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Sequential Contraction Compression Device Aids in the Healing of an Ischemic Foot Ulceration in a Chronic Dialysis Patient: A Case Report

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Case Study

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ABSTRACT

The authors present a case of an ischemic foot with distal gangrene in a diabetic patient with end stage renal disease on dialysis. Intervention with a sequential contraction compression device was initiated with the intention to increase distal blood flow and mitigate the need for a trans-metatarsal amputation. Sequential contraction compression therapy has been shown to be effective in increasing the macrocirculation to the lower extremity and this case report demonstrates that the system has an effect also on the microcirculation.

INTRODUCTION

Impaired blood flow is one of the main contributors to the development of chronic skin ulcerations [1,2]. This is particularly true in the Diabetic Foot. Chronic Renal Dialysis is another contributing factor to the development of wounds and increases the risk of ulcer development almost to the level of Diabetes [3]. In the treatment paradigm for chronic skin ulcerations, prevention or treatment of local or systemic infection usually takes precedence. This is followed with treatment protocols whose goal is to convert the unhealthy tissue to viable tissue in the wound bed and the eventual epithelialization and closure of the wound. A significant part of wound healing is neoangiogenesis, whereby new blood vessels are induced to grow in the new tissue, enabling better oxygenation and metabolism within the wound [4]. Revascularization in numerous forms is also an integral part of this treatment paradigm especially in the poorly perfused wound and leg [5].

Intermittent Compression Device (ICD) therapy is a known therapy for the treatment of edema and other vascular conditions. Of late, ICD has also been utilized in the treatment of chronic ulcerations of the lower limb [6]. The drawback of ICD use is poor patient compliance and complications with the device [7,8]. The Flowaid FA-100 Sequential Contraction Compression device (SCCD) has a similar function as the ICD's but a different mode of action. The FA-100 SCCD generates peristaltic muscular contractions of the leg resulting in increased blood flow and an overall increased vasculature [9,10].

SCCD is applied via four electrodes to the back of the leg and the intended dosage is 1-2 h per affected leg daily. The treatment can be given and continued during any activity, mitigating the need for staying in place during the therapy.

The authors have in the past utilized the SCCD successfully for the treatment of vascular conditions. The authors describe a case where the off label use of the SCCD is investigated for the treatment of an ischemic wound in the foot.

CASE DESCRIPTION

A 73 year old female with a history of 40 years of smoking 1 pack per day, Ischemic Heart disease and Type 2 Diabetes Mellitus (30 years history), currently with End Stage Renal Disease and receiving Dialysis three times weekly for the last four years, presented to our clinic with what appeared to be dry gangrene demarcated at the Metatarso-Phalangeal line **(Figure 1)** present for a few days. Trans metatarsal amputation (TMA) was recommended for this patient as Doppler evaluation of the peripheral blood flow showed adequate perfusion for healing after this surgery. The patient was very reluctant to have surgery and asked for any

alternative therapies available to stay off surgical intervention. Medical intervention was not an option because of the patient's complicated medical history.

Figure 1. Ischemic foot at presentation.

The medical team searched for a method to try and reperfuse the distal area. An ICD was ordered but the patient could not tolerate treatment with the device and discontinued use after just a few sessions. A FlowAid FA-100 SCCD device was acquired and applied to the patient's leg. The patient followed the protocol of twice daily usage of 2 h per session and continued using the device for 1 month. The patient's pain levels decreased and ambulation increased. Doppler examination showed no change in the microvasculature of the foot, but there was significant improvement to the quality of the skin closer to the ischemic toes. There was also a positive change in the look of the toes and amputation was further delayed.

After a second month with the SCCD the lesser toes recovered as did some of the proximal portion of the hallux **(Figure 2)**. The distal portion of the hallux was debrided away and the wound healed within fourteen days. The patient continues to have full function of an almost complete foot, when TMA was recommended as a primary treatment.

Figure 2. Foot after treatment with SCCD and amputation of distal hallux.

DISCUSSION

The healing of wounds is a multispecialty and multiorgan function. On the level of the wound, numerous processes occur in order for the wound to heal. These include stimulation of epithelial cells to grow, stimulation of collagen synthesis, creation of new blood vessels, and the increased oxygenation of the tissue. On a macro level there are oftentimes many underlying conditions that need to be treated in order to heal the wound and keep it healed. In the case of venous ulcers, reduction of leg edema has been shown to increase the healing rate by a significant amount. In the case of Diabetic and Ischemic ulcerations, increasing the overall blood flow to the area is an important fact of wound healing.

External mechanical increase in blood flow that is by ICD has been shown effective in having an effect on wound closure rates. The problems with these devices are that they are loud, difficult to use, have many usage complications, and require the patient to be sedentary for the entire treatment period. All of these lead to poor patient compliance and a waste of resources.

The FlowAid FA-100 SCCD produces the same effect as the ICD without the complications mentioned above. The SCCD is small, portable and easy to use. Patient compliance is extremely high. The resulting contractions of the leg help to evacuate the limb of pooled venous blood and allows for more and better arterial return thus revascularizing the limb and causing an increase in tissue oxygenation.

CONCLUSION

While not intended as a primary wound care device, the clinical results generated by the SCCD imply that it would be a useful adjunct therapy in wound care, especially in increasing the vasculature to the foot and leg. A clinical trial proving this is called for, but clinical practice would indicate that the SCCD has a place in the wound care field as well as the vascular.

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