difference within group.

Discussion

The results of this experiment revealed that thyroid irradiation by laser induce a case of hypothyroidism which was characterized by decrease T3 and T4 levels and increase TSH secretion from anterior pituitary gland. Primary hypothyroidism is manifested by elevated TSH and depression of plasma T3 and T4 (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 T3 and T4 levels (12). This explains the increase of TSH secretion in our experiment. TSH the most reliable explanation for the normalization of hormones level after 18th 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.

References
