

Volume measurement for monitoring of edema treatment by electronic devices

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Since more than 2200 years (Archimedes) water displacement method (WD) is the only way to determine the volume of corpuses of irregular surface. Known as water plethysmography, it is used to measure volume of patient's leg with edema. However, this method implies considerable disadvantages. It is difficult to handle, dependent on temperature and not adaptable to different heights of patients. Moreover, the volume values are restricted

to the lower leg.

Despite these disadvantages, water plethysmography is said to be the gold standard for monitoring of edema treatment.

Since several years, electronic body scanners are available. The models are based on different technologies. Within a study, an inexpensive equipment (Figure 1) was checked in comparison to WD-method. Advantages and disadvantages were compared. To realize this, it was necessary to compensate differences in measuring methods - especially the adaption of different length proportions. For this purpose, a modified WD-device was used to approach both methods and to compensate systematic differences (Figure 2). Looking on absolute values of volume measurement, the investigation showed that WD and BT600 deliver

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Veins and Lymphatics 2018; 7:7990
doi:10.4081/vl.2018.7990

comparable results. The differences between both methods were below 50 mL (Figure 3). Using dummies, reproducibility of BT600 measurements was 6 times better than same results, which were achieved by WD-method. The results with healthy sub-



Figure 1. Device BT600.



Figure 2. Water plethysmograph with variable overflow.

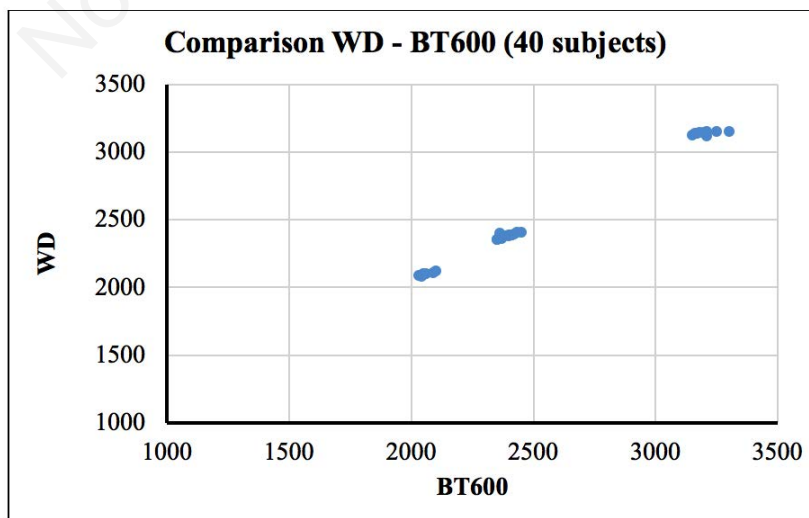


Figure 3. Results of a comparison with 40 subjects.

jects showed similar results (0.5%...1% coefficient of variation).

In combination of good results regarding precision and reproducibility, easiness of handling and delivering results for lower as well as upper leg, it may be recommended to use electronic measuring devices for edema monitoring.¹⁻⁴

References

1. Blättler W. Venous leg symptoms in healthy subjects assessed during prolonged standing. *J Vasc Surg* 2016;4: 455-62.
2. Kauder S. “Image 3D” zur Unterschenkelvolumenbestimmung im Vergleich mit der Wasserplethysmographie. *Phlebologie* 2011;40: 342-77.
3. Rabe. Water displacement leg volumetry in clinical studies – a discussion of error sources. *BMC Med Res Methodol* 2010;10:5.
4. Kling TI. The effect of water temperature on hand volume during volumetric measurement using water displacement method. *J Hand Ther* 1993;6:202-4.

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