

COMPARING LIMB-VOLUME MEASUREMENT TECHNIQUES: 3D MODELS FROM AN INFRARED DEPTH SENSOR VERSUS WATER DISPLACEMENT

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Here, a new method for measuring limb volume based on infrared depth sensors is introduced. The system can be operated by professionals and non-professionals, as it requires no special training – making it possible to use the system in the comfort of the patients' homes or at remote locations.

This high availability of the system allows for the early detection of swelling associated with lymphedema – a chronic disease caused by failure in the lymphatic system. Early detection and management can significantly reduce the potential for symptoms and complications; however, many patients fail to seek medical assistance at the first sign of the disease. So, the proposed system can potentially affect the lives of nearly 500,000 people in the U.S. who suffer from lymphedema and over 2.4 million breast cancer survivors who are at-risk for developing this disease at some point in their life.

In this paper, an explanation of the system and its operation is presented. The goal is to demonstrate the complete automation of the process of 3D imaging the arms. The proposed volume-measurement method takes just a couple of minutes to acquire the images. It has low cost, high accuracy and virtually no cleanup. It is also capable of capturing local swelling sites (an indicative symptom of the early stages of lymphedema). Further, because patients can perform the measurements at home, those measurements can be taken at much more frequent intervals.

The main objectives of this study were to: 1) exam the relationship between commonly used water displacement limb measurement and the proposed technique using 3D depth sensors; and 2) determine the reliability of the proposed method. A comparison of the proposed method with the perometry scanner was also carried out with the same objectives. Being an ongoing research, the results presented here are limited to 14 arms of mainly healthy volunteers. In the future, test will include a larger number of limbs of healthy as well as cancer patients.

SPECTROPHOTOMETRIC DETERMINATION OF LYMPH NODES DYE ACCUMULATION AFTER SHORT EXPOSURE TO MULTIDIRECTIONAL VIBRATIONS (ANDULLATION*) OR MANUAL MASSAGE, IN MICE

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Background: Whole Body Vibration is frequently used in sports, wellbeing, and medical fields. Their physiological effects are intensively studied.

Objective: To examine the short time effects of multidirectional vibrations (delivered in horizontal position) or manual massage, on the lymph nodes dye accumulation in mice.

METHODS: Local vibrations (30 Hz frequency, 3 minutes), or manual massage (3 minutes) were delivered after 20 \times 1 bilateral injections (footpad) of Evans blue dye (EBD) in 2 randomised groups of mice (total N= 15 animals). A randomised control group with only dye injected animals (N= 10 mice) was also used and compared to the other groups. The determination of dye quantity (\times g of EBD) in the lymph nodes (popliteal and sacral nodes) was carry out by spectrophotometric technique (wavelength: 620 nm), after animal euthanasia, lymph nodes removing and blue dye extracting from the dye-stained nodes.

Results: After vibrations, the quantities (\times 1) of EBD in popliteal lymph nodes are higher than in the control group (respectively, 0.56 ± 0.26 and 0.14 ± 0.17 , mean and sd, $p < 0.05$), and they are also a statistical different than after massage (respectively, 0.56 ± 0.26 and 0.22 ± 0.16 , mean and sd, $p < 0.05$).

Exactly the same results are found about the quantities of EBD in sacral lymph nodes.

Conclusion: In our experimental conditions and according to our results, it seems that dye tracer accumulation in lymph nodes is better after a short exposure to multidirectional vibrations (30Hz) than without intervention on the lymph drainage or with massage on injection site in mice. The specific tracer accumulation in lymph node is an important lymph function parameter, depending on the quality of the lymph flow, but not only. In fact, it is also depending on the phagocytosis of Blue dye bound to endogenous proteins by the RES Cells like macrophages present in the node.

Keywords: Andullation, Manual massage, Horizontal vibrations, Lymph nodes dye accumulation, Microcirculation, Spectrophotometric analysis.