How old are your blood vessels?

The stiffness of the vascular wall increases due to the natural aging process. A lifestyle characterized by cardiovascular **risk factors** (smoking, overweight, stress, diabetes) exposes the vessels to early arteriosclerotic processes which accelerate the stiffening of the vessels. If the **elasticity of the vascular walls** decreases the pulse waves ejected by the heart cannot be dampened sufficiently. They can traverse the vascular tree down to the microcirculation and trigger heart attacks and strokes. This new method can help to diagnose the possibility of such **cardiovascular events** by detecting premature aging of the vessels early on. **Based on a mathematical windkessel model (WKM)** [2] the parameters of arterial stiffness can be determined:

pulse wave velocity (PWV)
central blood pressure (cBP)

With this information a physician is able to diagnose the patient specific cardiovascular condition.

[1] KARAMANOGLU, M.; O'ROURKE, M. F.; AVOLIO, A. P.; KELLY, R. P. (1993): An analysis of the relationship between central aortic and peripheral upper limb pressure waves in man. In: European Heart Journal 14 (2), S. 160–167. DOI: 10.1093/eurheartj/14.2.160.

[2] Hametner, Bernard; Wassertheuer, Siegfried; Kropf, Johannes; Mayer, Christopher; Holzinger, Andreas; Eber, Bernd; Weber, Thomas: Wave refelction quantification based on pressure waveforms alone - methods, comparison, and clinical covariates. In: Computer methods and programs in biomedicine 109 (2013), Nr. 3, S. 250-259

[3] Baulmann, J. 2010. Arterielle Gefäßsteifigkeit und Pulswellenanalyse. Positionspapier zu Grundlagen, Methodik, Beeinflussbarkeit und Ergebnisinterpretation. *DMW,Deutsche Medizinische Wochenschrift* 135, S. 4–14.

[4] Pierre Boutouyrie: Determinants of pulse wave velocity in healthy people and in the presence of cardiovascular risk factors: 'establishing normal and reference values'. In: European Heart Journal 31 (2010), Nr. 19, S. 2338 - 2350. URL http://eurheartj.oxfordjournals.org/content/ehj/31/19/2338.full.pdf - Überprüfungsdatum 2017-05-10

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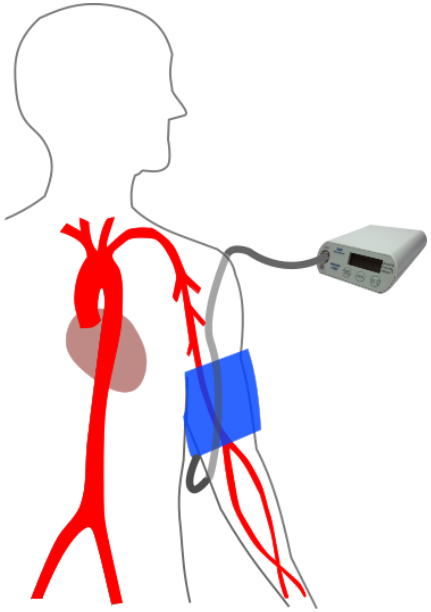
PHYSIO-PORT AS

Determining arterial stiffness and cardiovascular risk



Measurement Procedure

blood pressure measurement at the upper arm

↓

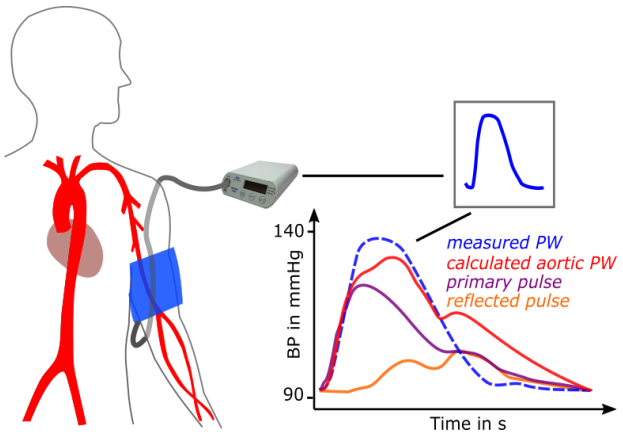
calculation of pulse curve in the aorta

↓

pulse wave analysis for derminining the arterial stiffness

↓

output of the individual risk for outbreak of cardiovascular disease

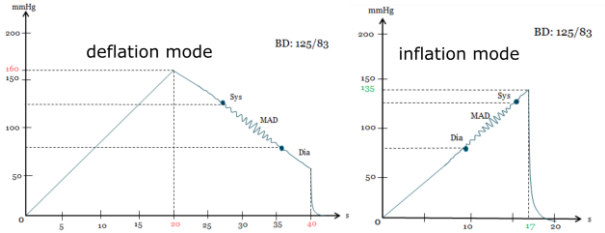


Blood Pressure Measurement

Primarily, PHYSIO-PORT AS is a **non-invasive blood pressure (NIBP) measuring device** for long-term measurements. It relies on the oscillometric method to determine the following BP parameters:

systolic BP (SYS)
diastolic BP (DIA)
heart rate (HR)

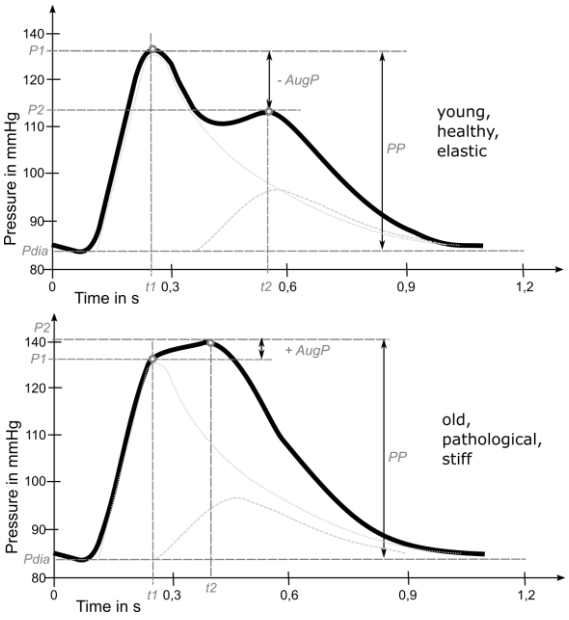
PHYSIO-PORT AS supports the conventional measurement during deflation of the cuff as well as the innovative **Inflation Measurement Technology** which reduces the duration of a single measurement to a minimum. In case of failure of the inflation measurement (e.g. because of artifacts), the device automatically switches to deflation mode to ensure correct measurement results.



In case of a measurement of the arterial stiffness, the cuff pressure is held for 15 seconds after the BP measurement is completed (tourniquet mode). In this timeframe the blood pressure curve is recorded for the following pulse wave analysis.

Analysis of the Pulse Wave

Because of the left ventricular contraction a primary pressure wave propagates through the arterial vascular tree. The velocity of this wave is called **pulse wave velocity (PWV)**. The wave is reflected in the peripheral vessels moves back towards the heart. The higher the arterial stiffness, the higher is the PWV. Because of that the reflected pulse reaches the aorta earlier which changes the shape of the pulse wave and the **central blood Pressure (cBP)**. This leads to a higher pulse pressure (PP) in the arteries and at the same time to an impairment of the heart's oxygen supply. This is characterized by the **augmentation**.



With the aid of the calculated parameters of arterial stiffness and the measured brachial blood pressure the **cardiovascular condition** can be estimated by the physician. [3]