Studying and Evaluating the Effect of Laser on Bacterial Species, (A Vetro Study)

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Abstract

Background: *Candida* species are part of the normal oral microbiota being *Candida albicans*.

Objective: This study was designed and carried out to find the effect of laser on *Candida albicans* bacterial cell line.

Materials and Method: 16 mice 2 months ages which divided into 4 groups each one consist of 4 mice, while additional 4 mice (group E) were not exposed to the laser beam and considered as a control while the other groups were irradiated with laser beam after anaesthetized and swapped by the species on the tongue of target animal with range of 250 clinical isolates of *Candida* species, the groups were exposed for different time 10, 15, 20, and 25 seconds (groups A, B, C, and D respectively) with a duration of 2 hours.

Results: The no. of colony/2cm² were calculated for four times and there mean was calculated, the means were 10⁹, 10⁷, 10⁴, and 10², for groups A, B, C, and D respectively, while it was 10¹⁵ in control group.

Conclusions: Laser beam reached the tissue of the cervical lymph nodules that treated with laser, the electromagnetic oscillations gradually “swing and excite “single cells, this thought to eventually intensify the bionomical process that ultimately regulate the performance of various vital organs.

Keywords: *Candida albicans*, laser, bacterial species, vetro study.

Introduction

Candida species are part of the normal oral microbiota being *Candida albicans* the most common species associated with clinical manifestations, which range from superficial mucocutaneous lesions, such as oropharyngeal candidiasis (OPC), to disseminated forms of the infection ⁽¹⁻³⁾. OPC is the result of adhesion and penetration of fungal species into the oral tissues⁽⁴⁾ and it has a high incidence in patients that use immunosuppressive drugs, broad-spectrum antibiotics, anti-diabetic mediations, anticancer therapies, and in patients with the acquired immunodeficiency syndrome (AIDS)⁽⁵⁾.

This study evaluated the effectiveness of antimicrobial Low Level Laser Therapy (LLT) in the treatment of oral candidiasis by using diode laser to reduce the activity of fungi(*Candida*)in the tongue. This model of oral candidiasis was developed to allow the monitoring of the infection and the establishment of the laser treatment. Three-weeks-old female and male mice were immunosuppressed and inoculated with *C. albicans* to induce oral candidiasis. After the appearance of white coated tongue the subject were ready for study.

Materials and Method

Twenty white mice were randomly ascending taken 2 months of age; 100gm of weight were prepared for this study. The animals were grouped for six groups,each of 4 mice,treated and not treated mice. One group were taken as a control,the other were treated by laser, all the animals tangs were swapped by the *Candida* that cultured in the agar, after preparing the culture. A range of 250 clinical isolates of *Candida* species were streaked

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onto chocolate agar and incubated for 48 hours at 37°C in the presence of an atmosphere of 6% CO₂. All cultures were grown in 90 mm diameter plastic petri dishes with 25 ml of chocolate agar.

Group A,B,C,D were treated with laser by irradiated the cervical lymph nodules of the target animal by different duration times 10, 15, 20, and 25 min respectively and repeated the same for four days, while group E was considered as control and were not treated with laser beam. The animal anaesthetized and swapped by the species on the tongue of target animal, after the success appearing of the white coated spots on the tongue we take a swapped from each tongue of irradiated animal as follows:

- **Group A:** Continuous irradiated by laser for 10 sec twice daily with duration time of two hours
- **Group B:** Continuous irradiated by laser for 15 sec twice daily with duration time of two hours.

- Same procedure was applied on the groups C, and D with time of irradiation of 20, and 25 min respectively. After three days we swapped the tongue of the animals of each groups and cultured them in chocolate agar, incubated for 24 hours. Each petridish were examined under microscope and by using mesh lens we count the colony of each petri.
- **Group E:** remain as a control after swapped all the animals of his group with candida, and exam the swap of each animal (not treated) at the day four after the appearance of the white spot appearance.

Results and Discussions

The results that were collected are shown in table 1, and 2.

Table 1: The irradiated group

Radiated group	A	B	C	D	E
Animal number	4	4	4	4	4

Table 2: The effects of laser irradiation with respect to the numbers of colony

Groups	A	B	C	D	E
No. of colony/2cm ²	10 ⁹ , 10 ¹⁰ 10 ⁸ 10 ⁹	10 ⁷ , 10 ⁷ , 10 ⁸ , 10 ⁶	10 ⁴ 10 ² 10 ⁶ 10 ⁴	10 ² , 10 ² 10 ³ , 10 ¹	10 ¹⁴ 10 ¹² 10 ¹⁸ , 10 ¹⁶
Mean	10 ⁹	10 ⁷	10 ⁴	10 ²	10 ¹⁵

Many theories have been postulated about the mechanism of action for low level laser especially about the exact mechanism of action and the physiological changes occurring at the cellular level^(5,6).

The increasing in the diameter of diseased mice that swapped with *Candida* is a result of laser that laser beam carries electromagnetic oscillations of definite frequency. When it reaches the tissue of the cervical lymph nodules that treated with laser, the electromagnetic oscillations gradually “swing and excite “single cells, this thought to eventually intensify the bionomical process that ultimately regulate the performance of various vital organs, and then the cell itself begins to emit light similar to the rays of the laser and that let to stimulate the salivary gland secretion⁽³⁾.

The salivary glands connective tissue contains many plasma cells and lymphocytes that plasma cells secrete⁽²⁾, IgA, which form a complex with secretory component synthesized by the serous acinar, the IgA-rich secretory

complex released into the saliva is resistant to enzymatic digestion and constitutes an immunologic defense mechanism against pathogens in the oral cavity⁽³⁾, so the laser beam main job was to cause activation in the cell which in turn leads to an intensification of the bionomical processes shown in table 2.

The biological law states that weak stimuli excite physiological activity and moderately strong ones favor it, strong ones retard it and very strong ones arrest it from all laser irradiation of tissue show that units of light energy (photons) are absorbed by enzymes which react to light within the cell^(6,7).

Infrared light that used in this study absorbed at the cell membrane, this results in a change in membrane permeability, increased ATP levels and increased DNA production⁽⁸⁾. The photons picked up by the cell membrane result in improved membrane stability and increased activity of the ATP-dependent Na/K pump, because cell metabolism is influenced by Na/K movement

across the membrane, increasing the gradient will affect the flow of ions and hence the overall metabolism of the cell⁽⁹⁾.

Ethic Statement: The researchers already have ethical clearance from all required institution and laboratories.

Conflicts of Interest: The author declares that there are no conflicts of interest.

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References

1. Brandt EM. Candida and Candidiasis. *Emergency Infection Diseases*. 2002; 8(8): 876. doi: 10.3201/eid0808.020059.
2. Alsahafi E, Begg K, Amelio I, Raulf N, Lucarelli P, Sauter T, Tavassoli M. Clinical update on head and neck cancer: molecular biology and ongoing challenges. *Cell Death Diseases*. 2019; 10(8): 540. doi: 10.1038/s41419-019-1769-9
3. Yuan X, Song Y, Song Yi, Xu J, Wu Y, et al. Effect of Laser Irradiation on Cell Function and Its Implications in Raman Spectroscopy. *Applied and Environmental Microbiology*. 2018; 84(8): e02508-17. DOI: 10.1128/AEM.02508-17
4. Al-Kaisy AZ. To Evaluate the Action of Low Level Laser Mixing (LLL) on Submandibular Salivary Gland of Mice Inoculated with Bacteria. *International Journal of Science and Research (IJSR)*. 2017; 6(6): Paper ID: ART20174453. DOI: 10.21275/ART20174453
5. Stender AS, Marchuk K, Liu C, Sander S, Meyer MW, Smith EA, Neupane B, Wang G, Li J, Cheng JX, Huang B, Fang N. 2013. Single cell optical imaging and spectroscopy. *Chemical Review*. 2013; 113:2469-2527. <https://doi.org/10.1021/cr300336e>.
6. Al-Kaisy AZ. Laser increased fertilization by enhance the motility of human sperm. *International Journal of Biosciences*. 2018; 13(3): 105-108. DOI: <http://dx.doi.org/10.12692/ijb/13.3.105-108>
7. Lorenz B, Wichmann C, Stockel S, Rosch P, Popp J. 2017. Cultivation-free Raman spectroscopic investigations of bacteria. *Trends Microbiology*. 2017; 25: 413– 424. <https://doi.org/10.1016/j.tim.2017.01.002>.
8. Al-Kaisy AZ, Al-Eqabi DA. Comparison Study between two laser effects on enhancement of Human Sperm Motility. *Research Journal of Pharmacy and Technology*. 2019;12(11): 5530-5532. DOI: 10.5958/0974-360X.2019.00924.7
9. Dixit S, Ahmad I, Hakami A, Gular K, Tedla JS, Abohashrh M. Comparison of Anti-Microbial Effects of Low-Level Laser Irradiation and Microwave Diathermy on Gram-Positive and Gram-Negative Bacteria in an In Vitro Model. *Medicina (Kaunas)*. 2019; 55(7): 330. doi: 10.3390/medicina 55070330.