INFLUENCE OF CYCLOIDAL VIBRATION (VIBRO-PULSE®) ON LYMPHATIC FLOW AND CHANGES OBSERVED IN LYMPHATIC VESSELS.

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Introduction

Cycloidal vibration is a low frequency (25 to 30Hz) low amplitude oscillating action that projects in three planes, along, traverse and radially from the vibration generator. These fluctuate in each direction rising from a minimum to maximum level, at any one time the action in each of the directions will be at a different point in its cycle i.e. when at a maximum along the surface, the traverse vertical to the surface may be at a minimum. This "out of phase" oscillation produces a 3 dimensional Cycloidal vibration movement.

Cycloidal vibration therapy (VIBRO-PULSE®) when applied to human subjects has demonstrated increase in fluid turnover in skin tissue measured by dermascan ultrasound (1). Reduction in lower limb oedema when used as a treatment for lymphoedema, venous leg ulceration and lower limb cellulitis (2,3,4). In a randomised controlled trial for the treatment of lower limb cellulitis, oedema reduction was also measured. In the control group receiving the standard treatment of bed rest, the mean reduction in limb circumference was 2.3% by day 7. This compared to 6.6% mean reduction in limb circumference by day 7 for the experimental group receiving standard treatment plus Cycloidal Vibration to the lower limb 3 times a day for 30 minutes(3).

Cycloidal vibration increases lymphatic flow within the tissues resulting in oedema reduction. This study set out to investigate and visualise the direct effects of cycloidal vibration on lymphatic vessels in microcirculation in a skin based model in mice.

Method

This animal study was approved by the University Ethical Commission and involved 30 hairless mice. (65 M/IOPS NMRI VRO 30G and 50 S/SOPF SWISS NU/NU FE 20G)

The method used was transillumination microscopy in vivo. The mice were submitted to a total anaesthesia with Urethane 25 % subdermal injection. A longitudinal incision was made along the Linea Alba of the abdominal skin. The animal was placed and supported under a Leitz OPMI microsurgery microscope and the skin was reclined over a transparent probe attached to a cycloidal vibration generator (Fig 1).

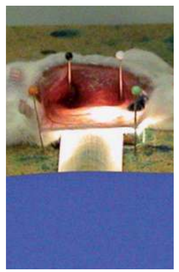

Fig. 1.

The lymphatic vessels were visualised by means of a Patent Blue V injection into the inguinal lymph node of the animal. A cold light source (Volpi Intralux 6000) illuminated the underside of the reclined skin.

The lymph flow and lymph vessel dilatation was observed for a 10 minute control / rest period. After the rest period the underside of the reclined skin was submitted to cycloidal vibration at a set speed of 28HZ for 10 minutes.

Any change in lymph flow or lymph vessel dilation was observed and photographed.

Results

When submitted to 10 minutes of Cycloidal vibration from rest a significant increase in lymphatic flow in the highlighted lymph vessels in 21 (70%) of the 30 mice tested was observed. An important dilation of the lymph vessel diameter was observed in 30 % of the mice.

Discussion

Lymphatics are thin walled vessels that carry lymph fluid. As fluid leaks from the vascular system it is returned to general circulation via the lymphatics. Changes in lymphatic flow are an important function in the reduction of oedema and in the process of wound healing. Increase in lymph flow helps to evacuate the waste products from the wound quicker and therefore has a clinical consequence in wound healing.

Lymph movement is due to the smooth muscle activity in the Tunica Media (mid layer of the vessel wall) and by unidirectional valves that divide lymphatic vessels into a series of compartments, called lymphangions. These exhibit contractions that actively pump lymph fluid. In response to higher lymph pressures they increase in frequency and strength and to increased flow they decrease frequency and strength of contraction. These two responses help maintain interstitial fluid balance (5,6).

The three dimensional oscillation action of cycloidal vibration is probably capable of stimulating the smooth muscles in the lymph vessel walls increasing activity of the lymphangions resulting in increased lymph flow and vessel dilation.

It was observed that the dilatation and the increased lymph flow induced no increased permeability of the lymph vessels. This demonstrates that the fragile microcirculation lymph vessels observed were not damaged as a result of being submitted to cycloidal vibration. We also noticed an influence on the arterial and venous circulation but this will be the subject of a further study.

Conclusion

This investigation has shown that there is an increase in lymph flow when the microcirculation in general and the lymph system in particular are submitted to cycloidal vibration.

Acknowledgment: Sponsored with a research grant from Vibrant Medical Ltd. UK.
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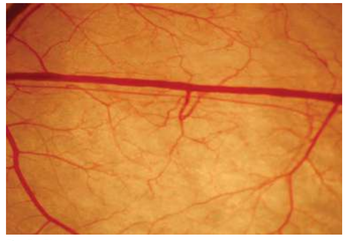

Fig. 2. Start.

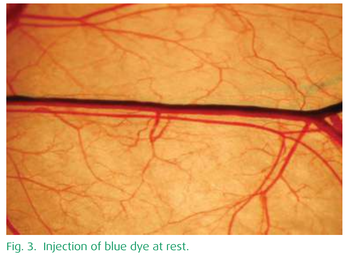

Fig. 3. Injection of blue dye at rest.

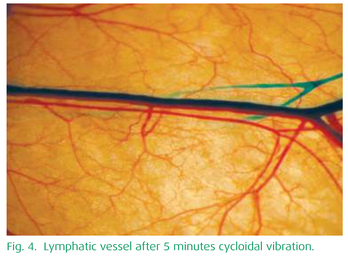

Fig. 4. Lymphatic vessel after 5 minutes cycloidal vibration.

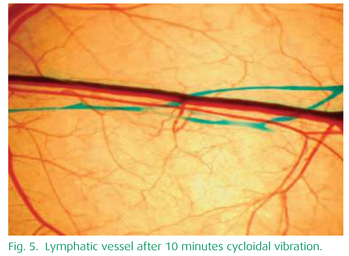

Fig. 5. Lymphatic vessel after 10 minutes cycloidal vibration.

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