## Pulsed radio frequency energy as physical therapy



## CHAPTER V DISCUSSION

Many adults with vascular disease and/or diabetes suffer with chronic leg or foot ulcers, leading to loss of functional ability, poor quality of life and long term ill-health. Studies on patients with chronic leg ulcers have reported the average duration of these ulcers is around 12-13 months, around 60-70% of patients have recurring ulcers, 24% of patients are hospitalized because of the ulcers and most people suffer from the condition for an average of 15 or more years. Care for chronic wounds is reported to cost 2-3% of total health care spending in developed countries and these costs are set to rise with ageing populations. Treatment in the U. S. costs over 3 billion \$US and the loss of over 2 million workdays a year. Similarly, Harding quotes a cost of £400 million each year in the U. K. In Australia, wound dressings are the second most frequent procedure in General Practitioner practice and chronic wound care accounts for 22-50% of community nursing time in the UK and Australia(Edwards et al., 2013).

In addition to direct health care costs, chronic wounds are associated with hidden burdens on the community resulting from loss of mobility, decreased functional ability, social isolation and loss of participation in the workforce and society(Price and Krasner, 2012).

The use of pulsed radio-frequency electromagnetic field (PEMF), also termed pulsed radiofrequency energy (PRFE) therapy has shown notable success in healing of chronic wounds. PEMF is a non-ionising energy at the shortwave radiofrequency band of the electromagnetic spectrum, commonly at a frequency of 27. 12MHz. Since the introduction of PEMF in the 1950s,

clinical studies on healing of chronic wounds and surgical recovery, as well orthopaedic studies have documented PEMF as a successful clinical therapy. PEMF therapy is none invasive and is delivered through the wound dressing, and to date has shown no unwanted side effects. With positive reports in the literature documenting PEMF as an effective therapy, its wider adoption as an adjunct therapy seems warranted(Rawe, 2012).

The measurement of wound dimension is an important component of successful wound management. Monitoring changes in wound area allows assessment of treatment efficacy and early detection of stasis or deterioration. The photographic method is an accurate alternative to digital planimetry system (Visitrak TM ) for measuring wound area. The photographic method is a more appropriate technique for clean and uncontaminated wounds, as contact with the wound bed is avoided(Chang et al., 2011).

This study investigated the efficacy of pulsed radio frequency energy as physical therapy modality in the treatment of chronic lower limb ulcers through reducing wound surface area (WSA) and wound volume.

The findings of this study indicated significant decrease in WSA after treatment in both groups A and B (P <0. 0001) with bitter percentage of improvement in group A (62. 78%) vs (16. 48% in group B). Also, there was significant difference between Group A, and Group B post treatment values of WSA (p <0. 0001) with favored results in group A.

Regarding the results of wound volume, both groups A and B showed significant decrease in wound volume after treatment (p <0. 0001) with https://assignbuster.com/pulsed-radio-frequency-energy-as-physical-therapy/

Page 4

percentage of improvement 68. 96% in group A and 31. 09% in group B. Also, there was significant difference between Group A, and Group B post treatment values of wound volume (p= 0.010) with favored results in group A.

Regarding the results of wound volume, there was significant increase in Ki-67% after treatment (p < 0.0001) in groups A only with percentage of improvement 253. 15%. Also, there was significant difference between Group A, and Group B post treatment values of wound volume (p < 0.010) with favored results in group A.

Therefore the results of current study confirmed the therapeutic efficiency of pulsed radio frequency energy as therapeutic modality in reducing wound surface area and wound volume and treatment of chronic lower limb ulcers.

The results of our study consistent or supported by the works reported by Kao et al. (2013); Rawe and Vlahovic (2012); Conner-Kerr and Senberg (2012); Frykbergetal. (2011); Lietal. (2011); Maier (2011);

Kloth et al. (1999); Bentall (1986).

Kao et al. (2013)evaluated the effect of Pulsed radiofrequency energy diabetic wounded Db/db mice. Gross closure, cell proliferation, and morphometric analysis of CD31-stained wound cross-sections were assessed. The mRNA expression of profibrotic factors (transforming growth factor- $\beta$ and platelet-derived growth factor-A), angiogenetic factors (vascular endothelial growth factor and basic fibroblast growth factor), and extracellular matrix components (collagen I and  $\alpha$ -smooth muscle actin) were evaluated by quantitative reverse-transcriptase polymerase chain

reaction. Collagen protein level of the wound was determined by Western blot analysis. Cell migration was monitored in monolayer dermal fibroblast cultures. The degree of collagen alignment and gelation time was quantitatively assessed using image analysis techniques. Results show that pulsed radiofrequency energy-treated wounds were characterized by dermal cell proliferation and increased collagen synthesis.

Rawe and Vlahovic (2012)evaluated the effect of a lightweight wearable form of a PFRE device on 3 diabetic foot ulcers and 1 venous stasis ulcer in a case report, the ulcers were present on the 4 patients for greater than 3 months and had failed to heal after conventional treatment. A lightweight battery powered, wearable form PRFE device was introduced as a treatment and used 6-8 hrs per day for a period of 6 weeks. All patients after 1 week of therapy showed improvement and wound size was seen to decrease. Patient 1 had a venous stasis ulcer, and reported significant pain relief after 2 weeks treatment. Patients 2 and 3 achieved complete healing after 3 weeks treatment, and patient 1 and patient 4 had a 95% and 88% reduction in wound size after the 6 week study period. Both these patients continued to complete healing using the PRFE device after the 6 week study period.

Conner-Kerr and Isenberg (2012)evaluated the benefit of using PRFE therapy in the treatment of chronic pressure ulcers via Provant Therapy System in 89 patients show 51% median decrease in wound surface area after 4 weeks. Accelerate wound healing rate so that the median of wound healing course reaches 0. 13 cm/d. the study concluded that PRFE therapy is a useful adjuvant treatment for healing of chronic pressure ulcers. Frykbergetal.(2011)conducted a study to explore the effect of PRFE on the rate of wound healing results show mean percent reduction in wound area after 4 weeks was  $49\% \pm 6\%$  for pressure ulcer (PU) (P <0. 0001),  $38\% \pm 6\%$  for diabetic foot ulcer (DFU) (P <0. 0001),  $44\% \pm 5\%$  for venous leg ulcer (VLU) (P <0. 0001), and  $39\% \pm 9\%$  for ulcers of various other etiologies (P = 0. 0001). The median wound reduction rate was 0. 08 cm (2)/day (range -4. 14- 2. 21). Results suggesting that a large proportion of these PRFE-treated ulcers wound have healed with ongoing therapy.

Lietal.(2011)investigated the effect of pulsed radiofrequency energy on cutaneous ulcers to understand its mechanism. Full-thickness cutaneous ulcers were created in diabetic mice. The experimental group was subject to pulsed radiofrequency energy treatment two times per day, whereas the sham group was subjected to sham devices. The rate of wound closure was evaluated by digital analysis of surface area of the wound bed, zone of reepithelialization, and rate of contraction. The results indicate that pulsed radiofrequency energy accelerates impaired wound healing mainly through wound contraction by means of stimulating cell proliferation, granulation tissue formation, and collagen deposition.

Maier (2011)evaluated the effect of PEMF on two patients with painful chronic cutaneous wounds in the lower limb. Adjunctive pulsed radio frequency energy was administered for 30 minutes twice daily through an applicator pad placed directly on the dressing over the wound area. Both patients reported immediate, marked pain reduction, allowing compression therapy. The ulcers healed completely within 3 weeks for patient 1 and 28 weeks for patient 2. Kloth et al. (1999)studied the effect of PRF treatment on healing of pressure ulcers in spinal cord injured patient. The study concluded that PRF treatment is a cost saving intervention that can stimulate the endogenous bioelectric tissue repair processes when wounds do not show evidence of healing with standard wound treatment. In addition, acceleration of tissue healing also reduces the pain and suffering experienced by individuals afflicted with chronic wounds. Also accelerated healing of chronic wounds with PRF enabled patients to return to functional activities sooner so undesirable complications do not develop.

Bentall(1986)evaluated the effect of pulsed radio-frequency energy in treatment of skin wounds. Results show that PEMF influenced the processes of acute secondary wound healing. The rate of healing was accelerated and the histological appearance of the actively treated wounds showed that the healed epidermis was more like normal skin than the scar tissue typical of secondary wound healing.

Finally, from the previous discussion of these results and according to reports of other investigators in similar studies, it can be explained that the beneficial effect of PRFE in treatment of lower limb ulcers is due to the following mechanisms:

Pulsed radio frequency energy found to make a significant improvement in the expression of genes involved in angiogenesis and wound remodeling. The expression of genes involved in angiogenesis and wound remodeling was assessed using microarray analysis of cultured human dermal fibroblasts (HDF) and human epidermal keratinocytes (HEK). Relative transcript levels of

Page 8

factors involved in these processes were determined at multiple time points following PRFE treatment using cDNA microarray analysis and confirmed by RT-PCR(Moffett et al., 2011).

Pulsed radio frequency energy found to promotes the healing of chronic wounds and facilitating the transition from a chronic inflammation cycle to that of a functional wound healing cycle, a process that in part may involve PRFE-mediated immunomodulation. The study concluded that PRFE field treatment of human dermal fibroblasts and epidermal keratinocytes resulted in robust increases in the levels of numerous transcripts encoding factors such as matrix metalloproteinases (MMPs) and their inhibitors (TIMPs), interleukin (IL)-related genes, interferon (INF)-related genes, and tumor necrosis factor (TNF)-related genes, that involved in the inflammatory phase of the wound healing process(Moffett et al., 2010).

Also, PEMF modulates the rate of calmodulin (CaM) activation when intracellular Ca2+ increases after insult or injury. This, in turn, modulates the activation of Ca/CaM-dependent constitutive nitric oxide synthase (cNOS) and, therefore, the dynamics of nitric oxide (NO) in the target cells/tissues. The Ca/CaM-dependent NO cascade is an important and early response to physical, chemical or thermal injury(Pilla, 2012).

So it can be claimed that, there was greater improvement after application of PRFE and so enhancing the treatment of chronic lower limb ulcers by decreasing the WSA, wound volume and increase the cell proliferation rate of the wound area. Also PRFE cost effective, and finally patient can regain to work quickly.