

## Microvascular Sex and Age-related Day-to-day Variability in Healthy Subjects

- Study protocol

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### Document revision history

Issue	Summary of change
01	New document

## Objectives

The aim of this study is to learn more about the microcirculation in the skin by examining sex and age-related day-to-day variability in healthy subjects.

## Design

Prospective observational study. In the study, four groups will be compared: Men aged 20-30 years, women aged 20-30 years, men aged 50-60 years and women aged 50-60 years. In total 48 participants will be included- 12 from each group.

## Background

The microcirculation consists of arterioles, capillaries and venules and is essential for nutrients and oxygen to be delivered to the tissue as well as waste products to be removed. The skin is often used as a model for studying the microcirculation.

Flowmotion is the rhythmical variations in measured skin blood flow that arise due to global and local regulations of the vessels and can be studied using frequency analysis of time-resolved blood flow signals.

There are many ways to study the microcirculation, most commonly are noninvasive optical techniques which measures the reflection of light used. In this study the single point technique EPOS and a larger area technique called PSI-X will be used. EPOS, based on laser doppler flowmetry (LDF) and diffuse reflectance spectroscopy (DRS), analyze speed-resolved perfusion, variations in red blood cell tissue fraction, oxygen saturation and vessel diameter. PSI-X, based on multi-exposure laser speckle contrast imaging (MELSCI) and multispectral imaging (MSI), analyze conventional perfusion, speed-resolved perfusion and oxygen saturation.

## Methods

To study day-to-day variability, each subject's data will be collected on two separate occasions within 7 days.

### Occasion 1

Once arriving to the lab, the subject will answer the following questions by filling in a questionnaire:

1. The subjects age and gender.
2. If the subject is biologically female- Usage of anticonception medication?
3. If the subject is biologically female- Number of days since the first day of the subject's period cycle, alternatively number of years since the subject's most recent period cycle?
4. How many minutes a week does the subject engage in high intensity workout (such as running, football ect)?
5. How many minutes a week does the subject engage in low intensity workout (such as hiking, biking, gardening work ect)?
6. Conformation to not have eaten two hours and not used nicotine, caffeine, or alcohol three hours prior to the experiment.
7. Conformation that the subject do not have a chronic disease such as diabetes, rheumatism ect.

Once the questions are filled in, the subject will receive information about the experiment and gets the opportunity to ask questions, thereafter a consent form is signed. The subject's height and weight will be measured and BMI calculated. The subjects skin type will be determined using the Fitzpatrick scale.

An acclimatization period of 15 minutes begins and the subject will remove socks and lay down. While the subject rests the equipment will be set up. A blood pressure cuff is placed around the upper arm as well as around the ankle. An EPOS-probe is placed on the dorsal side of the foot as well as the volar side of the forearm. A marker pen is used to mark the skin around the probes which enables the probe to be placed on the same location on the next measurement. A vacuum pillow is set up to position the arm and minimize movement artefacts. Once five minutes has passed, the subject's blood pressure and pulse are noted. Thereafter the PSI-X camera is set up and angled to film the plantar side of the foot from about 25 cm. The subject is asked to lay as still as possible during the measurement.

Once the acclimatization period has passed, the lights in the lab are turned off and the measurement will begin. Firstly, baseline data will be collected as the subject rest for 10 minutes without provocation. Thereafter the blood pressure cuff on the ankle will inflate to 250 mmHg for five minutes whilst data is collected. Lastly data is collected for five minutes after the blood pressure cuff deflates. Thereafter the PSI-X camera is moved and angled to film the forearm from a 25 cm distance. Baseline data will be collected on the arm as the subject rest for 10 minutes without provocation. Thereafter the blood pressure cuff on the upper arm will inflate to 250 mmHg for five minutes whilst data is collected and lastly data is collected for five minutes after the blood pressure cuff deflates. The temperature within the room is noted before and after the measurement.

## **Occasion 2**

When arriving to the lab, the subject will confirm to not have eaten 2 hours and not have consumed caffeine or alcohol 3 hours prior to the experiment. Thereafter the subject will remove socks and lay down as the acclimatization period begins. A blood pressure cuff is placed around the upper arm as well as around the ankle. The EPOS-probes are placed within the marked skin areas from the previous measurement. A vacuum pillow is set up to position the arm and minimize movement artefacts. Once five minutes has passed, the subject's blood pressure and pulse are noted. Thereafter the PSI-X camera is set up and angled to film the plantar side of the foot from about 25 cm. The subject is asked to lay as still as possible during the measurement.

Once the acclimatization period has passed, the lights in the lab are turned off and the measurement will begin. Firstly, baseline data will be collected as the subject rest for 10 minutes without provocation. Thereafter the blood pressure cuff on the ankle will inflate to 250 mmHg for five minutes whilst data is collected. Lastly data is collected for five minutes after the blood pressure cuff deflates. Thereafter the PSI-X camera is moved and angled to film the forearm from a 25 cm distance. Baseline data will be collected on the arm as the subject rest for 10 minutes without provocation. Thereafter the blood pressure cuff on the upper arm will inflate to 250 mmHg for five minutes whilst data is collected and lastly data is

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