EVALUATION OF PARAMETERS OF MICROCIRCULATORY BLOOD FLOW STRUCTURE BY WEARABLE PERFUSION SENSORS

Y.I. Loktionova[a], E.V. Zharkikh[a], E.A. Zherebtsov[b], I.O. Kozlov[a], V.V. Sidorov[c], A.I. Zherebtsova[a], S.G. Sokolovski[d], A.V. Dunaev[a], E.U. Rafailov[d,e]

[a]Research and Development Center of Biomedical Photonics, Orel State University named after I.S. Turgenev, Orel, Russia
[b]Optoelectronics and Measurement Techniques, University of Oulu, Oulu, FI-90014, Finland
[c]SPE "LAZMA" Ltd, Moscow, Russia
[d]Aston Institute of Photonic Technologies, Aston University, Birmingham, UK
[e]International Center of Critical Technologies in Medicine, Saratov State University, Saratov, Russia

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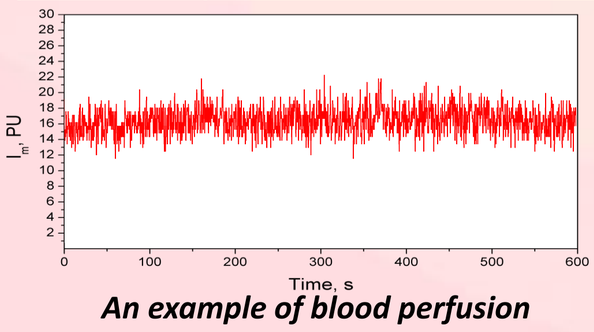
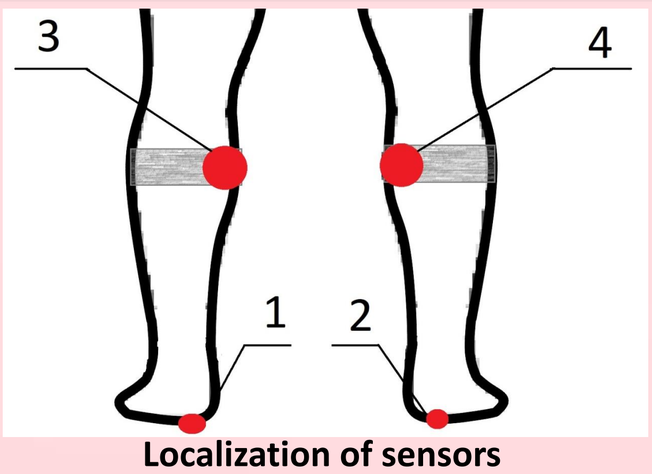
Introduction

2017 year	**More then 425 million people were diagnosed with diabetes**
2045 year	**More then 629 million people would be diagnosed with diabetes**



An example of blood perfusion record by LDF

This work aimed to investigate the parameters characterizing the regulation of the microcirculatory blood flow in normal conditions and their changes in pathology (on the example of diabetes mellitus).



Localization of sensors
(1 - right big toe; 2 - left big toe;
3 - right shin; 4 - left shin)

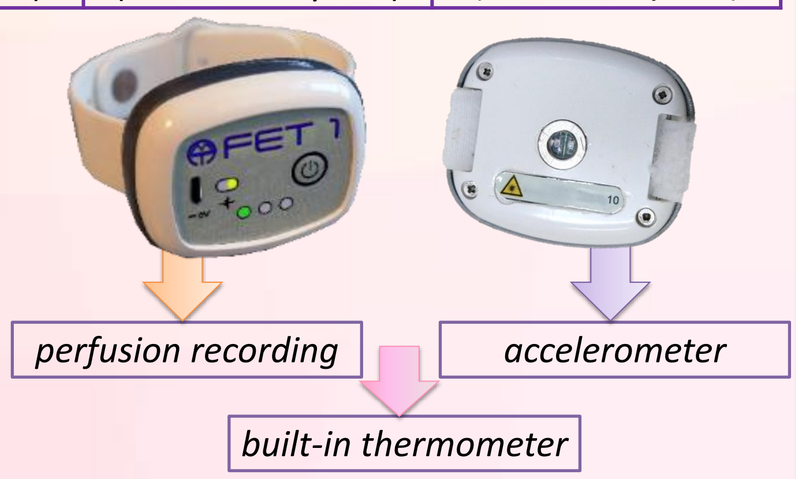
Microcirculation was recorded for **10 minutes**.

The subjects were rested supine; the analyzers were located in the upper third of the inner part of the shin and the back of the thumbs.

Materials and methods

Localization of sensors	Groups of volunteers: Healthy, 1 group	Groups of volunteers: Healthy, 2 group	Groups of volunteers: With type 2 diabetes
Shins	-	**9** volunteers (52.3±10.7 years)	**16** patients (57.2±9.1 years)
Big toes	**17** volunteers (21.7±1.4 years)	**10** volunteers (51.8±14.4 years)	**43** patients (56.6±11.8 years)

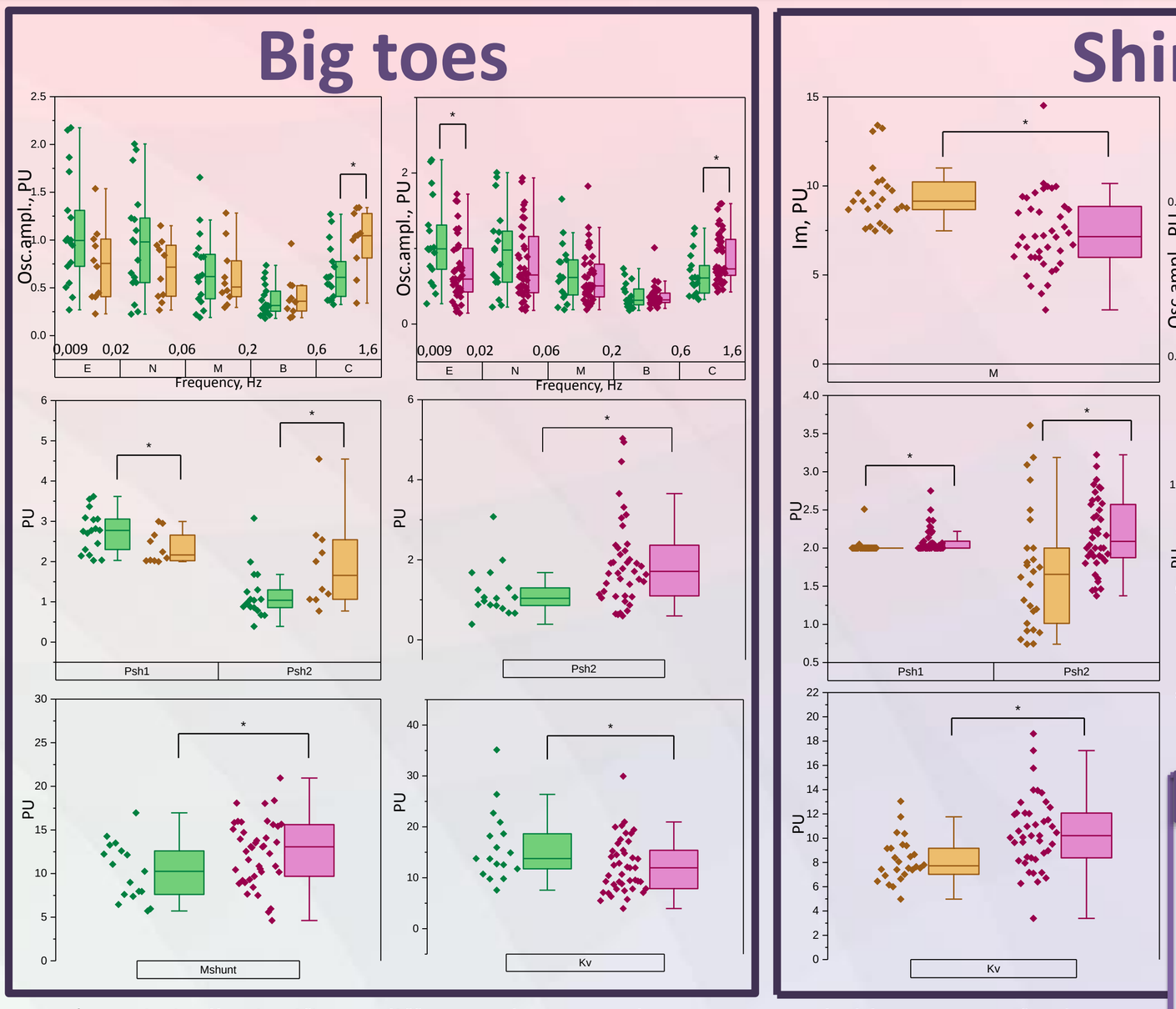
Wearable sensor system for multipoint measurements of blood perfusion



Technical parameters:
Emitter - VCSEL laser
Receiver – 2 photodiodes
λ = 850 nm, P = 1mW

During the study, the following parameters were calculated and analysed:
- average perfusion level;
- amplitudes of blood flow oscillations in the endothelial, neurogenic, myogenic, respiratory and cardiac frequency bands;
- bypass index;
- nutritive and shunt blood flow.

Results and discussion



**-statistically significant difference between the younger and older groups of volunteers (p<0,05 according to the Wilcoxon signed-rank test).*

young healthy volunteers

middle-age healthy volunteers

middle-age patients with type 2 diabetes

A statistically significant difference was found in

A) big toes between:
- **1 group** and **2 group** in:
  - cardiac oscillations;
  - bypass index;
- **1 group** and **patients** in:
  - endothelial and cardiac oscillations;
  - bypass index;
  - nutritive blood flow;
  - variation coefficient.

B) shins between:
- **2 group** and patients in:
  - average perfusion level;
  - endothelial, neurogenic and cardiac oscillations;
  - bypass index;
  - nutritive and shunt blood flow;
  - variation coefficient.

Conclusions

The calculation of the above parameters allows one:
- to assess the state of systems that regulate microcirculatory blood flow;
- to evaluate perfusion in nutritive and shunt paths.

The implemented LDF data processing method has demonstrated a better sensitivity to microcirculatory disorders in diabetes.

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Contact details

Yulia Loktionova

http://www.bmecenter.ru/en