REPEATABILITY OF DRT4 LASER DOPPLER MICROVASCULAR MEASUREMENTS

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INTRODUCTION

The Moor DRT4 Laser Doppler Monitor (Moor Instruments, Devon, UK) uses fiber optic cables to deliver two channels of 780 nm, 1.0 mW laser light to the interrogated tissue. The system is designed to evaluate microcirculation in 1 mm^3 of tissue at a depth of 1.0 mm. Like other systems, the DRT4 is not able to provide flow output in physical units since the geometry of the capillary bed is unknown. This limitation is overlooked clinically since the monitor allows functional testing of microcirculation, provides sufficient screening of those vessels and is not used for absolute measurements[1].

Use of laser Doppler (LD) monitors to provide follow up studies at the same site depends on finding the same capillary structure. Measurements may also be affected by temperature of tissue, tissue thickness, location of the probe and its orientation. Where repeated measures are needed for a research study, the reliability of measurements comes into question. If repeated measures can be taken at the same location and with controlled amounts of displacement from the original site, similar signals should be captured.

METHODS

Ten subjects from the general population were asked to refrain from eating, consuming alcohol or using nicotine products at least one hour before being studied. Each was studied in a reclined position that was relaxed and quiet. One LD probe was placed on the plantar hallux and the other under the first metatarsal head of the right foot as a control. Note that the control probe was never moved during the course of the experiment. The hallux location was marked with ink. The cable from the probe was directed proximally to register the orientation. Each probe collected data related to red blood cell motion (flux) and intensity of reflection (concentration).

Table 1: Interclass Correlations Coefficients (k=3. N=10). F=flux and C=concentration, both in arbitrary units; (1) sub-hallucial, (2) sub 1st metatarsal head [2].

Condition	F1	F2	C1	C2
Fixed position	0.94	0.97	0.94	0.97
Remove probe and replace	0.94	0.93	0.95	0.98
Remove probe and rotate 90	0.97	0.96	0.97	0.97
Remove probe and relocate 2 mm laterally	0.96	0.96	0.90	0.97
Remove probe and relocate 2 mm medially	0.92	0.92	0.90	0.98
Pooled Conditions	0.92	0.95	0.97	0.99

Data was collected in two-minute segments with approximately a one minute pause between measurements under five conditions for three trials each (see Table 1). Mean Flux and Concentration were evaluated using a Repeated Measures Analysis of Variance (ANOVA) in Staview™ 5.0. Intra-class correlation coefficients (ICC(2,1)) of Fluxes and Concentrations were determined as described by Denegar and Ball[2].

RESULTS AND DISCUSSION

ICCs were greater than 0.9 indicating that minor differences in DRT4 probe location were well tolerated in this test setting. The plantar big toe (hallux) has a high density of arterio-venous anastamoses presenting the best opportunity for interrogating microvascular flow with an LD on a repeatable basis[3]. Popel suggests the geometry of capillaries is not important since tissue is supplied from a network of vessels[4].

CONCLUSIONS

The Moor DRT4 LD Monitor has excellent reliability and hence may be appropriate for evaluation of hallucial microcirculation. Future efforts should apply similar technique to assess repeatability at other locations.

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