imedos

TECHNOLOGY FOR VASCULAR HEALTH

Dynamic Vessel Analysis

- non-invasive and contact-free examination – high patient tolerance
- high-precision eye tracking – maximum examination quality
- interdisciplinary use – cardiology, neurology, etc.
- unique access to the endothelial function – Innovation Made in Germany
- unparalleled device system worldwide – ahead of the competition

Dynamic Vessel Analysis

The method of Dynamic Vessel Analysis that is unique in the world enables non-invasive investigation of the functional and autoregulatory mechanisms of the smallest vessels. As an exceptional approach to this microcirculation, vessel analysis on the eye provides essential information on subclinical changes of the entire body. This “mirror image” provides information about the holistic vascular health of patients and allows important conclusions to be drawn about systemic diseases and the development of end organ damage.

To assess these mechanisms, the vessel diameters are measured in a sequence of digital images in real time. During the acquisition of this image sequence, the autoregulatory mechanisms are stimulated and their vascular response is recorded and analysed. The Imedos Dynamic Analyzer uses flicker light as a standard functional diagnostic stimulation to investigate retinal, endothelium-dependent microvascular dysfunction (MVD). The vascular response is mediated by nitric oxide (endothelial NO synthase) and plays a key role among the regulatory mechanisms of autoregulation and in many microcirculatory disorders and vascular diseases of various organs. Dynamic Vessel Analysis is therefore ideally suited for interdisciplinary use in clinical routine as well as for medical research.

Powerful technology – Innovation Made in Germany

Dynamic Vessel Analysis is available as an innovative solution in the form of a basic system that can be expanded with various additional modules depending on the area of application or the scientific issue. The basic system is the Imedos Dynamic Analyzers (IDA) including fundus camera, table, computer, monitor, analysis software & licence dongle.

Optional additional modules:
The research option extends an existing basic system with:

- digital video archiving for the storage and repeated evaluation of the video files of an examination,
- additional measuring points for the simultaneous investigation of up to 10 measuring locations,
- a modified measurement protocol to adapt the standard protocol to specific medical or medical-experimental questions and
- dynamic brightness measurement to investigate pulsation phenomena in the capillary bed.

The external signal unit is required to connect external devices such as ECG monitors or blood pressure monitors to the system.

The server solution enables the connection of different workstations and synchronisation of the corresponding databases.

The evaluation engine offers versatile possibilities for the individual and grouped evaluation of examination data adapted to different medical or medical-experimental questions.

Versatile application options

The various autoregulation or local regulation mechanisms can be investigated selectively by means of targeted stimuli. Some examples of this include:

- Stimulation using a flicker light to study neurovascular coupling and vascular endothelial function
- Stimulation by blood pressure elevation to study myogenic autoregulation (Bayliss effect)
- Stimulation by inhalation of respiratory gases of different compositions, for example 100 percent oxygen, to investigate the contractility of the vascular segments.

Worldwide, Dynamic Vessel Analysis is used in more than 20 countries for various scientific issues in almost all medical disciplines. This resulted in more than 750 publications, which form a broad scientific basis for the method and make it the gold standard in the increasingly important measurement of endothelial function.

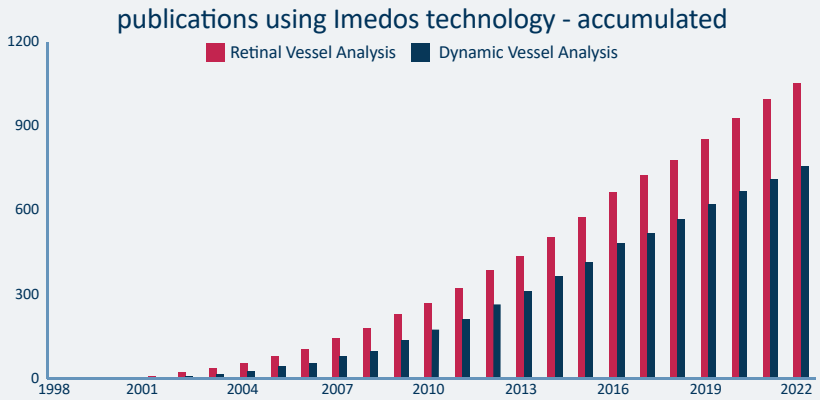

Figure 1: Number of publications on Retinal Vessel Analysis (red) and Dynamic Vessel Analysis (blue).

Examination procedure– standardised functional diagnosis with flicker light

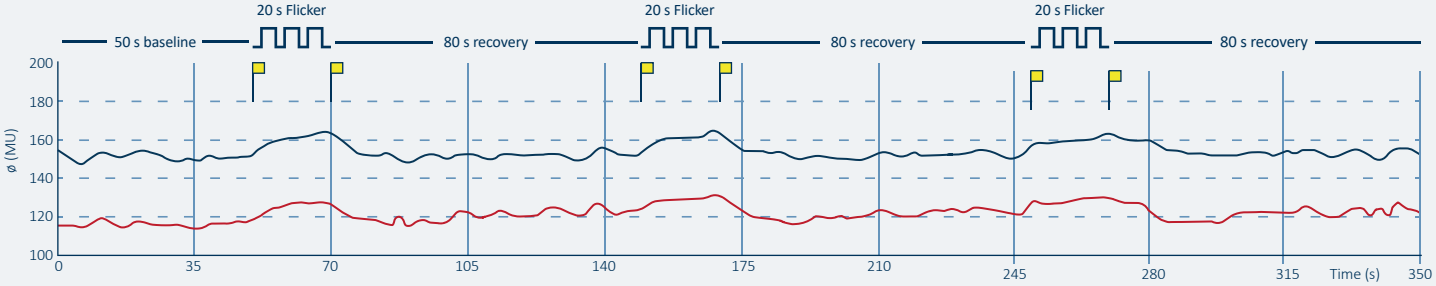

Figure 2: Graphical processing of the examination protocol of a standardised functional diagnosis using flicker light

1. Baseline phase: The baseline state of the retinal vessels is recorded over 50 s in order to subsequently calculate the dilation or constriction of the vessels in percent compared to the baseline.

2. Stimulation or flicker light phase: For functional diagnosis of the MVD, a flicker light is used for 20 s during vessels recording (stimulation phase). The green measuring light is interrupted as the image sequence changes (12.5 Hz) so that a dark image alternates with an illuminated one. The vascular response is recorded continuously and in real time.

3. Recovery phase: The stimulation phase is followed by a recovery phase, stipulated by the protocol, in which the vessel diameter values usually return to the baseline level.

4. Repetition: Phases 2 and 3 are both repeated twice. The monitor displays the vascular response in real time, based on locally calculated mean values, and the images are checked for plausibility and errors.

5. Combination of all phases: The three flicker phases are combined by means of signal averaging. The median values are then calculated and displayed graphically as the examination result, like in Figure 3.

Biomarkers

The Imedos examination protocol is based on a strict standardisation of the evaluation and is limited to the following three vascular parameters:

- Flicker light induced dilation of the artery (FID art): Arterial dilation maximum of the vascular response to flicker light stimulation in % compared to baseline.
- Flicker light induced dilation of the vein (FID ven): Venous dilation maximum of the vascular response to flicker light stimulation in % compared to baseline.
- Flicker light constriction of the artery (FIC art): Arterial constriction maximum of the recovery phase of the vascular response to flicker light stimulation in % compared to baseline.

These vascular parameters characterise the MVD, the function or dysfunction of autoregulation and, at the same time, the autoregulatory reserve.

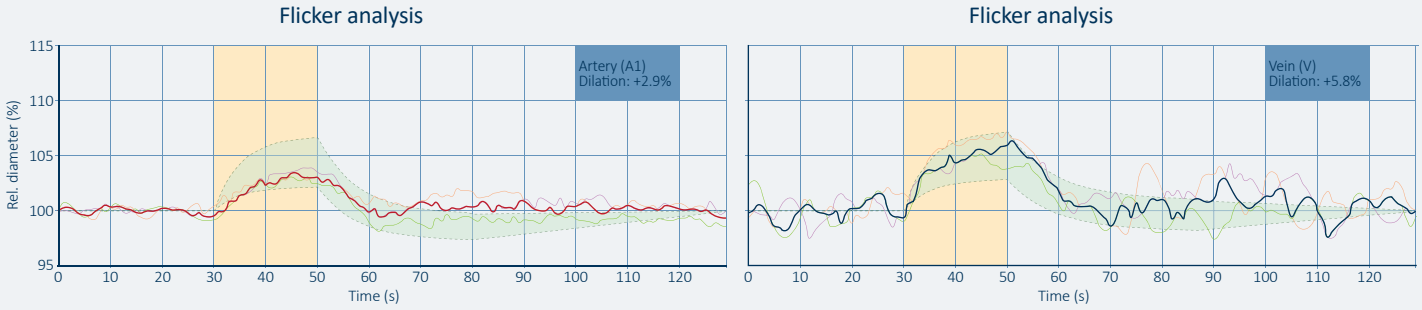

Figure 3: Graphical representation of the calculated median values of all three flicker phases for the artery (left) and vein (right).

The database for Dynamic Vessel Analysis

Vessel diameters are determined segment by segment with a spatial resolution of 10 µm per segment, along the marked vessel section. The measuring resolution is <1 µm. Any image shifts are automatically detected and corrected. For each 10 µm thin segment of a vessel section, this creates the temporal progression of the vessel diameters over the time selected for the examination. The time resolution of the measurements is 25 ms.

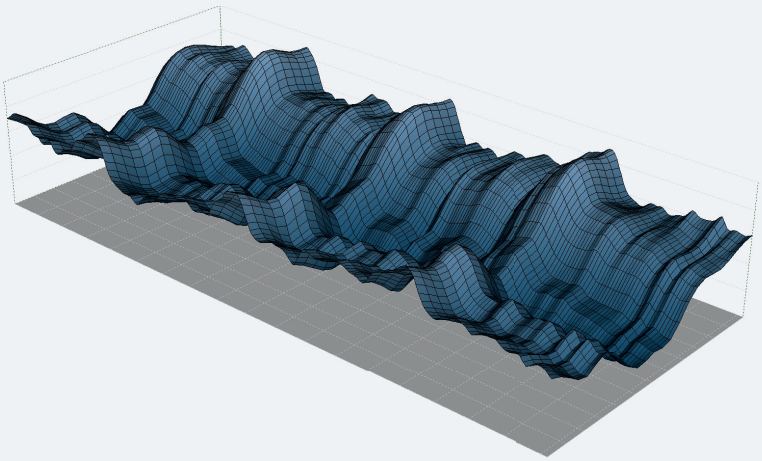

Figure 4: Example of a 3D database with recording of vessel diameters over a period of time

The vessel diameters determined along the vessel as a function of time then form the 3D data basis of the Dynamic Vessel Analysis shown in Figure 4.

Depending on the medical or experimental subject being investigated, the database can be evaluated in different ways, e.g. investigations of the spatial dependence along the vessels (constriction and dilation), pulsation analyses, time progression analyses or functional analyses using stimulations or provocations of the microcirculation.

Technical data – complete system

Instrument table	Height-adjustable from 70 cm - 95 cm
Dimensions/weight of IM-RC 3.0	432 mm x 104 mm x 600 mm 17 kg
Swivel range	± 15° horizontal
Ambient conditions	Temperature: +10 °C to +35 °C Rel. humidity: 30%-75%
Storage conditions	Temperature: -10 °C to +55 °C Rel. humidity: 10%-95%
Accessories	Instrument table with computer unit (including mouse and keyboard), mouse and unit for power supply (BU-17).
Dimensions/weight of instrument table	1225 mm x 610 mm x 646 – 946 mm 85 kg
Permitted load of instrument table	max. 80 kg
Monitor	24 inches

Electrical specifications

IM-RC 3.0	
Power supply	Desktop power supply
Supply voltage	100 – 240 V AC; 47 – 63 Hz; 0.6 A
Electrical power consumption	25 VA max.
Electrical protection class	I
Degree of protection	IP 20
Applied part	Type B

Comfort Workstation WS-C15 instrument table with computer unit and safety module (BU-17)	
Supply voltage	100-130 V / 220-240 V AC; 50/60 Hz
Electrical power consumption	65 VA max.
Electrical protection class	I
Degree of protection	IP20
Applied part	Type B

Optical specifications

Resolution on the retina	
Field of view angle	30°
Magnification	0.44
Refractive error compensation	-15 to +15 D
LED illumination	Red-free
Working distance (front lens to patient eye)	42 mm
Flicker light stimulation	12.5 Hz

Imedos Health GmbH
Tatzendpromenade 2A | 07745 Jena | Germany
+49 3641-63960
info@imedos.com | www.imedos.com

Please feel free to contact us for further information!

Always up-to-date at:

LINKEDIN

Further information can be found at:

WEBSITE

Please feel free to contact us for further information:

CONTACT

We will be happy to answer any questions you may have:

EMAIL