

## COMPARISON OF THE EFFECTS OF *NIGELLA SATIVA* OIL AND LASER ON TREATMENTS ON EXPERIMENTAL WOUND HEALING IN RATS

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### ABSTRACT

**Objective:** The study investigated the influences of treatment with *Nigella sativa* oil and laser therapy on wound healing in rats. The period of the inflammatory phase reduced through both laser and *N. sativa* oil actions; though, the laser was more effective than *N. sativa* oil, with more significant results.

**Methods:** We used 52 healthy rats male and divided the rats randomly into three groups. The treatment protocols used included *N. sativa* oil in the first group, laser in the second group, and control in the third group. In all groups, we performed histopathologic evaluations on the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, and 7<sup>th</sup> days after surgery.

**Results:** The proliferation phase of each treatment indicated an increase in the number of fibroblasts, as well as stimulation of collagen formation and synthesis. Positive results on the inflammatory, proliferation, and maturation phases for both treatments of wound healing.

**Conclusion:** Laser treatment was more effective than *N. sativa* oil in the first two phases of wound healing.

### Keywords:

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### INTRODUCTION

Several procedures have been applied to investigation healing encouragement; however, little research considered these modalities in compare to each other [1,2]. In this study, we estimated the influence of low-level laser in wound healing and compared it with *Nigella sativa* oil.

The main objects of the act of damages are fast wound restorative and an able and attractively adequate scar. Interesting growths have meaningfully biologic events complicated in wound restitution. The skin used growth factors to promote wound healing.

Restoration of important reliability and specialty of disturbed tissue of the wound be affected by the interaction of healing stages. These conforming phases comprise inflammation, re-epithelization, granulation tissue formation, wound reduction, and tissue repair. Although fibroblasts confirm an essential in wound healing as well as other elements such as growth factors [3,4].

The usage of ordinary produces as a substitute remedy in wound remedial then remedy has been increasing in the past little periods [5]

Native appliance of black seed oil investigational wounds takes been create to improve wound restorative [6].

Collagen synthesis is essential for wound healing because, during the process, fibroblasts migrate toward the injured area and produce collagen to increase tissue permeability [7,8].

*N. sativa* seed, usually identified as black seed, has been used as an actual medication for several illnesses for hundreds of years in many humanities.

It is most famous for the Prophetic Medicine "Embrace off to application of the Blackseed, aimed at it takes a remedying meant for all disease excepting decease." It includes various dynamic elements comprising

thymoquinone, thymohydroquinone, dithymoquinone, thymol, carvacrol, nigellimine, nigellicine, nigellidine, and alpha-hederin.

*N. sativa* seed and its oil were creating to stimulate wound healing in plantation animals [9].

Furthermore, ether extract of *N. sativa* seed applied topically onto staphylococcal-infected skin in mice enhanced healing by reducing total and absolute differential aqueous extricate from *N. sativa* revealed low- slung free radical scavenging action plus encouraged gingival fibroblast propagation by way of hurried wound closing action although its non-significant result on collagen creation [10].

Similar anti-inflammatory effect of *N. sativa* fixed oil and thymoquinone has also been reported earlier by Kirui *et al.* [11].

Preparations from plants have been used since ancient time to accelerate the process of wound healing. The efficacy of these medicines relies absolutely off on applied practice, then surveillance approved off orally since one generation to the next with little supportive certification.

Wounds are physical damages that caused in disruption of the skin [12].

Wound healing contains an arranged evolution of actions that regenerate the integrity of the injured tissue: Inflammatory, proliferation, and remodeling stages [13].

The dissimilar stages of the wound healing procedure overlay and preferably at least two different courses should be influenced by a plant-based remedying before it is said to have wound healing properties [14].

Several plants in the rough formula or recognized active-components have been examined for their healing effects of skin wounds.

Conferring to Roy *et al.* [15] *N. sativa* is some of the plants that have been extensively applied in local perform to rebuild minor wounds.

The investigation has revealed that the obtain from *N. sativa* can heal burn-related skin wounds in a rat model [16] and the topical appliance of oil equipped from its seeds can accelerate wound healing [17,18].

Collagen synthesis is essential for wound healing because, during the process, fibroblasts migrate toward the injured area and produce collagen to increase tissue permeability [19].

## METHODS

We used 52 healthy rats male, each 200–250 g. The study was carried out. Bedding and environmental conditions were similar among all animals. All rats were housed in fed standard rat chow and water was kept in a cleaned mesh cage.

The animals were obtained from the Animals Breeding Center, College of Pharmacy/University of Baghdad. After making a 1 cm linear incision at the dorsal skin, the locate of incision area in anesthetized animal, we divided the rats randomly into three groups. The treatment protocols used included *N. sativa* oil in the first group, laser in the second group, and control in the third group five rats were used for primary trials. In all groups, we performed histopathologic evaluations on the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> and 7<sup>th</sup> day after surgery.

- Group (1): Consist of (20) animals. The wound incision of animals was the application of the at sativa seed oil daily
- Group (2): Consist of the (20) animals. The wound incision of the animals was exposed to the laser daily
- Group (3): Twelfth animals considered as a control group.

The histopathology inspection was performed to evaluate the amount of inflammatory cells; the microscopic sort's appearance of fibroblast, granulation tissue, and epithelial cells for each sample.

## Apparatuses operated

Helium-neon (He-Ne) laser (China, JGQ-250) continuous of wavelength 632.8 nm was laboring. Its output power is 0.85 mW and, a ray point of 0.125 cm<sup>2</sup> area at 180 s and energy density 1.224 J/cm<sup>2</sup>.

## RESULTS

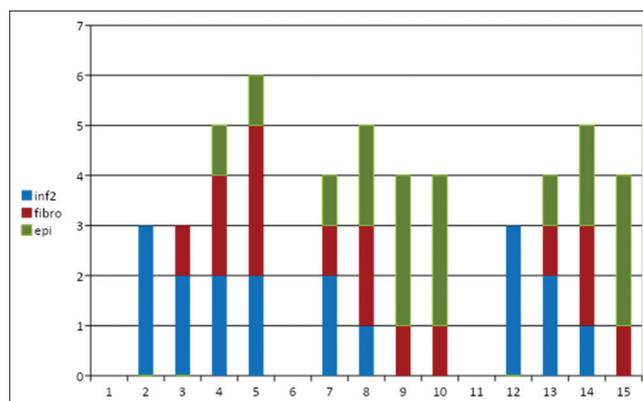
The mark of wound healing was observed on the 7<sup>th</sup> day in the *N. sativa* oil and on the 5<sup>th</sup> day in the laser treatment group Fig. 1.

The duration of the inflammatory phase decreased in the laser and *N. sativa* oil groups compared with the control groups. Compared with *N. sativa* oil treatment, the laser treatment was found to be more effective, with more significant results.

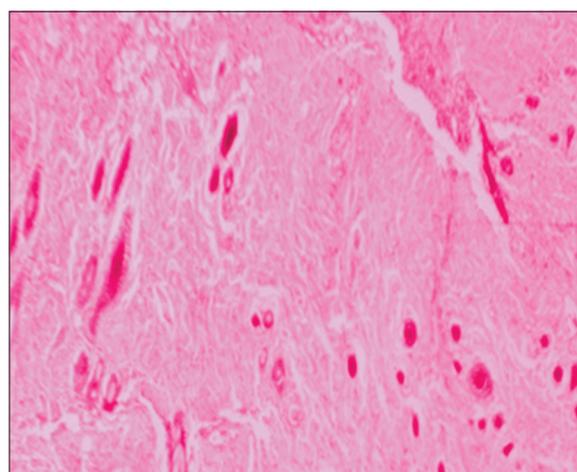
The proliferation phase was positively affected in the treatment groups by an increase in the number of fibroblasts, as well as stimulation of the collagen synthesis and the composition, compared with the control groups. The laser treatment proved more effective than the *N. sativa* oil treatment in the proliferation phase. The collagen density and the arrangement were significantly better in the treatment groups than in the control groups, but laser treatment was more effective than *N. sativa* oil Fig. 2-9.

## DISCUSSION

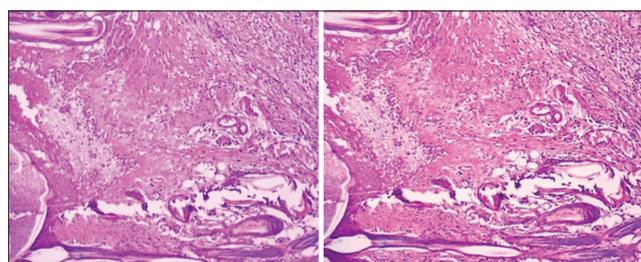
The topical treatment is widely used as a therapeutic approximate in the handling of wounds [20,21]. In wound treatment, topical application is often used as a therapeutic method. Numerous experiments reveal that black seed oil enhances wound healing in the topical appliance [22-25]. Histology analyses approve the enhancement in the wounds remedial of rabbit skin by black seed oil [26-28]. Wound healing includes a flow of actions described by the accomplishment of biological procedures in a definite command and a sure time structure. These actions exemplify the rearrangement of the injured tissue in an effort to repair as normal a disorder as is potential. The normal response of a living organism is to repair the wounds in the shortest time [29].



**Fig. 1: Wound healing changes after treatment by laser and the local application of *Nigella sativa* oil with control of the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, and 7<sup>th</sup> days**



**Fig. 2: Three days postoperatively with the application by *Nigella sativa* oil, show moderate inflammatory cells and mild of fibroblasts plus began the re-epithelization**

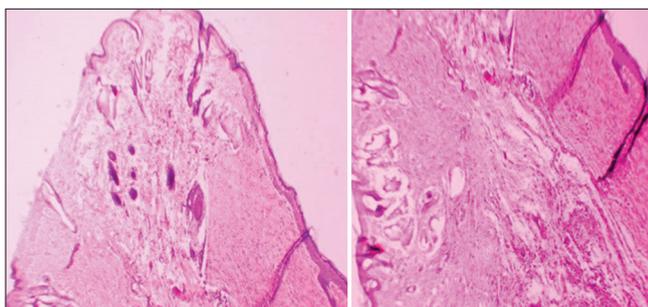


**Fig. 3: Three days postoperatively of the control group, there is a moderate amount of inflammatory cells infiltration with mild of fibroblasts and granulation tissue**

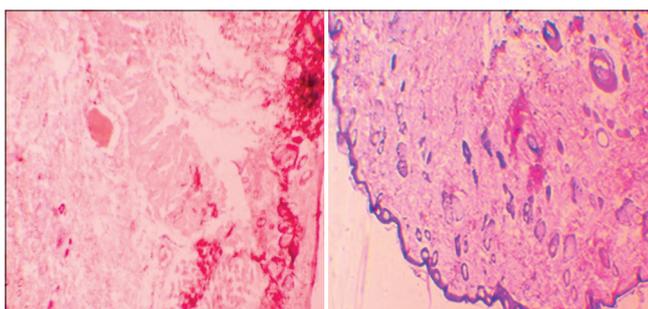
Prominently of the biological ability of the *N. sativa* seeds exposed toward owed to thymoquinone, the main element off necessary oil. The seeds oil has anti-inflammatory, analgesic, antipyretic, antimicrobial, and antineoplastic action [30-34].

Some researchers who cured hamsters with *N. sativa* oil, and create an important raise of phagocytic action and phagocytic index of peritoneal macrophages and lymphocyte count in the peripheral blood *N. sativa* includes proteins which can accelerate the dermal fibroblast [35].

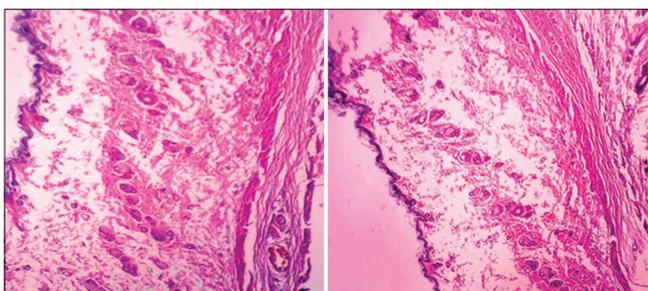
Laser treatment has also been studied in wound healing [36-40].



**Fig. 4:** Healing of irradiated wound by helium-neon laser 3 days postoperatively, moderate of granulation tissue is observed with epithelization



**Fig. 5:** The 5 days post-operation of the wound by *Nigella sativa* oil describes by moderate fibroblasts and epithelization plus mild inflammatory cells



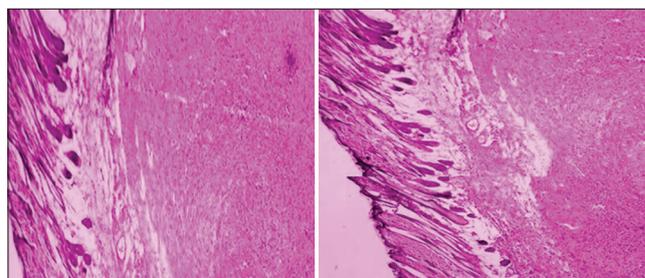
**Fig. 6:** The line of incision of control group 5 day postoperatively indicates moderate inflammatory cells and fibroblast proliferation. Plus an initial appearance of the epithelization

At present, laser treatment is used for decubitus and diabetic ulcers, open wounds, venous ulcers, graft ulcers, incisions, and burns. Studies *in vivo* and *in vitro* showed that laser treatment accelerated biochemical reactions, fibroblast activity, collagen metabolism, neovascularization, qualified scar formation, and wound formation [41-44].

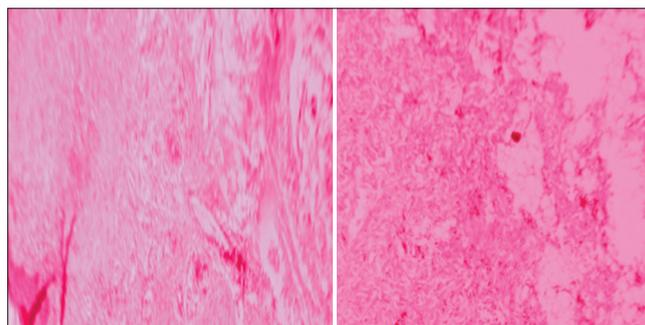
Many researchers proved the success of He-Ne laser in wound healing [45-50].

The amount increased in the laser treatment group compared with its control group. This result shows inhibited inflammation, which is wanted in clean wound healing. Some researchers have reported that low-energy laser treatment decreased the period of the inflammatory phase [51].

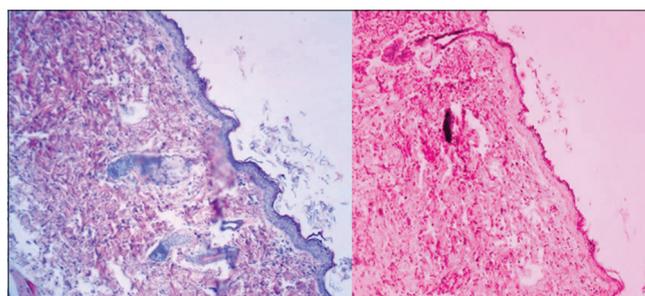
When we compared these two modalities in the inflammatory phase, the laser treatment was more effective, with more significant results than the *N. sativa* oil treatment. The numbers of macrophages were decreased in the laser group compared with the *N. sativa* oil group, indicating that the laser treatment decreased the duration of inflammatory phase significantly more than the *N. sativa* oil treatment.



**Fig. 7:** Wound healing irradiated by helium-neon laser is complete 5 days postoperatively which is characterized by epidermis formation at the site of the incision



**Fig. 8:** Wound healing by *Nigella sativa* oil is complete 7 days postoperatively, cellular fibrous connective tissues are observed



**Fig. 9:** Line of incision 7 days postoperatively of the control group, show hyperplasia of the epithelial cells with round and thick rete ridge

We could not find any similar study comparing the effect of *N. sativa* oil and laser treatment on wound healing in rats in literature.

In our study, the proliferation phase was positively affected in the treatment groups by the increase in the number of fibroblasts, as well as stimulation of the collagen synthesis and the composition, compared with their control groups. Compared with the *N. sativa* oil treatment, the laser treatment proved more effective in the proliferation phase.

The maturation or remodeling phase is the last and longest phase of wound healing. The most important development is the remodeling and maturation of collagen during this phase.

Our study showed that both *N. sativa* oil treatment and laser treatment have beneficial effects in the inflammatory, proliferation, and maturation phases of wound healing, compared with their control groups.

However, in tissue sections treated with *N. sativa* oil observed the presence of some of the variables or fiber due to the possibility of the presence of impurities in the commercial *N. sativa* oil or lack purity or focus accuracy.

## CONCLUSION

The laser treatment, however, was considered more effective than the *N. sativa* oil treatment in the first two phases of wound healing.

## AUTHOR'S CONTRIBUTIONS

Prof. Shorouk Mohammed Abbas Al-Tamimi has performed a wide range of reading and analysis of data.

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