

ABSTRACT

Studies On Microvascular Resistance Using Near Infrared Photoplethysmography**Rosemarie Evita Bissessarsingh**

Near Infrared Photoplethysmography (NIRP) is a non-invasive technique that is used to evaluate blood volume pulsations in the microcirculation. The NIRP pulse comprises a rise time, Tg and a fall time, Ta. In this thesis, it is hypothesized that the ratio of the rise time to the fall time, Tg/Ta may be used as a measure of peripheral microvascular resistance.

Studies were conducted over periods ranging from seventy seconds to several days to evaluate the degree of consistency in Tg/Ta. Next, measurements of this ratio were made before and after maneuvers that altered the microvascular resistance of healthy subjects. Thirdly, Tg/Ta was examined in patients with diabetes mellitus and sickle cell disease, where there is a known increase in microvascular resistance. Finally, the effect of Pulsed Electromagnetic Field (PEMF) therapy on Tg/Ta of diabetic patients was examined.

The findings indicate that Tg is relatively stable over short-term and long-term periods while Ta seems to vary over long-term recording sessions. When regression analysis was performed on Tg/Ta it was determined that age, diabetes mellitus and the female gender caused significant increases in the ratio ($p = 0.000$, 0.001 , 0.018 respectively). There was also an increase in Tg/Ta in sickle cell patients in crisis ($p = 0.004$). No significant changes in Tg/Ta however were evident after cold water limb immersion ($p = 0.922$) or dynamic exercise of the hand ($p = 0.134$) of healthy subjects, however there was a decrease in Tg/Ta after the finger of a healthy subject was cuffed with a rubber band ($p = 0.015$). There were no consistent changes in Tg/Ta after application of PEMF therapy to diabetic subjects.

Based on the investigations in this thesis, Tg/Ta seems to be higher in disease states with increased microvascular resistance. With increased samples Tg/Ta may also prove to be a possible marker of microvascular resistance in healthy subjects.

Keywords: Rosemarie Evita Bissessarsingh; Near Infrared Photoplethysmography; microvascular resistance.