



Methodology fact sheet: Flow-mediated dilation (FMD)

Background

- Endothelial dysfunction plays a pivotal role in the pathogenesis of atherosclerosis and cardiovascular disease.
- FMD is a non-invasive technique to assess endothelial dysfunction.
- Brachial FMD has significant predictive value for future cardiovascular events.

Why measure endothelial dysfunction using FMD?

FMD is a cost-effective, non-invasive method to quantify endothelial function. It is a validated marker for predicting future cardiovascular events: a 1% decrease in FMD correlates with a 13% increased risk of such an event. FMD can be implemented in any trial of an investigational product.

FMD measurements are right for you if you want to quantify endothelial function to determine the impact of your medicinal product on this important prognostic marker for future cardiovascular disease.

What does the endothelium do?

As the blood flow velocity increases, the endothelium (the inner lining of the artery) produces nitric oxide, which relaxes the adjacent muscular layer, leading to dilation. Factors that decrease nitric oxide availability affect endothelial function. They include age, gender, physical activity, smoking, obesity and hypertension.

How does FMD work?

Nitric oxide is released in response to shear stress, which causes the smooth muscle cell of the arterial wall to relax. This in turn leads to arterial dilation, which can be measured via ultrasound.

- Acquisition of dilation data (diameter of the artery at rest and after the induction of hyperemia).

At Profil, the images are obtained with a high-resolution ultrasound scanner with a 12 MHz linear array transducer and analyzed with a Brachial Analyzer 5 from MIA LLC. All measurements are performed by certified FMD sonographers, each of whom has performed at least 100 FMD measurements, in a quiet room that is maintained at $22 \pm 2^\circ\text{C}$ with low light and no direct sunlight.

- Calculation of FMD as the percentage increase in artery diameter during hyperemia.
- Quality control of the measurements

At Profil, each FMD analysis is performed by a certified FMD analyst and checked by another certified FMD analyst. Inter-individual variability is <1%..

Did you know?

Patient anxiety can be a confounding factor in FMD measurements. Familiarizing the subject with the room and conditions can help prevent this anxiety.

Important!

Subjects should not eat or drink, exercise, or consume tobacco or caffeine for at least 12 hours prior to FMD measurement. Also, no vitamin supplements should be taken for 72 hours beforehand.

Other considerations

Female subjects should get FMD measurements during the first week of their menstrual cycle. Vasoactive substances should be discontinued for at least 4 half-lives before measurements.

Advantages of FMD

- FMD is a non-invasive method for measuring endothelial function.
- It's a validated and clinically relevant research tool for investigational product trials.
- It can easily be combined with physicomachanical assessments, such as pulse wave analysis and vascular compliance.

Challenges with FMD

- Standardization at every stage of the process, including in how subjects are prepared, is of the utmost importance to avoid any variability.

Conclusion

- FMD is a validated marker for endothelial dysfunction and future risk of cardiovascular events.
- Standardization of the operational and analytical procedures is crucial for high-quality FMD data.
- Our FMD lab has state-of-the-art instruments, highly trained and certified staff, and standardized methodology for this technique.

Further reading

1. Herbrand, T. 2019. More precise assessment of flow-mediated dilation (FMD) by measuring at maximum dilating peak time (MDP) in subjects with and without type 2 diabetes (T2D). American Diabetes Association.
2. Jax, T., et al. 2017. A randomised, active- and placebo-controlled, three-period crossover trial to investigate short-term effects of the dipeptidyl peptidase-4 inhibitor linagliptin on macro- and microvascular endothelial function in type 2 diabetes. Cardiovasc. Diabetol. 16(1): 13.
3. Herbrand, T. 2018. Flow-mediated vasodilation: why we do it and how to do it. Profil Blog. [profil.com/FMD-blog](https://www.profil.com/FMD-blog)
4. Herbrand, T. 2018. Studying endothelial function in clinical trials. Profil Webinar. [profil.com/FMD-webinar](https://www.profil.com/FMD-webinar)

Profil: the leading CRO for metabolic research
Profil Institut für Stoffwechselforschung GmbH
Hellersbergstr. 9
41460 Neuss (near Düsseldorf)
Germany

Phone: +49 21 31 40 180
Email: contact@profil.com

www.profil.com

