

Extracorporeal Shock Wave Therapy for the treatment of venous ulcers in the lower limbs



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Chronic venous ulcers are one of the most common medical problems today. The treatment has always been challenging and over the years many conservative and surgical alternatives have been proposed. During the past three decades, extracorporeal shock wave therapy (ESWT) has been introduced in several medical specialties.

According to the clinical findings, the ESWT appears to significantly improve the healing process of chronic wounds, increasing the release of endogenous angiogenic factor from endothelial cells and fibroblasts, consequently fastening the healing process of chronic wounds.

The present report describes the application of ESWT for the treatment of chronic venous ulcers in the lower limbs and compared the results with those obtained by conventional treatment on the contralateral leg.

KEY WORDS: Difficult wounds, Extracorporeal Shock Wave Therapy (ESWT), Lower limbs, Venous ulcers

Introduction

Venous ulcers are complex wounds caused by chronic venous insufficiency in the lower extremities¹. Considering the dramatic increase of this pathology among the population, these wounds are becoming a major social and economic issue². Many studies in recent years, have focused on the treatment of chronic ulcers and a remarkable variety of conservative and surgical options have been proposed³.

Advanced dressings have recently generated considerable research interest, but a number of alternative approaches may be also taken into account, especially in the field of physical therapies, i.e. shockwaves.

Over the past three decades, extracorporeal shock waves (ESW) were introduced to treat several pathologies. Notwithstanding the increasing clinical use, the exact mechanism of action for ESW remains uncertain. They seem to increase the release of endogenous angiogenic factor from endothelial cells and fibroblasts, stimulate revascularization, release of local growth factors and recruitment of appropriate stem cells to the target area, consequently fastening the healing process of chronic wounds.

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Case report

A 63 year-old patient affected by chronic venous insufficiency of the lower limbs presented two ulcers on the



Fig. 1: Female patient (63 yrs) with two venous ulcers on the right leg (a 1,5 x 2 cm ulcer on the external malleolar region and 4 x 2cm ulcer on the medial pretibial aspect).



Fig. 3: Incomplete closure of the wound on the left leg after six weeks of conventional dressings.



Fig. 2: The same patient presented also with one 4 x 1,5 cm ulcer on the medial pretibial aspect of the left lower leg.

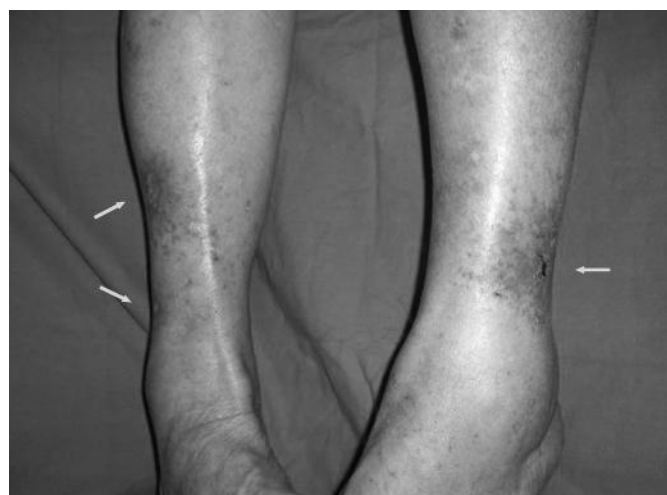


Fig. 4: Final clinical result after six sessions (6 weeks) of ESWT. Complete closure of the wounds on the right leg treated with ESWT and incomplete closure of the wound on the left leg treated with conventional dressings.

right leg (1,5 x 2 cm ulcer on the external malleolar region and 4 x 2 cm ulcer on the medial pretibial region) (Fig. 1) and one on the left leg (4 x 1,5 cm ulcer on the medial pretibial region) (Fig. 2).

The right leg ulcers have been treated with extracorporeal shock wave therapy (ESWT) that consisted of 100 impulses at 0,037 mJ/mm² each per cm² (Evotron, High Medical Technologies, Lengwil, Switzerland) ⁴. The focal volume of the hand-handled probes (Trode) was 10-15 mm in diameter and the total energy applied for each impulse was 3,5 mJ, with a frequency of 4 Hz or 240 impulses/min.

The patient underwent single sessions of ESWT once a week for six weeks, for a total of six sessions. After six

weeks, a complete healing of the wounds on the right leg had been achieved.

The left leg ulcer has been treated with conventional dressings consisting of disinfection and application of medicated gauze every week for six weeks. At the end of the study period, the healing was still incomplete (Figg. 3-4).

Discussion

Chronic ulcers represent a challenging area because the healing process is altered by local or systemic factors, which prevent the closure of the skin defect and scar

formation. On account of their complex etiology, current treatments are not always successful and require variable time-cost period in supporting the healing process. Recent studies suggest the potential use of shock waves to improve the healing process of these wounds. Extracorporeal shock wave therapy proves to be effective in lesions that are unresponsive to conservative or advanced dressing treatments. Furthermore, ESWT can be combined with advanced dressings, which are the first choice treatment but need to be placed one at a time. Moreover, ESWT is a noninvasive technique and shows an apparently low complication rate.

Shock waves' biological effects have been extensively investigated both *in vitro* and *in vivo*. These studies demonstrate that ESW are effective in stimulating several growth factors, inducing angiogenesis, accelerating the inflammatory and early proliferative stages of repair and therefore the healing of fractures, injuries and wounds ^{5,6}.

Moreover, ESW have proven to have effects on nerve conduction, reducing pain in chronic degenerative pathologies, and they also demonstrate an antibacterial potential ^{7,8}.

Although previous clinical studies have mainly considered the orthopedic use of shock waves, much research in recent years has focused on the potential applications of ESW in the field of reconstructive surgery ⁹. The positive results obtained by 'in vitro' studies encourage further investigation of the ESWT. A worthwhile study about the management of chronic ulcers proves the effectiveness of ESWT in enhancing the healing process of chronic wounds.

Chronic ulcers are histologically characterized by disorganized endothelial proliferation, presence of parakeratotic keratinocytes, connective tissue not organized in fibrils, increased number of lymphocytes and granulocytes with alterations of proteins, electrolytes and cytokines. In these wounds, shock waves seem to stimulate endothelial organization and increase the deposition of connective tissue and the stimulation of epithelialization. However, on account of the direct microtraumatic effect of ESWT, the possibility of bleeding, petechiae, hematoma or seroma formation and painful sensation have been described ¹⁰. Yet, ESWT can be used without local anesthesia.

Conclusion

The present report describes the application of ESWT for the treatment of chronic venous ulcers in the lower limbs and compared the results with those obtained by conventional treatment on the contralateral leg. According to the clinical findings, the ESWT appears to significantly improve the healing process of chronic wounds.

Furthermore, the ESWT presents a remarkable advan-

tage as it can be performed in association with advanced dressings.

Advanced dressings are currently considered gold standard for the treatment of chronic ulcers, so much that the therapeutic approach to complex wounds often contemplate only the use of such dressings. As for the shock waves, they not only can be used in association with advanced dressings, but also enhance their therapeutic effect.

In conclusion, ESWT seems a profitable technology and may be proposed as a safe, feasible and cost-effective support in the treatment of chronic wounds.

Riassunto

Al giorno d'oggi le ulcere venose croniche sono uno dei problemi medici più comuni. Il trattamento è sempre stato difficile e nel corso degli anni molte alternative conservative e chirurgiche sono state proposte. Nel corso degli ultimi tre decenni, la terapia extracorporea ad onde d'urto (ESWT) è stata introdotta in diverse specialità mediche.

Secondo i risultati clinici, la ESWT sembra migliorare in modo significativo il processo di guarigione delle ferite croniche, incrementando il rilascio endogeno del fattore angiogenico dalle cellule endoteliali e dai fibroblasti, e di conseguenza la chiusura nel processo di guarigione delle ferite croniche.

La presente relazione descrive l'applicazione delle ESWT per il trattamento delle ulcere venose croniche degli arti inferiori e confronta i risultati con quelli ottenuti mediante trattamento convenzionale sulla gamba controllata.

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