

Assessing Endothelial Dysfunction

Endothelial dysfunction is one of the key events in the development of atherosclerosis and is considered to be one of the first pathological symptoms in disease progression. It has also been proven in patients with type I or type II diabetes, systemic sclerosis, preeclampsia, hypertension, as well as other cardiovascular related diseases.¹

Being an early marker, the possibility to use objective tests to assess endothelial function in different patient groups is of great interest. Early knowledge of endothelial dysfunction may assist in predicting cardiovascular risk and evaluating the outcome of treatment.

Studies have demonstrated that skin blood flow properties correlate well with the general condition of the endothelium.² The skin is an easily accessible organ and provides clinicians with an excellent model for testing endothelial function in everyday work. Laser Doppler is a well established technique for the analysis of the microcirculation.³ Combining this technology with local heating of the skin, or with reactive hyperemia or iontophoresis, further facilitates the interpretation of data.

Local Thermal Hyperemia

Skin blood flow increases as a response to local heating. This increase is thought to be caused by an initial axon reflex mediated vasodilation followed by a sustained plateau phase induced by nitric oxide.^{4,5,6,7} It is well established that endothelial dysfunction is characterized by decreased production or reduced local bioavailability of nitric oxide. Local heating of the skin in patients with suspected endothelial dysfunction and analysis of the plateau phase thus provides a simple and straightforward method to diagnose endothelial dysfunction.

Iontophoresis

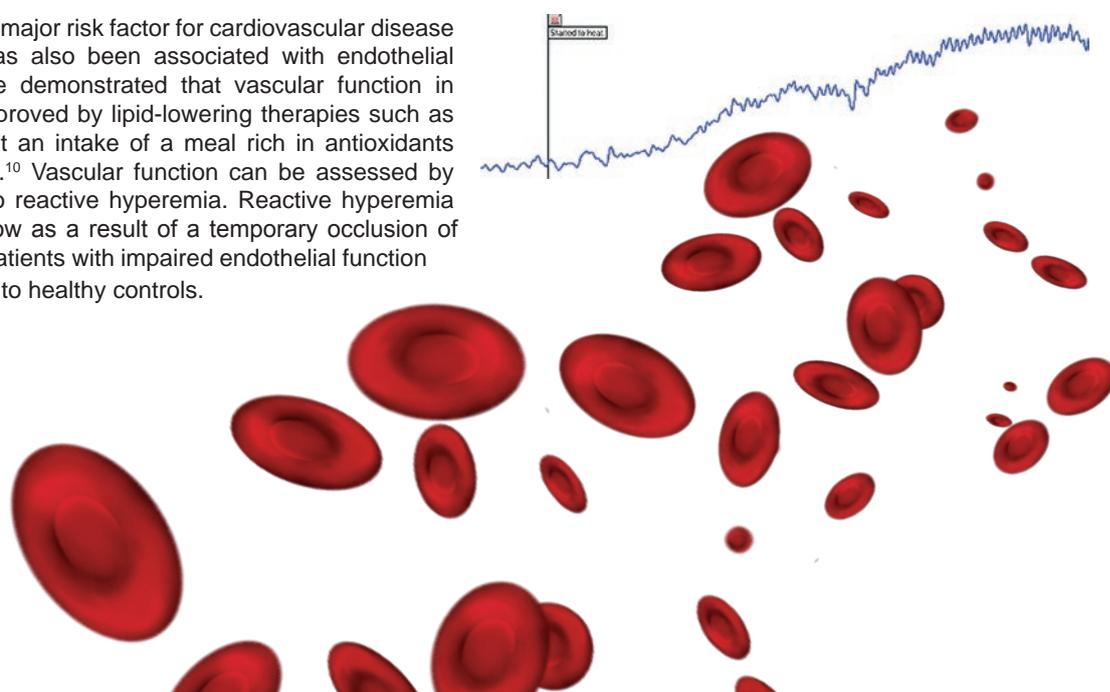
Endothelial function can be evaluated by local administration of vasoactive drugs such as acetyl choline by iontophoresis.

Iontophoresis is a technique that uses an electric current to transport drugs in ionic form across the skin. In combination with laser Doppler, the vascular reaction can be studied by measuring changes in microcirculatory blood flow. There is evidence showing that patients with disturbed endothelial function have a different reaction to substances such as acetyl choline. The exact mechanism for acetyl choline induced vasodilation is unknown, but several studies suggest the involvement of nitric oxide, prostaglandins and derived hyperpolarizing factor.^{4,8,9}

Post-Occlusive Reactive Hyperemia

Hypercholesterolemia is a major risk factor for cardiovascular disease and atherosclerosis. It has also been associated with endothelial dysfunction. Studies have demonstrated that vascular function in these patients may be improved by lipid-lowering therapies such as statins.² Others prove that an intake of a meal rich in antioxidants also has a positive effect.¹⁰ Vascular function can be assessed by observing the response to reactive hyperemia. Reactive hyperemia is an increase in blood flow as a result of a temporary occlusion of an arterial blood supply. Patients with impaired endothelial function show a different response to healthy controls.

The endothelium is the thin layer of cells lining the interior of every vessel in the circulatory system. It plays a central role in blood pressure regulation as well as thermoregulation, blood clotting, inflammation, edema, and control of passage to tissues in and out from blood. Impaired function is characterized by a disturbed endothelium-dependent vasodilation and decreased bioavailability of nitric oxide. Endothelial dysfunction is for example an early feature in patients with hypertension and hypercholesterolemia.



PeriFlux System 5000 offers an **operator-independent, non-invasive** solution for endothelial function assessments in the skin. It is a modular system with **flexibility** in the number and function of channels included. Laser Doppler technology can be combined with a heat unit, transcutaneous oxygen unit and/or pressure unit allowing for a range of different approaches to study the peripheral circulation. To further extend the possibilities, various laser Doppler probes suitable for measurements in different tissues/organs have been designed. The comprehensive PeriSoft for Windows software is used to operate the system and for data analysis.



PeriFlux System 5000 equipped with PF 5010 Laser Doppler Unit, PF 5020 Temp Unit, PF 5040 tcpO₂ and PF 5050 Pressure Unit.

Combining different Function Units and Accessories allows for versatile use

Laser Doppler technology can be combined with a heat unit, transcutaneous oxygen unit and/or pressure unit allowing for a range of different approaches to study the peripheral circulation.

Function Unit			Accessory				Application
PF 5010 <i>Laser Doppler</i>	PF 5020 <i>Heat</i>	PF 5050 <i>Pressure</i>	Probe 407 <i>Basic</i>	Probe 457 <i>Thermostatic</i>	Pressure Accessory Kit <i>cuffs, tubing, pump</i>	Perilont Kit <i>probe, power supply, disposables</i>	
✓	✓			✓			THERMAL HYPEREMIA
✓	✓					✓	IONTOPHORESIS
✓			✓		✓		REACTIVE HYPEREMIA

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Due to Perimed's commitment to continuous improvement of our products, all specifications are subject to change without notice.

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