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EFFECTS OF PULSED RF ENERGY ON POSTMASTECTOMY ARM LYMPHEDEMA

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Objectives: Arm lymphedema (L-E) that occurs following mastectomy and related cancer treatment often develops gradually, and if untreated tends to worsen. Therapeutic measures, such as complete decongestive therapy (CDT) which includes compression and massage, are effective in reducing L-E in some patients. A physiological aspect of properly applied massage is its promotion of lymphatic drainage by expanding collateral lymphatic channels that connect to normally functioning lymphatic collectors. This provides useful alternative lymphatic pathways to accommodate drainage of excess lymph that is blocked from its normal routes. It was reasoned that if a simple method were available to facilitate collateral lymphatic enlargement then it might initially augment CDT outcomes and possibly provide patients with a longer-term continuous therapy option. Because previous work[1-2] showed that low-energy pulsed radio-frequency therapy at 27.120 MHz increased skin blood flow, likely via enlargement of vascular channels, it was hypothesized that this approach might also serve to similarly affect lymphatic channels. We therefore sought to determine if such an approach might have a positive impact on L-E reduction. As this therapy has not been previously used for L-E, the research was exploratory, with the goal to determine if treatments alone would provide evidence of potential efficacy.
Methods: Seven post-mastectomy patients with unilateral arm L-E were studied. They were treated 4-6 times for 60 minutes over a 2-week interval using pulsed RF (27.120 MHz at 700 pps, Magnatherm, IME). The dual heads of the device were placed over the affected arm about one cm. from the skin. Arm volumes were measured before starting treatment and prior to the start of each follow-up treatment. Edema volume was calculated as the difference between the volume of the affected (treated) arm and the control arm. Percent edema was calculated as edema volume divided by control arm volume. Skin blood perfusion (SBF) was measured by laser-Doppler using a thin non-metallic laser-Doppler probe placed on the affected arm at a standardized site midway between the wrist and elbow. Transcutaneous oxygen tension ($TcPO_2$) was monitored with $TcPO_2$ probes placed on the affected and control arm.
Results: Arm volume data (mean $\pm$ sem) showed that the initial percent edema of 24.5 $\pm$ 7.3%, was significantly reduced to 18.5 $\pm$ 6.3% ($p<0.01$) after one treatment, with further reductions occurring through the fourth treatment. Four treatments were associated with a reduction in percent edema to 56.2 $\pm$ 8.4% of its initial value. The largest effect appeared to occur early in the treatment sequence. SBF significantly increased after about 30 minutes of treatment, continued to rise and was maintained for at least 20 minutes after treatment was terminated. Thus, SBF showed a progressive increase from its baseline value of 266 $\pm$ 10 a.u. (Friedman test, $p<0.001$) and was significantly greater than baseline after 30 minutes of treatment (371 $\pm$ 38 a.u., $p=0.018$ Wilcoxon test). By 60 minutes, SBF reached 705 $\pm$ 122 a.u., which was on average 4.10 $\pm$ 0.87 times greater than baseline. Contrastingly, $TcPO_2$ did not significantly change in either the treated or control arm. Prior to initiation of treatment, $TcPO_2$ values were not significantly different between affected and treated arms (72.7 $\pm$6.9 vs. 64.1 $\pm$ 6.4 mmHg).
Conclusions: The initial results are encouraging, especially in view of the fact that the women in this pilot study had already received CDT therapy and had long standing residual lymphedema. Volume reduction was rapid and significant and occurred using only ~10% of the device maximum power. It is unknown if different power levels would change the observed short-term outcome. The role of the observed SBF increase during individual treatments, in mediating the lymphedema reduction, is not known. However, an intriguing possibility is that mechanisms similar to those that cause SBF to increase, also act to increase lymphatic flow by expanding collateral channels or by enhancing functional activity of lymph vessels. Although these initial findings are encouraging and the method tested may prove to be a useful compliment to current therapeutic practice, final conclusions must await further and expanded placebo controlled tests that are currently underway.

1. Mayrovitz HN & Larsen PB Effects of pulsed electromagnetic fields on skin microvascular blood perfusion. Wounds 1992;4:197-202.
2. Mayrovitz HN & Larsen PB A preliminary study to evaluate the effect of pulsed radio frequency field treatment on lower extremity periulcer skin microcirculation of diabetic patients. Wounds 1995;7:90-93