The use of polarized, polychromatic, non-coherent light on a non-healing burn wound

Summary: *This study assesses the effectiveness of utilising polarized, polychromatic, non-coherent light in the conservative management of a non-healing burn wound located on the distal aspect of the fifth metatarsal head of a 66 year old diabetic male. The wound area was managed conservatively at the Concord Hospital Burns Unit using conventional methods for 19 weeks with negligible improvement. After 19 weeks Light Therapy commenced. The use of Wound gel and bactigras dressing was continued during this time in conjunction with the Light Therapy using the Compact BIOPTRON lamp. This treatment resulted in the closure of the wound 15.5 weeks after commencement of Light Therapy. Polarised Light Therapy provided an opportunity to monitoring healing rates where the potential for healing appeared limited.*

BACKGROUND

Light Therapy

Phototherapy has been studied in many areas of medicine over many years with particular advances during the last couple of decades. Mester et al found that low-energy laser irradiation has a bio-stimulating effect [1] and that the application of laser irradiation stimulates wound healing resulting in faster closure of wounds, especially in the case of refractory and persistent ulcers [2]. A similar stimulation of wound healing was observed in the application of a polarised light source developed by Fenyo [3], which was found to trigger human cellular and humoral defences [3-5]. The advantages of this light source over the laser include lower costs, fewer risks, a larger treatment area and no important user skills.

Scientific mechanisms underlying light therapy treatments include:

- The activation of ATP, an important storage and energy transfer mechanism within the body;
- An increased support for the multiplication of collagen fibres;
- The enhancement of important specific enzymes involved in cell regeneration;
- Support for the lymphatic system for cellular regeneration;
- Beneficial development of new blood vessels;
- Creation of a significant increase in DNA and protein synthesis within the cells of the body.

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BIOPTRON Light, through the cell structure in the skin:

- harmonises metabolic processes;
- reinforces the immune system;
- stimulates the regenerative and reparative processes of the entire organism.

The unique properties of BIOPTRON Light (listed below) enable it to penetrate not only the skin but also underlying tissues. Thus the positive effect of the BIOPTRON light is not limited to the treated skin area but has a beneficial effect on the entire organism.

Polarisation: BIOPTRON Light is polarised light: its waves move (oscillate) exclusively in parallel planes. The light emitted by the BIOPTRON devices reaches a polarisation degree of 95%.

Polychromy: BIOPTRON Light is a polychromatic light. This means that its spectrum does not contain only one wavelength as with laser light. It has a broad range, including parts of visible and infrared spectrum. The wavelength of BIOPTRON light ranges from 480 to 3,400 nm. BIOPTRON Light does not contain UV radiation!

Incoherency: As opposed to laser light, BIOPTRON Light is incoherent or out-of-phase light. This means that the light waves are not synchronised.

Low Energy: BIOPTRON Light has a low energy density. This energy density has strong bio-stimulative effects and allows the light to stimulate various biological processes in the body in a positive way.

Years of testing have affirmed the positive effects of the unique BIOPTRON Light and have led to its wide-ranging application in numerous fields of medicine.

Many scientific and research studies have created a basis for the broad use of BIOPTRON Light Therapy throughout the world. BIOPTRON Light Therapy is today used as a part of standard medical therapy and as an essential resource in prevention and rehabilitation.

The scientific team of the BIOPTRON AG Company works with eminent experts, researchers and medical doctors in numerous countries in an effort to explain the characteristics and therapeutic effectiveness of polarised light. This work is described in the published results of research projects in many respected medical publications [6-12].

The patient

The patient was a 66 year old diabetic male with a history including IDDM of ten years, peripheral neuropathy, obesity, previous smoker, hypertension and PVD. The patient also had previous ulcers with extended healing times. The injury occurred as a result of warming his feet in front of a radiant heater. Two days later he presented to the Ambulatory Burn Wound Clinic at the Concord Hospital with blistering to the great toe on his left foot and intact eschar to the fifth metatarsal head on his right foot. The burn wound was 5cm * 2cm in size.

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TREATMENT PRIOR TO LIGHT THERAPY

A non-surgical approach was adopted for the treatment of the burn. An intact eschar was noted and treatment commenced using Acticote to maintain a drier environment. The use of Acticote continued for the next 8 weeks. At the end of this period a separation of the eschar was noted and mechanical debridement was attended. Note that further debridement of the wound continued throughout this treatment.

Next daily Alginate dressing was applied for the duration of 4 weeks. Since the patient's visits numbered 2 per week, his family was educated in changing the dressing in between visits and hospital staff were on call at all times in case of any complications in between visits. At the end of this period an increase in the deposition of slough was noted and the wound also appeared to have increased in depth.

The treatment was then changed to a wound gel and bactigras dressing. This treatment continued for the next 5 weeks. During this period some inflammation to surrounding tissue occurred. A wound swab was obtained with a negative result. An X-ray was performed in order to exclude any underlying pathology. This was also clear. The patient's blood sugars were stable.

Aquacel AG was then used for 1 week to reduce inflammation and further debride the wound.

Figure 1 shows the wound 1 week prior to the commencement of Light Therapy.

Figure 1: *Patient's wound 18 weeks after burn, 1 week prior to commencement of light therapy.*

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Equipment

The patient used the BIOPTRON Compact III lamp at home. Its ergonomic design, size and weight make it very portable and easy to use. It has a filter diameter of 4cm and an in-built timer which emits a short sound signal every two minutes to monitor session length.

The BIOPTRON 2 lamp was used during hospital sessions. It is intended for professional use in medicine although its innovative design and safety of use enable easy application under home conditions. It has a filter diameter of 15 cm and comes equipped with an in-built timer and display as well as an electronic switch for soft start and soft stop, whereby the sophisticated parts of the device are well maintained.

The technical data for the BIOPTRON Compact III and BIOPTRON 2 lamps is given below:

Power supply	100-230 V~ - 50/60 Hz	
Power consumption	● Bioptron Compact ● Bioptron 2	56 VA 1.4 - 1.0 VA
Fuse	● Bioptron 2	T2A/250 V
Rated power of halogen	● Bioptron Compact ● Bioptron 2	20 W 90 W
Protective class	● Bioptron Compact ● Bioptron 2	Class II - IP 20 Class I - IP 20
Device type	● Bioptron Compact ● Bioptron 2	Type BF Type B
Weight	● Bioptron Compact ● Bioptron 2	0.5 Kg 4.3 kg
Ambient temperatures	Operation Storage	+ 10°C to + 40° C + 5°C to + 45° C
Wavelength	480 - 3400 nm	
Degree of polarisation	>95% (590-1550nm)	
Specific power density	av. 40 mW/cm2	
Light energy per minute	av. 2.4 J/cm2	
CE labelling		

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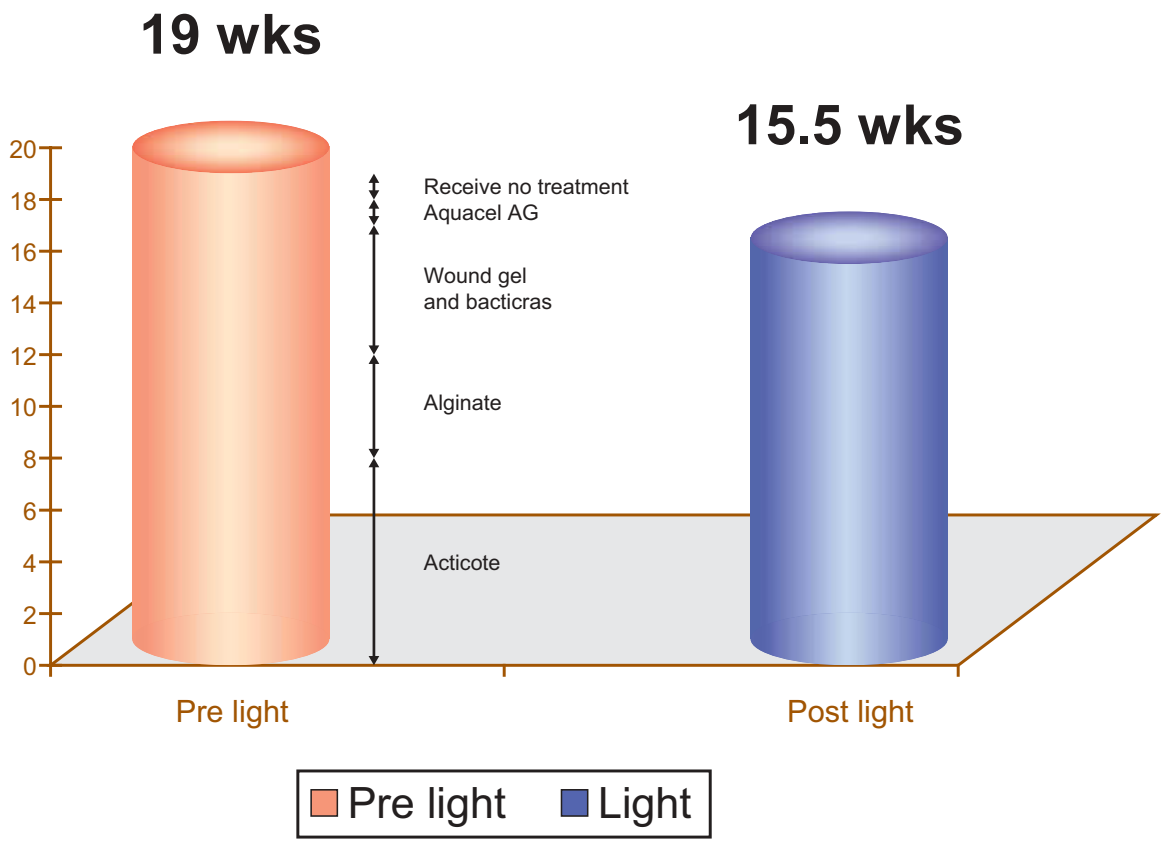
Method

Light Therapy commenced after 19 weeks and consisted of daily treatments lasting 5 minutes after thorough cleansing in conjunction with the continued use of wound gel and bactigras dressings. The patient's visits decreased to 1 per week and the family were further instructed in the use of light therapy in between visits to the hospital. The patient was treated at home with the Compact BIOPTRON III lamp.

At 12.5 weeks after commencement of Light Therapy treatment the patient was hospitalised for Pneumonia and further Light Therapy Treatments were administered at the Hospital. At this time the wound was found to be decreased in size. A further 3 weeks of dressings and Light Therapy resulted in the closure of the wound.

Results

As shown in graph 1, the pre-light therapy consisted of 19 weeks and it showed minimal results. Total light therapy time was 15.5 weeks and resulted in the closure of the patient's wound. The total healing time was 34 weeks.



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Figures A - F below show the gradual healing of the wound after the commencement of the Light Therapy Treatment.

Fig. A: *Patient's wound 18 weeks after burn, 1 week prior to light therapy.*

Fig. B: *20.8 weeks post burn, 2 weeks after light therapy has been started.*

Fig. C: *24.1 weeks post burn, 5.2 weeks after light therapy has been started.*

Fig. D: *26.7 weeks post burn, 7.7 weeks after light therapy has been started.*

Fig. E: *31.2 weeks post burn, 12.2 weeks after light therapy has been started.*

Fig. F: *Clinical outcome showing healed wound, 34.5 weeks post burn, 15.5 weeks after light therapy has been started.*

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CONCLUSION

Light Therapy stimulates the body's natural healing potentials to regulate and regenerate. Polarised Light Therapy provided an opportunity to monitor healing rates where the potential for healing appeared limited. On this particular patient, Light Therapy proved essential where other conservative treatments proved ineffective on their own. The Concord Hospital Burns Unit will continue to use BIOPTRON Light Therapy on their outpatients and monitor outcomes. A well designed randomised controlled study should be carried out to confirm the efficiency of light therapy.

This case was presented for the first time at the Asia Pacific Burns Congress incorporating Australian and New Zealand Burn Association Annual Scientific Meeting, which was held during the 8-12 September 2003, at the Brisbane Convention & Exhibition Centre in Brisbane, Queensland, Australia.

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