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MOTION OF RIGID PARTICLES FLOWING IN A MICROFLUIDIC DEVICE WITH A PRONOUNCED STENOSIS: TRAJECTORIES AND DEFORMATION INDEX

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The study of the blood flow behaviour in stenosis has been extensively investigated [1-3], due to the important role that the fluid dynamics plays in the progress of diseases, such as, arteriosclerosis or infarcts [4]. On the other hand, the motion studies with rigid red blood cells (*r*RBCs) [5] or artificial rigid red blood cells (*ar*RBCs) has also been investigated, due to the important role that plays in clarifying the hydrodynamic characteristics of these cells.
These kind of studies are essential not only as an attempt to understand the blood flow behaviour in microcirculation, but also to develop microfluidic devices, as a clinical alternative methodology to detect blood diseases.
With this premise, we investigated the trajectories and deformation index (DI) of *ar*RBCs along polydimethylsiloxane (PDMS) microchannel device with a pronounced stenosis (75%), using a confocal micro-PIV system at different flow rates (1, 10, 20µl/min).
The working fluid used was a solution of Dextran 40 (Sigma-Aldrich) containing a mixture of 0.5% Polystyrene (PS) latex microsphere (Alfa Aesar, 10 µm), that simulated the abnormal rigid RBCs mixed with 1% Haematocrit (Hct) of healthy ovine RBCs (± 5 µm).
As a result we find a maximum DI of the *ar*RBC in the beginning of the stenosis (sections 2 and 3) when the flow rate was maximum (20µl/min), shown in illustration 1(b). The results for the healthy RBCs were similar, but with a DI four times bigger (data not show).

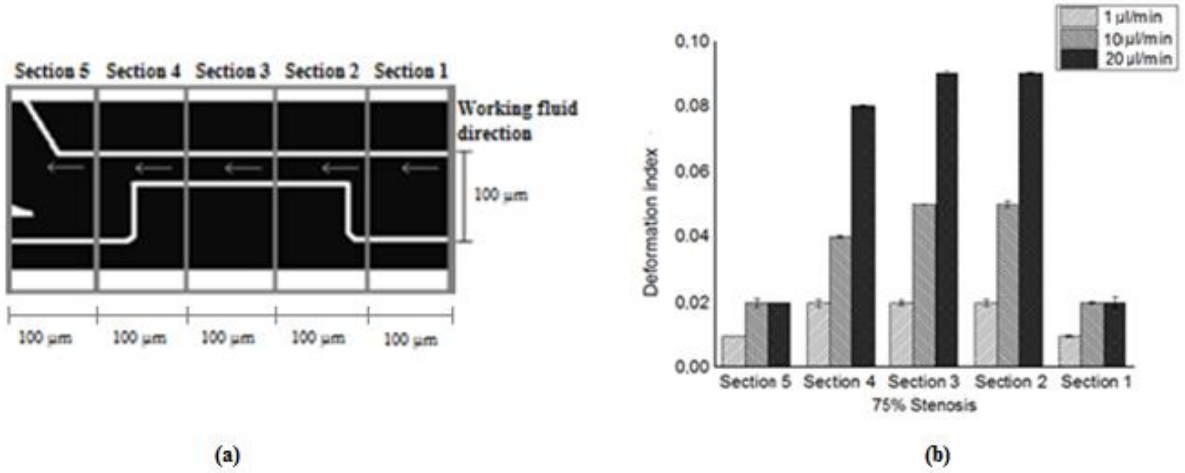

Illustration 1. (a) Scheme of the microchannel stenosis device divided in the five sections, in order to measure the DI. (b) DI of the *ar*RBCs at different flow rates, along the five sections of the microchannel stenosis device. Error bars show a 95% of confidence interval.

Regarding the trajectories, we find that rigid and healthy RBCs have a slightly shift in all flow rates in study (data not show), when compare between them. It was also observed that the flow rate had a more significant influence in the trajectory of cells at the middle position of the microchannel. This motion differences can be extremely important on the development of a microfluidic device to detect early stage blood diseases.

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