

Effect of Compression... Beyond the Swollen Leg

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ABSTRACT

Purpose: Compression applied to the limb is the gold standard for the management of venous leg ulcers (VLU)¹. Mechanism of the impact of compression on healing of VLU has focused primarily on the impact that compression has on the underlying venous anatomy with numerous studies citing reduced venous reflux, reduced venous hypertension and reduced overall limb edema as primary outcomes that have a beneficial effect on wound healing.¹⁻² A new type of compression therapy, characterized as 'fuzzy wale' compression, which can be applied directly in contact with the wound bed, has shown dramatic impact on healing times in previously recalcitrant wounds. Five detailed case studies to be presented demonstrating outcomes including change in wound volume and time to wound closure.

Methods: Five patients (3 men, 2 women) between ages of 54 and 82, presented to separate outpatient lymphedema/wound clinics with non-healing ulcerations of LE of varying durations (6 months to 2 years). Intervention included 'fuzzy wale compression' directly in contact with the wound bed along with various secondary dressings to maintain a moist wound environment or manage exudate as necessary for each wound. Additional compression therapy applied over the 'fuzzy wale compression' where appropriate. Wound measurements and photos to be provided.

Findings: In each case, noted improvement in wound dimension and appearance with each dressing change. Previously recalcitrant wounds were resolved with only the addition of the compression directly on the wound bed. Note re-epithelization along the "furrows" created by the fuzzy wale compression.

Conclusions: Compression has been shown to have an impact on the macro-circulation however little has been mentioned in the literature about the impact that compression applied directly to the wound. Ability of the fuzzy wale technology to apply compression evenly into the wound bed and along wound margins, even those that have small irregular surface area, thereby enhancing the overall effects of compression seen on a larger scale, with resolution of induration and fibrosis in the peri-wound tissue, thereby increasing perfusion to promote wound healing.

MATERIAL AND METHOD

Fuzzy Wale Elastic compression textile is stockinet that is composed of fuzzy longitudinal wales that are connected by Lycra spandex elastic yarns. Fuzzy wales create a unique compression stockinet that compresses just 20% of the skin surface.

The non-compressed subcutaneous tissue between the wales has open veins and lymphatics that promote return edema fluid into the vascular space. The compression profile created is comparable to "mild" compression (15 – 20mmHg).

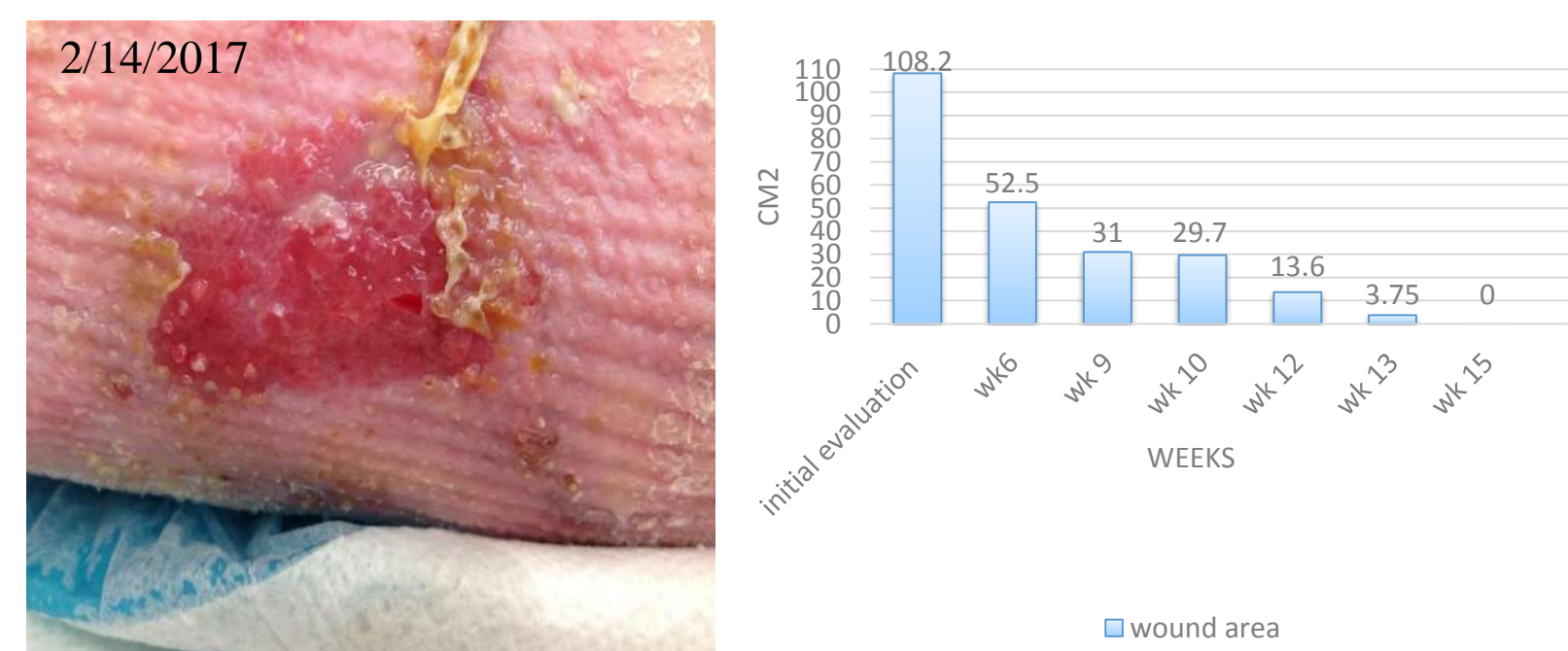
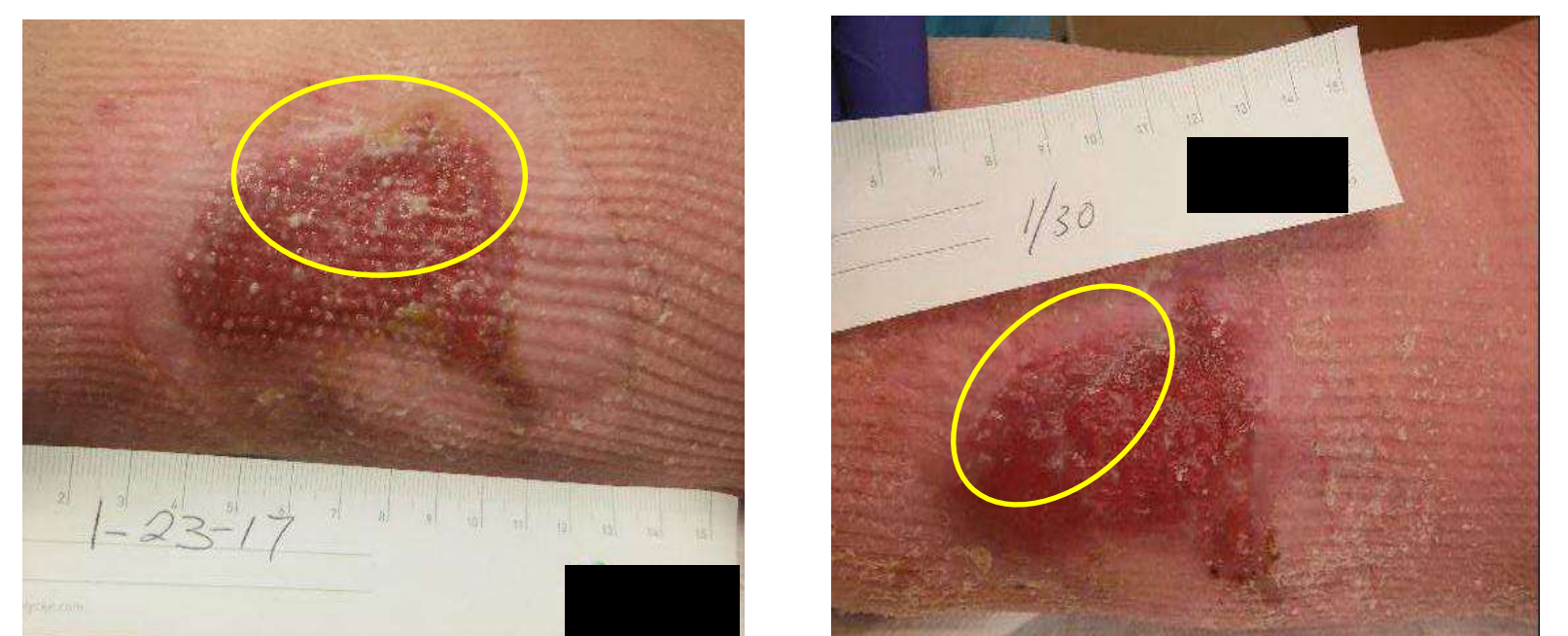


This case series of patients referred to two separate outpatient clinics for management of non-healing ulcers, details the history of five patients with recalcitrant ulcerations and/or "edema" for which traditional compression therapy had not produced adequate healing.

Each patient received moist wound care and Fuzzy Wale Elastic compression textile either in direct contact with or over a single layer thin contact layer. Outcomes measured included limb volume change, wound area and time to wound closure.

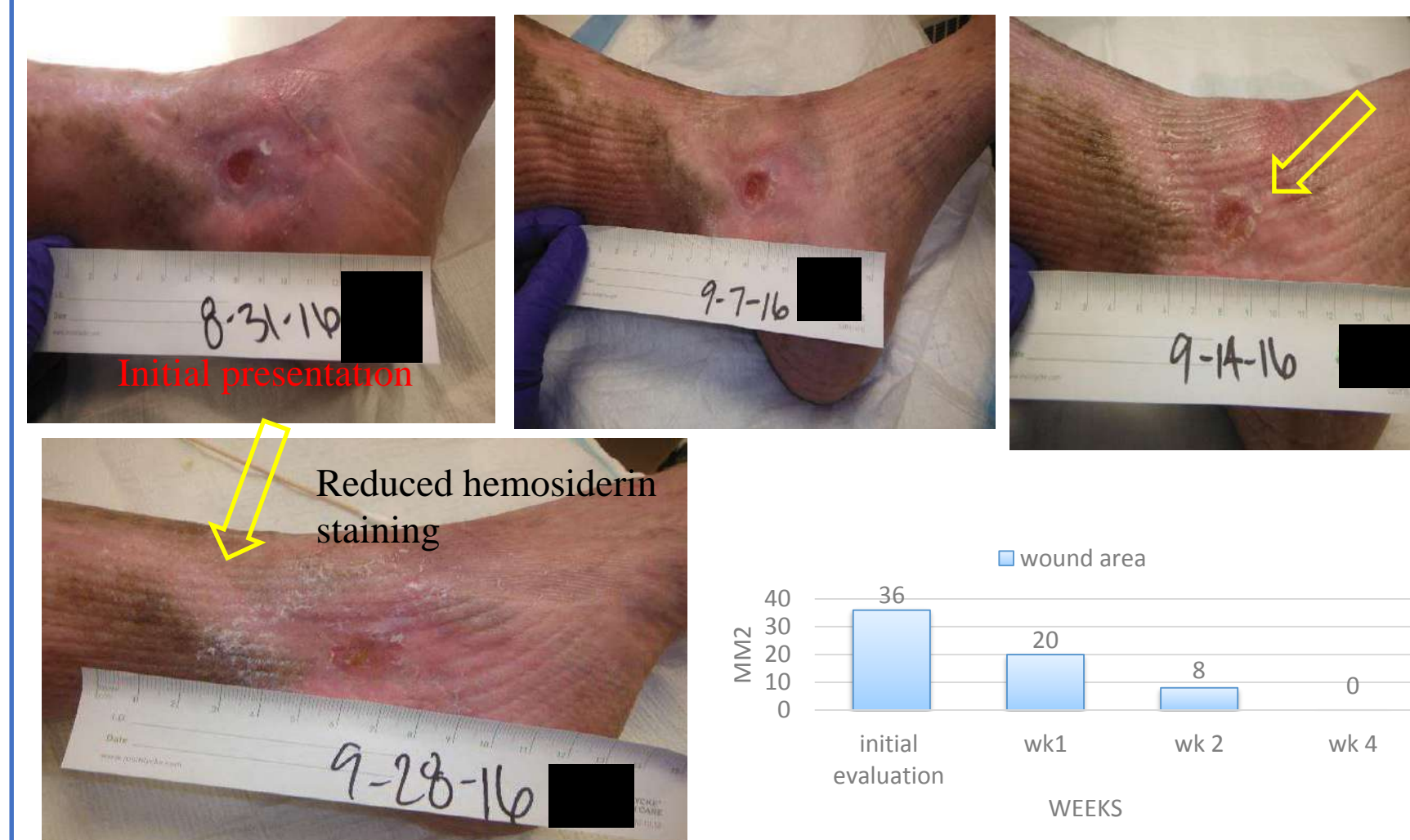
Case 1

- 67 year old female with h/o chronic posterior calf wound due to deep hematoma
 - PMH significant for chronic LE lipedema, lymphedema, DM, morbid obesity, neuropathy, chronic kidney disease
 - Wound duration: > 7 months
 - Previous treatments:
 - Surgical I/Ds, NPWT, CTPs, moist wound care
 - Compression options used: 2 and 3 layer inelastic compression wraps
- Wound was heavy draining due to lipedema/lymphedema, margins stalled, Fuzzy Wale compression was placed over collagen sheets/CTP on the wound surface. Collagen was absorbed into the tissues and fuzzy wale compression was directly on the wound base. Fragile epithelium was protected with silicone contact layer.



Case 2

- 76 year old female with h/o chronic venous ulcer left LE
 - PMH significant for CVI, tobacco use, PAD, CAD
 - Wound duration: 19 years
 - Previous treatments:
 - Moist wound care, skin grafting, cellular tissue applications, exercise, stationary bike
 - Compression options used: 2 layer inelastic compression wrap
- Original wound volume was 140 cm squared: 20x7x.5cm. Wound progressed with conservative care down to a small remaining malleolar wound. Healing then stalled, Fuzzy Wale compression was then placed over the wound as the primary dressing. Marginal epithelization progressed rapidly over the surface of the wound care; leading to full closure.



Case 3

- 71 year old male with h/o ischemic ulcer of the right dorsal foot
 - PMH: PAD, ETOH, + smoker, CAD, prostate CA, HTN, immobility
 - Previous treatment:
 - Revascularization, NPWT, moist wound care, collagen, surgical debridement with allograft placement, Ultrasound, topical oxygen
 - Did not tolerate any type of compression, even gauze wrapped loosely
- Fuzzy wale elastic compression was used in contact with the wound care, collagen was applied under the fuzzy wale material.



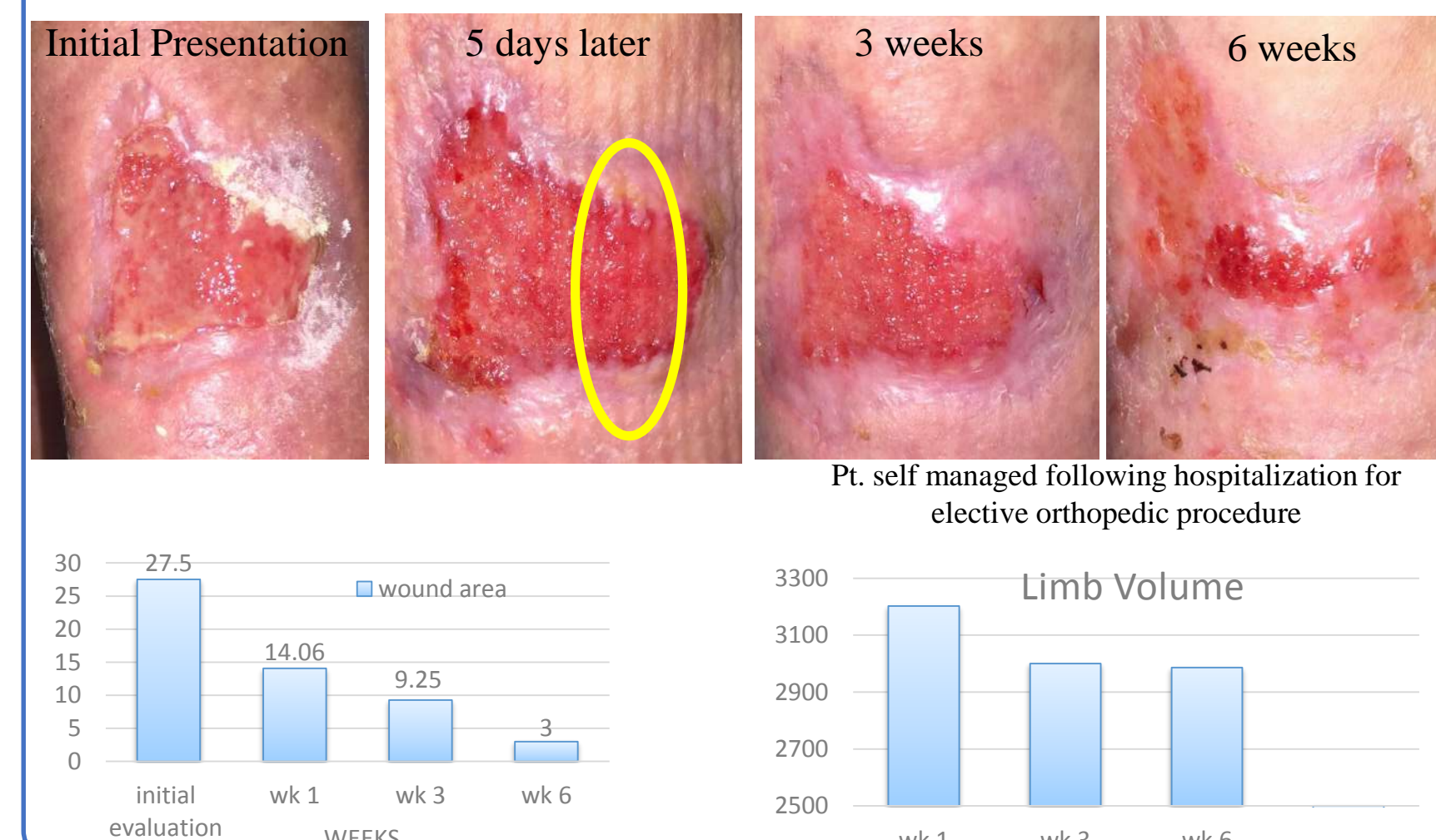
Case 4

- 66 year old male with h/o recurrent ulceration right LE
 - PMH significant for CVI, obesity, lymphedema, cellulitis
 - Wound duration: > 6 months
 - Previous treatments:
 - Dressings including foams with silver, absorbent dressing, topical antifungals, oral antibiotics and short course of NPWT.
 - Compression products including 2 layer cohesive wraps, multi-layer lymphedema wrap, flat knit garments, long stretch bandages.
- EdemaWear was initially used in direct contact with wound bed however noted some irritation therefore switch to single layer of transfer dressing under EdemaWear.



Case 5

- 63 year old male with bilateral LE ulceration
 - PMH significant for RA, PVD, pt. is non-ambulatory
 - Wound duration: > 1 year
 - Previous treatment:
 - dressings including foams with silver, absorbent dressing, topical antifungals, oral antibiotics
 - compression product – elastic tubular single layer, anti-embolic stockings
- EdemaWear was applied directly over the wound /leg -> primary moisture transfer dressing -> 4x4-> kling to secure. No other compression applied.



Discussion

Compression is a necessity for LE edema management and has been shown to have a positive impact on healing of LE ulcerations.^{1,4} The effects of compression discussed in literature thus far has largely been focused on the positive effects of compression on the macro-circulation of the limb, via its direct impact on the venous system. Advances in real time lymphatic imaging have produced a number of new avenues for the scientific research on the impact of compression on the superficial lymphatics. There is a growing number of studies looking at the impact of compression and it's impact on the function of the lymphatic system.^{5,6} The findings of these studies demonstrates that compression has impact on lymphatic function. However, to date the authors of this case study have found no discussion in the literature showing the impact of irregular compression applied directly to the wound margins and wound bed surface.

The unique design of the Fuzzy Wale ElasticTextile utilizes longitudinal yarn compression allowing for a focused compression on subcutaneous tissue, resulting in alternating areas of compression across the wound base and margins. This localized variation of compression directly on the skin, wound base tissue and margins has demonstrated signs of enhanced edge effect as evident by resolution of epibole and peri-wound fibrosis as well as the appearance of epithelization along the "furrows" (as pictured in case studies highlighted). This could be due to increased micro-circulation. An additional feature of this particular form of compression is its ability to conform to the wound bed. This allows for equal pressure distribution across the wound without risk of focal compression in one area which can be created with attempts to bolster a wound in concave anatomical regions.

There has been much focus recently with regards to interface pressure and static stiffness of compression products and the impact on the applied tissue. However, there has not been mention of the impact of compression on the subcutaneous tissue. Chronic non-healing wounds are manifestations of a myriad of co-morbid underlying pathologies that result in the inability of the skin to repair itself. There are numerous wound care applications on the market to 'promote healing' via a variety of mechanisms. In particular, the focus on delayed edge effect, has led to the rise in usage of advanced modalities to progress epithelization⁷ However, there has been no mention of the role of the functioning lymphatics and/or products to address impaired lymphatic function in this ongoing scientific investigation. The impact of the lymphatics is also key and as such, additional research into the impact that different forms of compression have on the venous and lymphatic system, as well as cellular senescence at a microcirculatory level is necessary. Perhaps the reason for the recidivism in the chronic non-healing wound patient is that the treatment thus far has only been to address the macrovascular changes with little to no attention on the micro-vascular system and lymphatics. A functioning lymphatic system is essential for healthy skin. Should not wound healing focus be healing the skin, including the lymphatics, not just the wound.

Conclusions

The addition of Fuzzy Wale Elastic textile demonstrated an immediate positive impact on healing of previously recalcitrant wounds, even in those patients whom traditional medical grade compression (i.e. those with ABI <0.65) is contra-indicated. The Fuzzy Wale Elastic textile increased resolution of peri-wound edema, fibrosis, epibole in/around the wound causing an improvement in edge effect as well as reduced hemosiderin staining in the surrounding tissues. Migration of epithelial cells along the furrows can be clearly seen.

There is clearly need for additional scientific investigation looking at the mechanism of action of this type of compression, as well as its possible usage across the spectrum of wound healing and edema management.

References

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