

THE USE OF TRANSDERMAL CONTINUOUS OXYGEN THERAPY FOR THE TREATMENT OF CHRONIC RECALCITRANT SICKLE CELL DISEASE ULCERS

Ikechukwu S. Igwegbe, MD, MHA, Gladys Onojobi, MD, Margaret Fadojutimi-Akinsiku, RN* and Alan M. Hirsh, MD#

* Howard University Center for Sickle Cell Disease, Washington, DC #University Hospitals, Ahuja Medical Center, Beachwood, Ohio

INTRODUCTION

Leg ulcerations are common in homozygous sickle cell anemia (also known as SCD – Sickle Cell Disease). The rate of occurrence is believed to be between 8-10%, but rates as high as 50% have been reported¹. These ulcers can be disabling², severely painful, and often require analgesics. Additionally healing of these ulcers is very slow, taking months or years, if at all.³ The average duration of chronic ulcers in SCD patients has been reported from 6 months² to exceeding 3 years.⁴ Once healed, approximately 97% of healed sickle cell ulcers will recur in less than 1 year.⁵ A single Sickle Cell leg ulcer is a predictor of increased additional wounds with a 23 fold increased risk factor of developing future ulcers while having an active ulcer carries a 146 fold increased risk.⁵

Due to the chronic, recalcitrant nature of these wounds, patients can experience chronic pain, disfigurement, embarrassment, isolation and loss of income.⁴ There is a high degree of urgency in discovering a treatment for Sickle Cell Disease ulcers that is effective for long periods of time, or better still, a method for eliminating the reoccurrence and proliferation of these wounds entirely.

Venographic studies have revealed that unlike many other wound etiologies, venous insufficiency is not the primary cause of Sickle Cell Disease ulcers.² Rather, it is deprivation of oxygen to the skin caused by arteriovenous shunting, which has been postulated as the principal cause of the ulcerations.² To date, there has been little success in determining a consistent approach to treating these chronic Sickle Cell ulcers. In light of the oxygen skin deprivation theory, an approach to provide increased oxygenation through the wound bed is considered logical. In addition, other “wound bed” approaches for SCD ulcers, in the area of pain management, have been effective.³

One approach of administering oxygen to the wound bed is by using a device that provides continuous oxygen. Oxygen plays a role in energy metabolism, neovascularization, collagen deposition, polymorphonuclear function, and fibroblast proliferation.⁶ Studies on Transdermal Continuous Oxygen Therapy (TCOT) suggests it may improve other components of ischemic healing, including granulation tissue and reepithelialization.⁷ Transdermal Continuous Oxygen Therapy (TCOT) is currently the only method that allows oxygen to be continuously supplied to an open wound, and all other treatments to date have been regionally (topically) or systemically intermittent. The unit is marketed as EPIFLO® (by Ogenix, Beechwood, Ohio). The small, 3 oz., portable fuel cell based oxygen concentrator provides near 100% oxygen at a rate of 3 ml/hour. The oxygen is transported beneath standard occlusive or semi-occlusive dressings via a thin cannula (60” in length), attached to a Luer lock on the TCOT unit. The small size of the unit allows the patient to be ambulatory during the treatment and receive continuous oxygen delivery to the wound while they are away from the clinic or hospital.

METHOD

Three patients with long histories of recurring Sickle Cell Disease ulcers that would not heal with various conventional and/or other adjunctive wound healing modalities were treated with Transdermal Continuous Oxygen Therapy (TCOT).

SUBJECTS

The patients had recurring non healing wounds for 30 years, 21 years and 20 years respectively. All three patients healed or improved to near healing for treatment periods of 3 weeks to 36 weeks.

CONCLUSION

TCOT has been shown to be a new effective way to treat patients with sickle cell ulcers. Since results of this method are typically noticeable within 4 weeks, this may be a very inexpensive adjunctive treatment modality to determine a possible favorable outcome with a very brief treatment period. With further studies, it may prove to be the therapy of choice for treating sickle cell ulcers and other ulcers and wounds caused by deprivation of oxygen to the wound site.

REFERENCES

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TCOT device utilized in case study

CASE 1



WEEK	LENGTH	WIDTH	DEPTH
WEEK 1	4 CM	4 CM	0.5 CM
WEEK 1	2 CM	3 CM	0.3 CM
WEEK 7	2 CM	3 CM	0.2 CM
WEEK 14	1 CM	0.5 CM	0.1 CM
WEEK 36	<0.5 CM	<0.5 CM	NEGLIGIBLE

A 51 year old man was presented with SCD homozygous SS (HBSS) and chronic bilateral leg ulcer in his right lower leg. Diagnosis of disease was made at 11 years of age. Received wound grafts in both legs at 48 years of age. After only 4 months, the graft was rejected. The patient has had recurring leg ulcers for 30 years and the ulcers have been consistent for the past ten years occurring with more regularity. During TCOT treatment, the patient also received Exchange Blood Transfusion (EBT) every 6 weeks and during the treatment period had 8 courses of EBT. Prior to TCOT the ulcers were treated with wet dressing, Vaseline gauze, honey, and compression dressing. TCOT was used on the medial aspect of the left lower third of the patient’s leg. Participant had TCOT concentrator changed every 15 days. The treatment ran for 36 weeks. Within 1 week, the wound area reduced from 4 cm x 4 cm to 2cm x 3cm and reduced the depth by 40% (see chart). By week 36, the depth was negligible and the wound area reduced to a small pinhole. “The patient has been ulcer-free for 5 months (as of this writing) at the TCOT-treated wound site”.

CASE 2



WEEK	LENGTH	WIDTH	DEPTH
WEEK 0	1.5 CM	1.5 CM	0.2 CM
WEEK 12	<0.1 CM	<0.1 CM	NEGLIGIBLE

A 33 year old man with homozygous SS (HBSS) was presented. At time of treatment he had been on hydroxyurea for one year. On average he had a vaso-occlusive crisis about 6 times per year. The target ulcer developed about 1 year prior to commencing TCOT treatment on the left big toe. Prior to treatment, ulcers were very painful and debilitating to the patient and he was placed on Sulindac for 10 days to relieve the pain. He attended clinic every 15 days for replacement of device. Ulcer was completely healed in 3 months. At time of publication of this poster there has been no reoccurrence of the ulcers and the patient has been ulcer free for 8 months.

CASE 3



WEEK	LENGTH	WIDTH	DEPTH
WEEK 0	6 CM	2.5 CM	MODERATE
WEEK 2	5.4 CM	1.6 CM	SHALLOW
WEEK 3	5.6 CM	2.2 CM	SUPERFICIAL

50 year old male presented to clinic with a 20 year history of non healing ulcers on both legs. The patient was refractory to all therapies. Within 2 weeks, TCOT had greatly reduced the wounds size and the surface epithelialized. Within 3 weeks the surface of the wound was totally healed. The patient reported that it was “the best healing he had ever seen in 20 years.”