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Short Communication

A COMBINATION OF NANOHEAL® AND LOW LEVEL LASER THERAPY FOR SEPTIC WOUND HEALING IN ANIMALS

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SUMMARY

The present paper describes the wound healing properties of Nanoheal® when it is combined with Low Level Laser Therapy (LLLT). Nanoheal® is a product developed by TRPVB under TANUVAS that comprises chlorhexidine di-gluconate and calcium phosphate and has shown wound healing properties in pilot trials. It was found that LLLT therapy had properties like neoangiogenesis, antibacterial effect and reduces oedema around the wound. The healing properties like physical appearance of the wound and wound contraction studies were carried out in the septic wound cases presented to VCC, Tirunelveli. Haematological studies and microbiological studies were performed and the results obtained are discussed in the present paper.

Keywords: Animals, Low level Laser therapy, Nano heal, Wound healing

Low level laser therapy (LLLT) has neoangiogenesis, antibacterial effect and reduces oedema around the wound (Meideros *et al*., 2017; Rashidi *et al*., 2015). In addition, LLLT has vasodilating, anti-inflammatory, analgesic properties (Calin *et al*., 2010) and prevents bloody exudate in hyperglycemia condition that normally delays wound healing (Herranz-Aparicio *et al*., 2013). A range of 0.1 to 12 J/cm^2 energy density is recommended for laser therapy of wounds. Factors such as exposure time, frequency and duration of treatment affect the outcome of the treatment with LLLT (Rashidi *et al*., 2015). Calcium phosphate chlorhexidine polymers can significantly enhance the wound healing rates in surgical wounds created in experimental mice (Viswanathan, *et al*., 2016). Based on the review of literature, a study was designed to evaluate the combined effect of LLLT and Nanoheal on wound healing in animals with septic wounds.

Animals admitted with septic wound in the surgery unit of VCC, VCRI, Tirunelveli were screened and suitable cases were selected for the study. Routine wound care was done by lavaging the wound with normal saline and necrosed tissue was debrided. The wounds were subjected to Low Level Laser therapy given at the rate of 1 J/cm^2 for a duration of 10 minutes. The time interval of the therapy varied from daily basis to alternate days or once in two days depending on the presence and nature of discharge in the wound. If purulent discharge was noticed, laser therapy was given daily till the discharge had reduced. If serous discharge was noticed, the time interval of therapy was fixed at alternate or once in two days. Laser therapy was stopped or focalized as granulation tissue formation was noticed. Nanoheal® was applied from day zero of the treatment and continued till the wound tissue was replaced by the scar tissue. Surface area/greatest length and width/ diameter estimation was done by tracing of wound on a graph paper. The percentage of wound contraction was calculated as follows:

$$\text{Wound contraction in percentage} = \frac{\text{Initial wound size} - \text{specific day wound size}}{\text{Initial wound size}} \times 100$$

Photographic evaluation of the wound was done as and when the case was presented or until complete healing. Physical changes like colour, moisture, granulation tissue, discharge/exudates, oedema of peripheral tissue, character of the wound edges were recorded. Microbiological samples were collected from the wound surface by sterile swabs for isolation and culture of the organism. Blood samples were collected before and after treatments for estimation of Haemoglobin concentration, RBC, Platelet, WBC counts, DLC and serum/blood glucose estimation.

Six cases of cutaneous wounds were included in the research (Table 1, Fig.1.) of which 4 were dogs, one each of calf and goat were included in the present study. The etiology of the wounds was automobile accident in all cases. There was a closed fracture of the distal phalanx in the calf with mild osteomyelitic changes on x-ray at the time of presentation, which necessitated antibiotic therapy. The location of the wound was on the medial aspect of the left forelimb in two dogs, left and right metatarsals in one dog, digits of left forelimb in calf and lateral aspect of right forelimb fetlock joint and digits in the goat. The breeds of dogs included in the study were Chippiparai, Rajapalayam

Table 1
The signalment of cases involved in the study

Case No.	Animal	Breed	Age	Sex
1.	Dog	Chippiparai	2 m	M
2.	Dog	Rajapalayam	1 ½ yr	M
3.	Dog	Dachshund	3 ½ yr	M
4.	Dog	Dachshund	3 ½ yr	M
5.	Calf	ND	8 months	M
6.	Goat	Kanni	2 yr	F

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Day - 0 **Day - 22** **Day - 0** **Day - 11**

Case I. Chippiparai pup with septic wound in the medial aspect of left forelimbnear carpus with mild purulent discharge

Case II. Rajapalayam dog with septic wound in the left forelimb in the distal radius and carpus with mild purulent discharge

Day - 0 **Day - 11** **Day - 0** **Day - 12**

Case III. Dachshund with septic wound in the left hind limb extending from medial aspect of metatarsal with serous discharge

Case IV. Dachshund with septic wound in the lateral aspect of the right hind limb in the distal metatarsal region

Day - 0 **Day - 30** **Day - 0** **Day - 30**

Case V. Calf with septic wound in the left forelimb digits with purulent discharge

Case VI. Kanni goat with septic wound in the lateral aspect of right forelimb–fetlock joint and digits with purulent discharge

Fig. 1. Showing the cases presented and the outcome after treatment

and Dachshund. The calf was nondescript and goat was Kanni breed. Three of the dogs and the calf were males and the goat was female. The age group of the animals ranged from 2 months to 3 and half years. All the wounds were moist, with discharge varying from purulent to serous, wound edges were raised in five cases and uneven in all cases. In goat, the wound was deep and the wound edges were not raised. There was erythematous appearance of the wound in all the five cases due to licking of the animal except in the goat. So Elizabethan collar was advised for dogs, the calf and the goat owners were advised to keep their animals tied short so as to prevent licking of the wound. Protective bandages were also applied in all cases.

Signs of wound healing were seen after third day of subsequent laser therapy. As the treatment commenced, wound bed became dry soon after laser therapy with oozing of fluid from the depth of the wound. As the treatment was continued, the wound became completely dry and the raised wound edges levelled and whitish colouration of the wound edges near the skin was noticed. The microorganisms that were isolated from the wound were *Pseudomonas* spp, *E. coli*, *Klebsiella* spp. and *Staphylococcus* spp. Pseudomonas is commonly seen organism in moist wound as it has affinity towards moisture (Mitik-Deneva *et al.,* 2009 and Abraham *et al.,* 2009). The blood parameters were normal in all animals

except in two cases with high PCV suggestive of dehydration. There was neutrophilia in the calf indicative of prevention of an active infection by the neutrophils (Wilgus *et al*., 2013). All the cases responded well to the treatment but in calf, due to poor management combined with existing osteomyelitis, resulted in rupture of the wound and pus discharge and hence amputation of the hoof was carried out. The wound healing time in four out of 6 cases was in the range of 10-12 days, whereas it took 22 days for the wound to heal in pup and 30 days for the wound in calf to heal. The percentage of wound contraction ranged from 47% to 95.6%. Eighty eight percentage of wound closure results from wound contraction and 12% by scar formation (Berry *et al*., 1998). This variation was correlated to the size of the wound, location of the wound, behaviour of the animal, management by the owner, environment, nutritional and feed related conditions.

From the treatment response and the results obtained, it may be concluded that Nano heal ®-LLLT (1 J/cm^2 for 10 minutes) combination was effective for the treatment of septic wound in animals and could give a faster healing rate irrespective of the size of the wound if there is no licking by the animal and maintained in good hygienic conditions. Any underlying infection or inflammation of the bone may interrupt the wound healing even after the signs of healing have been noticed.

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