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## Letter to Editor

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# Laser Method can Also be Used for Endothelial Function Assessment in Clinical Practice

We read with great interest the review by Poredos and Jezovnik entitled, "Testing of endothelial function and its clinical relevance"<sup>1)</sup>. Indeed, the study of endothelial function appears to be a very exciting issue because endothelial dysfunction precedes the development of morphological atherosclerotic changes and can also contribute to lesion development and later clinical complications. This review presented the advantages and disadvantages of different methods for assessing endothelial function, such as coronary endothelial testing, flow-mediated vasodilatation (FMD), venous occlusion plethysmography and peripheral arterial tonometry<sup>1)</sup>. These methods allow the study of endothelial function either in conduit arteries or resistance arteries<sup>2-4)</sup>. However, another non-invasive leading method, the laser method, is missing from this review<sup>5)</sup>. In 1975, laser Doppler flowmetry (LDF), which is a non-invasive contact method, was used for the first time to study the microcirculation<sup>6)</sup>. Since then, many authors have considered the skin microvascular circulation representative of the microcirculation of most vascular beds and have studied skin endothelial function using lasers<sup>5, 7)</sup>. Several studies have shown that the measurements obtained with lasers reflect the disease state<sup>5, 7)</sup>. Some authors have studied the relationship between endothelial function assessed by iontophoresis of acetylcholine coupled with LDF and endothelial function assessed by FMD<sup>8)</sup> and have found a strong linear relationship between these two measurements ( $R=0.92$ )<sup>8)</sup>. It is true that LDF, which was developed first, lacks reproducibility to enable its use in clinical practice<sup>7)</sup>. In recent years, a new technology, called laser speckle contrast imaging (LSCI), has been developed, and has considerably improved reproducibility compared to LDF. This improvement of reproducibility was mainly due to the increased region of tissue studied<sup>5, 9-11)</sup>. In brief, LSCI is a non-contact, real-time, non-invasive technology that relies on the speckle phenomenon to obtain a perfusion map of the tissues<sup>12)</sup>. The speckles, which correspond to bright and dark areas, are generated by backscattered light collected on a screen when an optically rough object (tissue) is illuminated with coherent light. Such as for LDF, when LSCI is used in conjunction with provocation tests (acetylcholine iontophoresis or local thermal hyperemia), endothelial function

can be assessed<sup>5)</sup>. Although the endothelium mediators involved in the vasodilatation induced by acetylcholine iontophoresis have been discussed, the late vasodilatation induced by local heating is mainly due to endothelial NO release<sup>5)</sup>. The other elements that strengthen the use of LSCI as a clinical tool for endothelial assessment are: (i) its ease of use, enabling nurses to perform the measurement, (ii) its low cost, the expense of the iontophoresis chamber is about 10 euros per measurement, (iii) the ability to perform measurements when patient moves slightly and (iv) its safety because it is a non-invasive painless measurement<sup>13)</sup>. Therefore, the laser method, especially LSCI, appears to be a promising exciting tool to study endothelial function and dysfunction in clinical practice.

### Conflicts of Interest

Guillaume Mahé, Pierre Abraham and Sylvain Durand declare no conflicts of interest and no financial relationship with a biotechnology manufacturer, a pharmaceutical company, or other commercial entity that has an interest in the subject matter of this letter.

### References

- 1) Poredos P, Jezovnik MK: Testing Endothelial Function and its Clinical Relevance. *J Atheroscler Thromb*, 2012 (in press)
- 2) Stoner L, Sabatier MJ: Use of ultrasound for non-invasive assessment of flow-mediated dilation. *J Atheroscler Thromb*, 2012; 19: 407-421
- 3) Okada S, Hiuge A, Makino H, Nagumo A, Takaki H, Konishi H, Goto Y, Yoshimasa Y, Miyamoto Y: Effect of exercise intervention on endothelial function and incidence of cardiovascular disease in patients with type 2 diabetes. *J Atheroscler Thromb*, 2010; 17: 828-833
- 4) Okumura K, Takahashi R, Taguchi N, Suzuki M, Cheng XW, Numaguchi Y, Ikeda N, Murohara T: Small Low-Density Lipoprotein Cholesterol Concentration is a Determinant of Endothelial Dysfunction by Peripheral Artery Tonometry in Men. *J Atheroscler Thromb*, 2012; 19: 897-903
- 5) Mahe G, Humeau-Heurtier A, Durand S, Leftheriotis G, Abraham P: Assessment of skin microvascular function and dysfunction with laser speckle contrast imaging. *Circ Cardiovasc Imaging*, 2012; 5: 155-163
- 6) Stern MD: In vivo evaluation of microcirculation by

- coherent light scattering. *Nature*, 1975; 254: 56-58
- 7) Cracowski JL, Minson CT, Salvat-Melis M, Halliwill JR: Methodological issues in the assessment of skin microvascular endothelial function in humans. *Trends Pharmacol Sci*, 2006; 27: 503-508
  - 8) Debbabi H, Bonnin P, Ducluzeau PH, Leftheriotis G, Levy BI: Noninvasive assessment of endothelial function in the skin microcirculation. *Am J Hypertens*, 2010; 23: 541-546
  - 9) Mahe G, Durand S, Humeau-Heurtier A, Leftheriotis G, Abraham P: Impact of Experimental Conditions on Non-contact Laser Recordings in Microvascular Studies. *Microcirculation*, 2012; 19: 669-675
  - 10) Rousseau P, Mahe G, Haj-Yassin F, Durand S, Humeau A, Leftheriotis G, Abraham P: Increasing the "region of interest" and "time of interest", both reduce the variability of blood flow measurements using laser speckle contrast imaging. *Microvasc Res*, 2011; 82: 88-91
  - 11) Humeau-Heurtier A, Buard B, Mahe G, Abraham P: Laser speckle contrast imaging of the skin: interest in processing the perfusion data. *Med Biol Eng Comput*, 2012; 50: 103-105
  - 12) Mahe G, Haj-Yassin F, Rousseau P, Humeau A, Durand S, Leftheriotis G, Abraham P: Distance between laser head and skin does not influence skin blood flow values recorded by laser speckle imaging. *Microvasc Res*, 2011; 82: 439-442
  - 13) Mahe G, Rousseau P, Durand S, Bricq S, Leftheriotis G, Abraham P: Laser speckle contrast imaging accurately measures blood flow over moving skin surfaces. *Microvasc Res*, 2011; 81: 183-188

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