Microcirculation of the eye – non-invasive window to the microcirculation in acute and chronic disease

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The microcirculation of the eye offers unique options to study acute and chronic vascular pathologies in living organisms. Different ocular tissue layers such as conjunctiva, iris or retina can be assessed non-invasively. Experimental set-ups, such as intravital microscopy, or clinical devices (e.g. side stream dark field – SDF – imaging) are available to visualize the ocular microvasculature.

With the advent of high resolution, non-invasive intravital microscopy equipment, it is possible to explore dynamic extra-, intra- and inter-cellular processes that cannot be reconstituted in vitro or ex vivo, or when a link between cellular events and tissue pathophysiology is being pursued. This is the case particularly if inflammation is involved since inflammatory changes in the microcirculation, such as margination and rolling as well as transition to adhesion and migration of immune cells can only be visualized by intravital imaging techniques.

Another domain of intravital imaging in the ocular microcirculation is the observation, quantification and diagnostics of functional changes in capillary blood flow. Changes of the blood flow in the smallest vessels of the eye can be an early indicator for acute (e.g. sepsis) or chronic (e.g. arteriosclerosis) systemic pathologies.

In the future, miniaturized hardware and automated video analysis software will facilitate routine use of ocular microcirculatory parameters for microvascular diagnostics and applied studies.