

Treatment of infected diabetic ulcer with laser biostimulation

A Case Report

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الخلاصة:

بإمكان الليزر ان يستخدم في علاج واحدة من مشاكل الطب الشائعة والصعبة وهي مشكلة القدم السكري وذلك لقابليته على تحفيز وسائل الدفاع والنمو الطبيعية وبكفاءة عالية مع قدر اقل من المضاعفات الجانبية وبساطة كبيرة في الاستخدام.

Abstract

Background

Treatment of infected diabetic ulcers is one of the difficult issues at our daily practice with routine use of lengthy and multiple courses of antibiotics that do nothing in already impaired healing mechanisms in most of the cases. Biostimulation principles had been used successfully with wide range of clinical disorders but still at their beginnings with diabetes problems.

Patient presentation

Severely infected and gangrenous diabetic ulcer of the foot

Results

Complete healing with no residual problem on follow up.

Conclusion

Laser can be used for treatment of one of the most common and difficult medical problems which is diabetic foot by it's ability to stimulate body natural defense mechanisms with high standard of success and simplicity and less range of side effects.

The Case

A diabetic male, 65 years old was referred to us at 12/5/ 2013 for vascular opinion regarding his left lower limb, he was complaining from infected left foot ulcer of 10 days duration. This ulcer was the result of gangrenous fifth toe amputation. The ulcer was wide extending from the base of fourth and fifth toes to about mid-foot and from dorsum to plantar surfaces with irregular margin, necrotic tissues, exposed gangrenous fifth metatarsal bone, and obvious, very offensive discharge (fig-1). The patient was on injectable broad spectrum antibiotics from the time of amputation (10 days) and poorly controlled diabetes, with slightly impaired renal function.



Fig-1: presentation

Clinical exam of the limb revealed impaired both neurological and vascular systems. Doppler study revealed stenosis of left external iliac artery, for which dilatation and stent insertion was achieved at 14/5/2013. Medical treatment was modified to control his general condition and then we proceeded for specific treatment of the ulcer.

Specific treatment

At 19/5/2013, we admitted the patient to hospital for one day and we excised as much as we can of necrotic tissues under local anesthesia, keeping the gangrenous fifth metatarsal bone for next sessions because the extent of amputation was not clear at first, we stopped all kinds of antibiotics, local and systemic. At 20/5/2013, we started our contactless laser sessions on daily basis at first. The parameters were:

power =8 w

Pulse length= 100 msec= 0.1 sec

Spot size= 0.9 cm²

Energy= 0.8 J

Power density= 8.8 w/cm²

Energy density= 0.8 J/cm²

Frequency=6 pulse/sec

mean pulses per session was about 1700 pulses

The machine used was diode laser KTP 532 nm from ARClaser company.

Regarding the treatment scheme and the mode of lasering the ulcer area, it was something subjective and empirical, so I used to give the laser in a circular manner at the ulcer edge between the skin and the ulcer bed concentrating on the hidden areas below the callus of the skin which I used to elevate it manually, with horizontal scanning manner to the bed, repeating the procedure many times for both (about 10

sessions to each), the speed of my hand was slow with 2-3 pulses per area, the patient felt no pain during the treatment because of his neuropathy. six sessions were given from 20/5-27/5 and the results were so encouraging because of healthy granulation tissue appeared and decrease in the offensive discharge (fig-2).



Fig-2: early post contactless laser results (the left picture after 3 sessions, the middle one after 5 sessions, the right picture after 6 sessions)

At that time we took the opinion of one of the experienced orthopedist at Babylon regarding amputation of the gangrenous fifth metatarsal, and he decided to proceed with ray amputation of that bone with soft tissue preservation and encouraged me to continue my management, so at 30/5/2013, the patient was admitted and the surgery was done to him at same day (fig-3).



Fig-3- post ray amputation

During the period from 1/6-9/6, 7 laser sessions were given with same above parameters with a mean of 1900 pulses per session and the results were very good with area of granulation tissue covering the whole bed of the ulcer (fig-4). Till this moment there were no local nor systemic antibiotics use nor adjunctive therapies, only daily dressing with gauze soaked with povidone iodine solution.



Fig-4- nice response to laser post amputation (after 6 sessions post amputation)

At 11/6, we noticed that the proximal end of the surgical wound was still discharging (arrow in fig-4 points to the site), and the risk of abscess formation was high because of potential space developed postoperatively which was so deep and now covered with skin making access to laser beam is difficult, so we decided to use a prophylactic course of wide spectrum antibiotics, we used injectable antibiotics (ceftriaxone 1 gm daily) till 27/6 when we stopped it, during this period 5 sessions were given with same setting and mean pulses were 2100 pulses, fibrin deposition was clinically obvious on all the ulcer edges (fig-5).



Fig-5 fibrin deposition

From 3/7-11/7, another 3 sessions with same setting and mean pulses. Because of the good amount of granulation tissue now found in the ulcer with smaller ulcer area, we reduced the power to 4 watts during the sessions given during the period from 16/7-21/8 and reducing the mean pulses per session to 1200. six sessions were given with healing continued at all margins of the ulcer but signs of deep tissue infection were still present (pus on squeezing as in fig-6) which made no difference to our treatment.



Fig-6: pus still present

Complete healing was achieved on 28/8, when we stopped further sessions and daily dressing (fig-7).



Figure-7: healing

Follow Up

Because of the presence of pus shortly before healing occurred, there was a risk of possible sinus tract formation or recurrence of the infection, but after 2 months, there were no residual problem regarding the ulcer with established and maintained complete healing (Fig-8).



Fig-8: 2 months follow up

Discussion

Variables that were found to be significant risk factors for severe foot infection were a history of previous amputation, peripheral vascular disease, and peripheral neuropathy¹, all these variables were present in our case and The condition of the case was limb-threatening condition according to university of Texas system² (presence of superficial ulcer, involvement of deep soft tissue and bone, and presence of gangrene).

It is well known that such cases should be debrided^{3,4}, and this was achieved in our case in 2 stages, the first was not so deep under local anesthesia, and after development of some granulation tissue we proceeded for deeper debridement and ray amputation of fifth metatarsal, we think that the extent of debridement of second stage was less than that if we did it from the start, and the ulcer bed postoperatively was more healthy with granulation tissue already present which decreased the risk of potential space abscess formation post-operative.

Several in vitro and in vivo studies have demonstrated that low level laser therapy has a significant influence on a variety of cellular functions and clinical conditions⁵⁻⁹ and it can influence a variety of biological processes including the acceleration of wound healing⁶⁻⁹, But in diabetes, wound healing is impaired by extrinsic and intrinsic factors. Intrinsic factors include abnormalities of growth factor production, reduced neutrophil activity, and reduced expression of extracellular matrix¹⁰. Neuroischemic ulcers took about 20 weeks to heal¹¹, we reach healing in our case with much shorter time (about 13 weeks), So can laser influence such impaired functions and accelerate healing? We need more studies and many pre and post laser tissue samples to be sure about that, unfortunately, such lab investigations are not available at Babylon/Iraq, but the clinical observations strongly support the beneficial use of laser in the treatment of such common and difficult to treat problem.

Conclusion

Once we prove by lab investigations that laser can stimulate important defective steps in healing of diabetic ulcer, laser will be less expensive and more simple than the use of adjunctive therapies with less days of hospitalization, less healing time, and less use of antibiotics and the resultant problems of side effects and resistant strains with very accepted healing and tissue preservation as in our case .

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