Using Low Level Laser (LLL) for Treatment of Infected Mice with Carcinoma by Activating the Lymph Node Action without Drugs

A.Z. Khaleel and A.A. Albir
Department of Basic Science, College of Dentistry,
University of Baghdad

Abstract

Regional immune response with mammary gland carcinoma was studied statistically. However, the prognostic value remains conflicting. Thirty mice were used in this study which infected werewith mammary gland carcinoma. The tumor size of the animals under study were measured before and after laser irradiation by using a vernier and compared these results were with that of non irradiated animals with laser (control group).

The aim of this study was to evaluate the effect of low level laser therapy (LLLT) on increasing the response of immune system by stimulating the lymph node action to decrease the cancer cell activity and then decreasing the tumor size of an infected mice.

The results of the gross observations showed enlargement in the irradiated lymph node in comparison with that of non irradiated ones. It could be said that the enlargement which occurred to this lymph node proved that there was an increase in immune response by using laser stimulation.

From this study, it can be concluded that the LLLT was an efficient tool in stimulating the defense cells found in the lymph node that attack the cancer cells locally. The result of this phenomenon demonstrates the decrease of the tumor size of the irradiated infected mice.

Introduction

Lymph nodes are encapsulated spherical or kidney-shaped organs. The nodes are found in the axilla and the groin, along the great

vessels of the neck, and in large numbers in the thorax and abdomen, especially in mesenteries. Each node contains an outer cortex, an inner cortex, and a medulla. Within the cortical lymphoid tissue are spherical structures called lymphoid nodules. These nodules are rich in B lymphocytes that react with antigens, increase in size, and proliferate by mitosis, resulting in large basophilic cells with prominent nucleoli called immunocytes (1). A large majority of lymphocytes in lymph nodes are static. When the lymph nodes elicit the immune response, then the nodes enlarge in size (reactive hyperplasia) (2).

Low level laser therapy (LLLT) was used successfully in biomedicine and some of the results are thought to be related to cell proliferation. The effect of LLLT on cell proliferation is debatable because studies have found both an increase and a decrease in proliferation of cell cultures. Cell culture is an excellent method to assess both effects and dose of treatment (3). In both soft tissue and connective tissue injuries, LLLT can increase the final tensile strength of the healed tissue. By increasing the amount of collagen production/ synthesis and by increasing the intra and inter- molecular hydrogen bonding in the collagen molecules, laser therapy contributes to improve tensile strength (4). Low level laser therapy (LLLT) has proved to be effective in treating and repairing biologically damaged tissue and to reduce pain. LLLT has also proven to be an efficient method for the prevention of oral muscovite (5). Several applications of laser in clinical procedures for dental hard tissues are either currently in practice or being developed since newer wavelengths as well as different methods and delivery systems are being applied in the field of dentistry (6) . In endodontic therapy lasers were used as treatment coadjuvant with reference to both, low intensity laser therapy (LILT) and high intensity laser treatment (HILT) to increase the success rate of the clinical procedures. Low intensity laser therapy has the ability to produce analgesic, anti-inflammatory and biomodulation effects on the irradiated soft tissue thereby improving the wound healing process and giving the patient a better condition of the postoperative experience (6).

Materials and Methods

Thirty mice were used in this study. All were infected with mammary gland carcinoma, divided into six groups of five mice each (A, B, C, D, E and control group).

After 11 days of successful infection, the nodes appeared and the animals were ready for the experiment.

The infected with carcinoma were anesthetized and irradiated with laser that was directed towards the cervical lymph node of the mice under study with a spot diameter of 1 cm and a distance from the laser source of 1 cm and as follows:-

Group A: irradiated with laser, for 15 minutes continuously, three times daily with a time interval of one hour each, and for one week.

Same procedure was applied for the other groups (B, C, D and E) with different duration time (two weeks, three weeks, and four weeks and 40 days respectively). At the end of each duration time of treatment, the lymph nodes were taken for gross observations.

Laser device of Ga- Al- P (Gallium- Aluminum- Phosphorus) of wave length of 810 nm worked in pulse mode of one second duration time. The tumor size of each node of the infected mice was measured by vernier, weekly, starting from nodes appearance until the last day of the experiment (40 days).

Control group: infected with carcinoma and non irradiated with laser.

Data was translated into code by using as especially design of need code sheet and in head into a computer system using SPSS version 13 software and the most obvious and strong positive linear time dependent parameter.

Results and Discussion

This study has emphasized that there was a correlation between the irradiation of the lymph node and the reduction of the tumor size as shown in table (2). However, assessing the degree of the immune response is not objective and has not reached a reproducible result (1, 8) in the present study when the laser treatment was used as a stimulatory procedure. The laser light induced aparticular effect on the cell proliferation and cell membrane, so the importance of electromagnetic radiation in the form of laser was to stimulate the macromolecules and initiate the confirmatory changes in proteins that cause transfer of energy to electrons within the cells (7, 9). The laser

action can be described by increasing metabolic activity; the result is that significant effect on damaged carcinoma cells by body defense (immunity) caused adecrease in tumor size as shown in figs (2 and 3) respectively. The clinical reduction in tumor size could be due to laser immunomodulation (9). This controversial concept of laser on tumor tissue can be clarified by the idea that LLLT may reduce tumor growth as shown in table (2), the mean size of the nodes measured before treatment and after infection with cancer was 2.2 mm^3. After one week of continuous treatment with laser, this size was 1.2 mm^3 after two weeks of treatment. There was an increase in the tumor size appeared in the third and forth week of the treatment, this inactivation of the defense system was related to many reasons according to the physical agents around the animals such as, atmospheric pressure, hot , dusty weather, and the given dose of the laser in the same time not enough to reactivate the immune system at these conditions, but this size still less than that of untreated animals (third and forth week) as shown in table (2).

A decrease in tumor size appeared after 40 days of continuous treatment, the tumor size was 1.2 mm^3; this decrease was a result of an efficient dose that was given to the infected animals to activate the immune system again.

Finally, this phenomenon of LLLT can open a new era in the treatment of cancer and also gives evidence that stimulation of lymph node activity by irradiation with this laser can be used to accelerate the healing process by stimulating the defense cells (plasma cells and macrophages) that found in the irradiated lymph node as shown in fig(1) especially these neighboring the tumors, and as a result stimulate the immune system that attacked the cancer cells and inhabited its activity.

References

1- Junqueira, L.C. and Carneiro, J. (2003). Basic histology: Text & atlas, 10th edn. Lange, N.Y.: 515 pp.

2- Okura, M.; Kagamiuchi, H.; Tominaga, G.;Iida, S.;Fukuda, Y. and Kogo, M. (2005). J. Oral Pathol. Med., 34: 214-219.

3- Pinheiro, A.L.; do-Nascliento,S.C.; de-Vieira, A.L.; Rolim, A.B.; da-Silva, P.S. and Brugnera, A.Jr. (2002). Braz Dent. J., 13: 109-112.

4- Reddy, G.K.; Stehno-Bittel, L. and Enwemeka, C.S. (2001). Wound Repair Regen., 9: 248-255.
5- Nes, A.G. and Posso, M.B. (2005). Int Nurs Rev., 52: 68-72.
6- DePaula Eduardo, C. and Gouw Soares, S. (2001). Med Laser Appl., 16: 231-243.
7- Brayant, G.L.; Davidson, J.M. and Osoff, D. (2004). J. Laryngoscope, 108: 7-13.
8- Cooper, M.A.; Pommering, T.L. and Orang, N.D. (2003). J. Amer. Fam. Phys., 68: 75-88.
9- Barber, A. (2005). J. World Assoc. Laser Ther., 14: 18-22.
10- De Castro, E. and Silve, Jr. (2001). Laser Surg. Med., 29: 73-77.
11- Drinnan, A. (2000). J. Gen. Dent., 48: 656-660.
12- Stadler, I. (2000). Laser Surg. Med., 27: 255-261.
13- Thawer, H.A. and Houghton, P.E. (2001). Laser Surg. Med., 29: 285- 295.
10- Cernen, C.; Montergero, F. and Castro, C. (2001). Amer. J. Surg., 174: 548 - 551.

Table (1): Different groups of mice of present investigation

	A	B	C	D	E	Control
Treatment	Carcinoma irradiated with laser for one week	Carcinoma irradiated with laser for two weeks	Carcinoma irradiated with laser for three weeks	Carcinoma irradiated with laser for four weeks	Carcinoma irradiated with laser for 40 days	Carcinoma (non irradiated with laser)
Number	5	5	5	5	5	5

Table (2): Diameter of the tumor (mm) after treatment with laser for 15 minutes, and different duration times.

Control	Tumor size /mm at different duration time of irradiation				
	1 week	Two weeks	Three weeks	Four weeks	40 days
Range	1.1– 3.3	1.2 – 3.5	1.56 – 3.6	1.8 – 3.7	2– 3.9
Mean	2.2	2.3	3.5	2.7	2.8
SD	1.1	1.2	1.1	1	1
R = 0.32	P= 0.25$^{(NS)}$				
B= 0.03	P= 0.38$^{(NS)}$				
Laser treated Carcinoma group					
Range	0.7 – 2.5	0.4 – 1.9	0.4 – 2.4	0.4 – 2.4	0.4 –1.8
Mean	1.6	1.2	1.4	1.4	1.2
SD	0.9	0.8	1	1	0.7
R = - 0.10	P= 0.73 (NS)				
B= - 0.01	P= 0.77 (NS)				

R-The ability of appling this relation on the popular.
B-The outcome with respect to income.

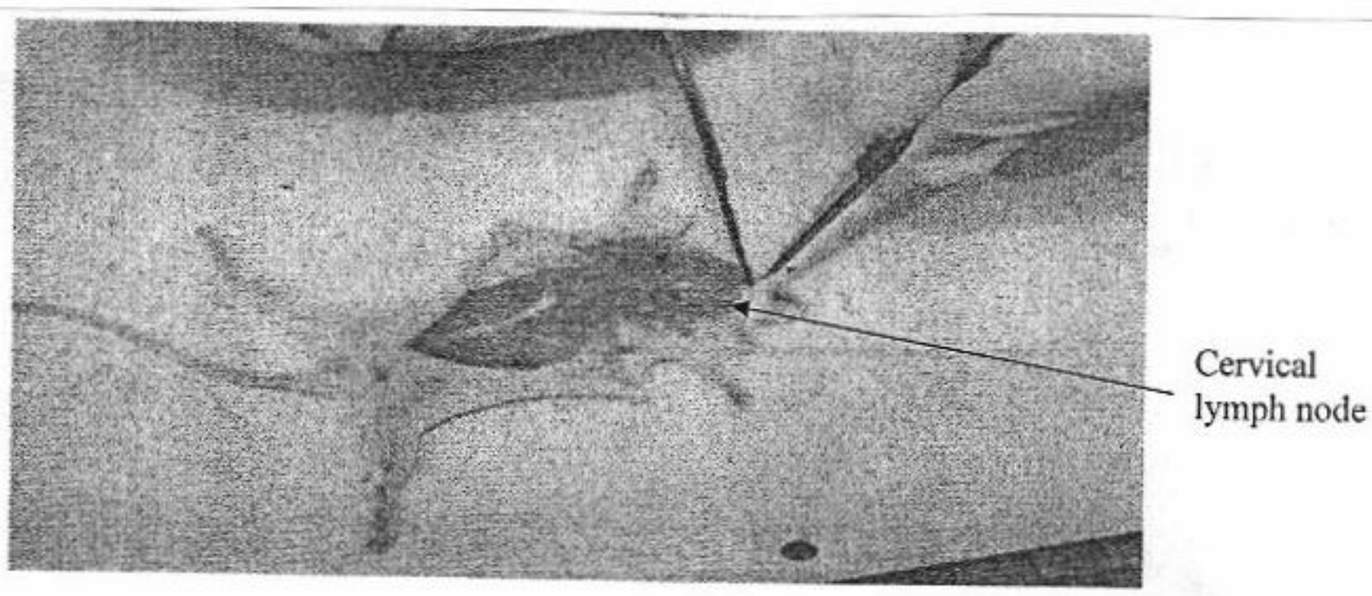

Fig. (1): Lymph node taken from the sacrificed animal.

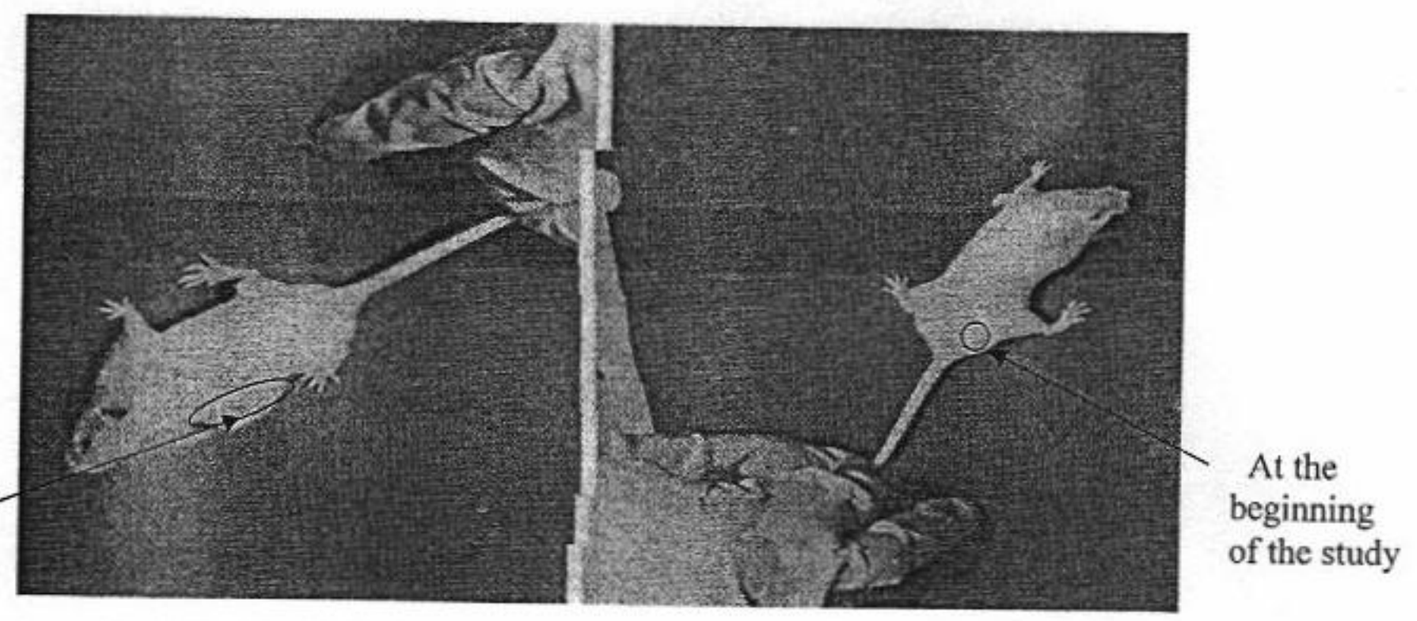

Fig. (2): Infected mice without laser therapy at the beginning and the end of the study.

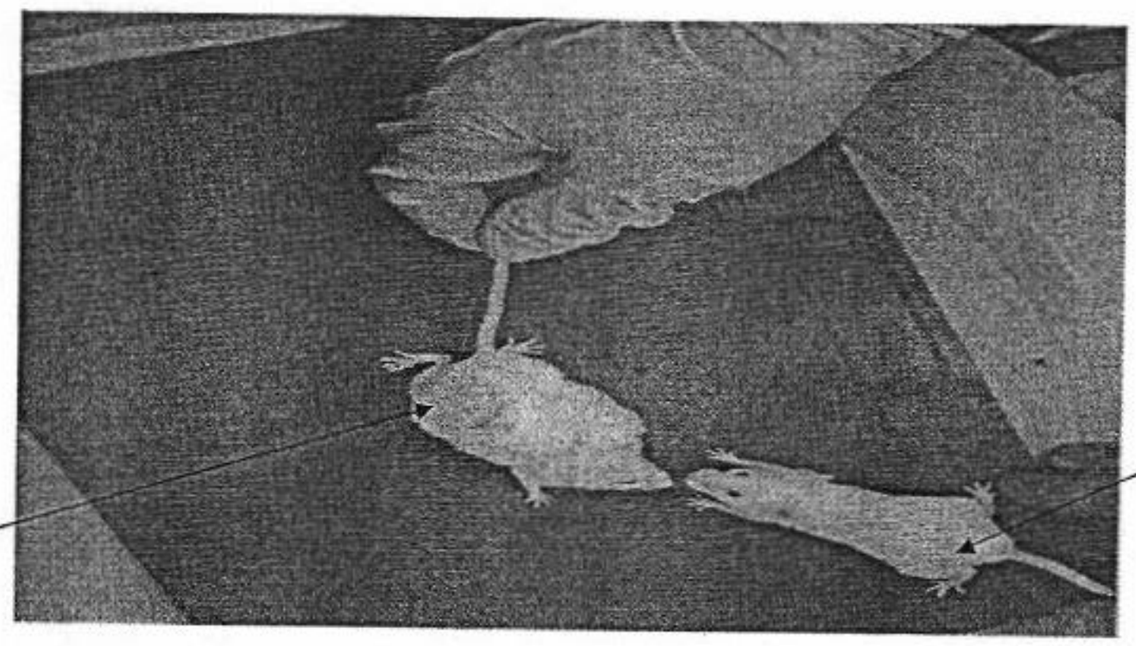

Fig. (3): A comparison between two infected animals: Laser irradiated and non irradiated at the end of the study (40 days).

استخدام ليزرواطئ القدرة (LLL) لعلاج الفئران المصابة بالسرطان وذلك بتنشيط العقدة اللمفية من دون استعمال العقاقير

عائدة زكي خليل وأحمد أنور البير
فرع العلوم الأساسية، كلية طب الأسنان، جامعة بغداد

الخلاصة

لقد تمت دراسة الاستجابة المناعية المحفزة باستخدام العلاج بليزر واطئ القدرة لثلاثين فارة مختبرية محقونة بسرطان الغدة اللبنيةإحصائيا. قيس حجم الورم باستخدام الفيرنيه للحيوانات موضوعة الدراسة قبل وبعد التشعيع بالليزر ومقارنة النتائج مع مجموعة الحيوانات غير المشععة بالليزر (مجموعة السيطرة) .

الهدف من هذه الدراسة هو تقييم تأثير العلاج بالليزر واطئ القدرة في تحفيز فعالية العقدة اللمفية المعرضة لليزر الذي أدى إلى زيادة قابلية الجهاز المناعي، ومن ثم تثبيط فعالية الخلايا السرطانية مما أدى إلى تقليل حجم الورم في الحيوانات المصابة.

أوضحت نتائج المشاهدة العيانية حصول كبر في حجم العقده اللمفية المشععه نتيجة للتحفيز بالليزر مقارنة بتلك غير المشععة. يمكن القول بان كبر حجم العقدة اللمفية المذكورة آنفا اثبت بان هنالك زيادة في الاستجابة المناعية باستخدام التحفيز با ليزر .

من هذه الدراسة ، أمكن الاستنتاج بأن الليزر أداة فعالة في تحفيز الخلايا المناعية الموجودة في العقدة اللمفية التي قامت بمهاجمة الخلايا السرطانية موقعيا وبالنتيجة أدى إلى صغر حجم الورم في الحيوانات المصابة.