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Original article

Assessment of the Laser`s efficacy in treatment of impaired healing wounds

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Abstract

Successes occurred in treatment of failing or impaired skin grafts, hypertophic scars ,atrophic skin , and atopic dermatitis using Low Level Laser Therapy, L.L.L.T. .

The aim of the current study is to assess the efficacy of L.L.L.T. on healing wounds failed to be healed by first intention for experimentally induced whole layers skin loss in rabbits.

Eight rabbits underwent the study , they were divided into two groups ,the procedure involved raising two discs of whole skin from the lateral surface of the thigh of both sides .The sites of the operation in the treated group were treated by diode laser daily until the wound was sealed. Diameters of the wounds were periodically measured every three days and histopathological assessment was performed on the seventh day of experimental wounds.

L.L.L.T. group of animals showed increasing in the process of healing than approximately 1.5 times when compared with the non - L.L.L.T. group. In tested group wound contraction was faster, vascularity was significantly better with abundant granulation tissue formation, greater formation of collagen fibers, greater mast cell number, epithelial creeping margin was faster and greater epithelial hyperplasia .

L.L.L.T. is arising as new tool to accelerate healing process, they showed significant advantages regarding wound therapy by accelerating healing of secondary intention in experimental animal.

Key words: Laser , Impaired healing wounds

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Introduction

Healing of complicated wounds is more prolonged process than the healing by primary intention because of the need to remove all dead tissues and necrotic debris and to fill in the tissue defect with vital cells. The base and margins of the defect are first layered with granulation tissue, as the leukocytes remove the exudate and debris the

wound "granulates" in from its margins, at the same time epithelial margins migrate and proliferate , (1& 2).

A second remarkable phenomenon in healing process is the wound contraction – aids in the repair, it has been shown that a defect of about 10 cm^2 in the skin of a rabbit become reduced over the course of six weeks to 5-10% of its original size, largely by contraction , (1& 2).

Systemic factors which influence wound healing are numerous, of these, nutrition with severe protein depletion impairs wound healing. Vitamin C plays an important role in collagen formation, in vitamin C deficiency therefore, the rate of wound healing and tensile strength is markedly impaired. Zinc deficiency is particularly important in extensive burn healing.

Diabetes mellitus is another important factor in delayed healing and steroid hormones have certain depressant effect on healing, (1) , of the local factors which may affect healing significantly, adequacy of local blood supply may well be the single most important influence in wound healing. Infection may lead to serious hindrance of repair and foreign bodies locally impedes healing process,(3).

Applying low level laser therapy to experimental wounds shows accelerated healing by affecting various aspects of reparative process including wound contraction and healing by scar tissue formation and probably it has a major role in dealing with protracted, and stagnant wound which resist healing, (4).

Materials & Methods

Eight rabbits were used and divided into two groups, group A (non – L.L.L.T. group) as a control group and group B (L.L.L.T. – group) as a test group .

Under Ketamine general anesthesia , after preparation of surgical field by povidon iodine 0.75% solution , two circles of whole skin thickness of approximately 20 mm. diameter were excised from the outer surface of rabbit's thigh. Local antibacterial spray was used and the wound left open to be healed without any surgical interference , hence eight wound were considered in this group.

Group B contained the same number (four rabbits and eight wounds). In this group the wounds were treated by low level diode laser with output 5 mW, in serial applications for five minutes each , daily , starting from the first day of the wound induction until the wound was sealed completely .

The wound diameters were periodically measured every three days until the wound closed completely by scar tissue formation. Histopathological study of incised biopsy specimen from the margin of the wounds including a wounded area and a normal skin was, also, performed .

It was shown that complete healing was accomplished in non- L.L.L.T. group A animals with a mean 24.2 days and L.L.L.T. group B with a mean 16.1 days and the time ratio between tested and control group was 1/1.5.

Results

Healing process was followed by wound diameter measurement every three days until the wounds were completely healed and histopathological assessment of incised tissue biopsy on the seventh day of the procedure .

Healing time in non- L.L.L.T. group (A) animals are shown in table (1). Complete healing required 21-27 days with a mean 24.2 days while healing times in L.L.L.T. group B as shown in table (2) were ranging between 12-21 days with a mean 16.2 days. Hence healing of tested group is approximately 1.5 fold less than that of control group. Figure (1) shows the healing time between two group.

Histopathological studies of wound sections from both groups shows significant advantages in L.L.L.T. group in form of abundant granulation tissue formation, thicker, denser and more naturally arranged collagen and greater marginal epithelial hyperplasia.

Table (1) : Healing time in non-LLLT group A rabbits .

Sample No.	Day zero	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27
1	20 mm.	18	15	12	11	9	6	2	1	Sealed
2	21 mm.	19	16	12	10	7	5	2	Sealed	
3	21 mm.	19	16	13	11	9	6	3	1	Sealed
4	19 mm.	17	16	12	9	6	2	1	Sealed	
5	20 mm.	18	15	11	7	4	1	Sealed		
6	19 mm.	17	14	10	7	4	1	Sealed		
7	20 mm.	18	16	13	10	9	7	2	Sealed	
8	19 mm.	17	15	12	9	7	6	4	Sealed	

Table 2 : Healing time in LLLT group B rabbits .

Sample No.	Day zero	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21
1	19 mm.	15	10	4	sealed			
2	20 mm.	16	11	5	2	sealed		
3	19 mm.	15	12	9	6	3	1	Sealed
4	19 mm.	14	9	6	1	sealed		
5	20 mm.	15	10	4	sealed			
6	21 mm.	16	10	6	3	1	sealed	
7	20 mm.	15	9	6	2	sealed		
8	21 mm.	16	11	6	3	sealed		

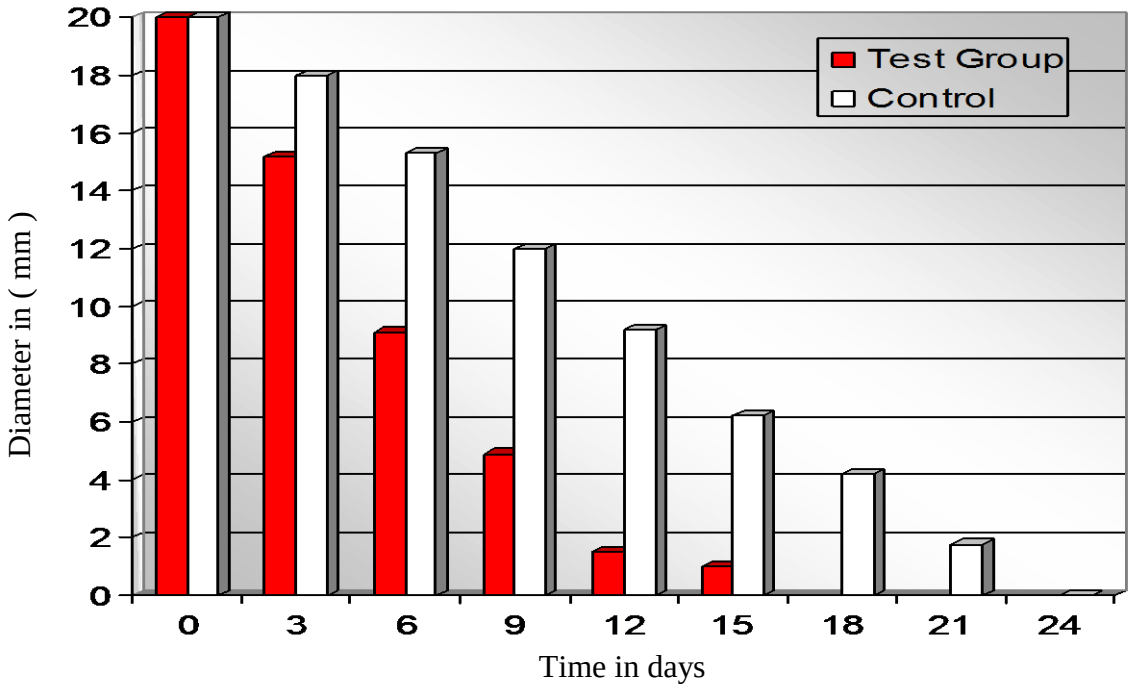

Figure 1: Time healing pattern between L.L.L.T. group and non- L.L.L.T. group , the mean

Comments

Among the factors that accelerate healing whether healing by primary or secondary intention, laser therapy experimentally shows promising results,(5,6&7) . Exposing such wounds to L.L.L.T. locally by serial applications in form of continuous , (5,6 &7) or pulsed types laser , (8) and the events in the wounds were followed by many healing parameters .

The mechanisms by which laser accomplished this biostimulation and accelerated healing are multifactorial, some of these factors are known and others are still debate, of these known factors are improving the microcirculation at tissue level and increasing the vascularity,(5,6&7) and this can be monitored by Doppler flow-meter, (5&6) improving the quality of granulation tissue by abundant vascular healthy granulation tissue, (6&7), activation of mast cell to proliferate and to lose their granules which in turn release chemical mediators which helps in healing process(7), accelerate epithelial hyperplasia of normal epithelial cells, (5) and enhance deposition of collagen fibers which lead to denser thicker and more naturally oriented collagen fibers with the normal collagen bundles nearby (5&6) and this can be proved by analysis of hydroxyproline
,(5) in the wound and by histopathological studies of the wounds,(5,6&7) .Again the tensile strength of treated wounds are much more than ordinary wounds which was measured by tensiometry,(8,9&10) .

While L.L.L.T. is effective for some specific applications, it's not a panacea. This paper provides an outline of the biological basis of L.L.L.T. and summarize the

findings of controlled experimental study of the use of L.L.L.T. for specific types of wounds.

Conclusions

1. L.L.L.T. arising as new tool to accelerate healing process and may be of value in healing of difficult and stagnant wound.
2. Detailed investigations are required to select the optimum beneficial effect of different types of lasers and different intensities.
3. L.L.L.T. showed significant advantages regarding wound therapy, accelerating healing of secondary intention in experimental animals and it affects various aspects of healing process, it accelerate wound contraction, marginal epithelial creeping and healing by scar formation.

Bibliography

1. Zainab, Awad. Radi , Ihsan F. Rostum & Sadiq, Abbas Al- Mukhtar; Preparation of vaccine against diabetic foot pathogenic bacteria using low level diode laser.. AL – Kindy College Medical Journal , Vol. 9, Issue :(2), Pp; 29 – 31.
2. Dunnia A. Barakat , Ihsan, F. Rostum & Sattar H. Ali . Accelerating Wound Healing and Skin Loss Sealing Using Low Level Laser Therapy. Iraqi Laser Scientists Journal. Issue 1; (1): 1-10, 2017.
3. F.R. Mohammed, Ihsan; Low-Level Laser Therapy Accelerates Collateral Circulation and Enhances Microcirculation **,** Photomedicine and Laser Surgery ,Volume 23, Number 3, Pp. 289–294 , 2005.
4. Chukuka, S. Enwemeka , : Laser Photo stimul ation , Vol: 12813. Fil: lla: / editorial .htm .
5. Ghamsari-SM ; Taguchi-K ; Abe-N.: Evaluation of low level laser therapy on primary healing of experimentally induced full thickness teat wounds in dairy cattle , Vet-Surg. , 1997 , Mar-Apr. ; 26(2) : 114-20 .
6. Ghamsari-SM ; Acorda-JA ; Taguchi-K.: Evaluation of wound healing of the teat with and without low level laser therapy in dairy tensiometry and hydroxyproline analysis , Br-Vet-J. 1996 , Sep. ,152 (5) : 583-92 .
7. Ghamsari-SM ; Taguchi-K ; Abe-N et al ; Histopathological effect of low level laser therapy on sutured wounds of the teat in dairy cattle ; Vet. Q. 1996 Mar. ; 18(1) : 17-21
8. El-Sayed – SO ; Dyson-M ; Effect of laser pulse repetition rate and pulse duration on mast cell number and degranulation , Lasers – Surg. Med. 1996 ; 19 (4) : 433-7 .
9. Padubidri-A ; Browne-E Jr ; Effect of vascular endothelial growth factors (VEGF) on survival of random extension of axial pattern skin flaps in the rat , Ann-Plast – Surg. 1996 ; 37 (6) : 604-11 .
10. Pinheiro-AL ; Cavalcanti – ET ; Pinheiro – TI et al ; Low level laser therapy in the management of disorders of the maxillfacial region , J. Clin-Laser – Med – Surg. 1997 ; 15 (4) : 181-3 .