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Structural, ultrastructural and morphometric study of the zebrafish cornea: a model for human corneal diseases?

Domenico Puzzolo[1], Antonio Micali[1], Antonina Pisani[1], Daniele Bruschetta[1], Edward Wylegala[2], Anna Nowinska[2], Domenico Bosco[3], Laura Sancillo[4], Rosa Alba Rana[4], Laura Rania[5], Elisa Postorino[5], Pasquale Aragona[5]

[1] Dipartimento SBIMF, Università di Messina, Messina, Italy - [2] Department of Ophthalmology, District Railway Hospital, Katowice, Poland - [3] IGM, CNR, Chieti, Italy - [4] Department of Medicine and Science of Aging, Università di Chieti, Chieti, Italy - [5] Department of Experimental Medical-Surgical Specialties, Regional Referral Center for the Ocular Surface Diseases, Università di Messina, Messina, Italy

The structural and ultrastructural organization of the ocular surface of Vertebrates is still partial and often controversial. A morphological and morphometric study of the adult zebrafish (*Danio rerio*) cornea was performed to provide a comprehensive description of its layers and to compare its organization to the human cornea [1,2]. The eyes of adult zebrafish were processed for light, transmission and scanning electron microscopy and a morphometric analysis was performed on several morphological parameters. The zebrafish cornea is thinner in its central part, while it is thicker in its periphery. Only four layers are present, as no Descemet membrane can be demonstrated. The epithelium is formed by 5-8 layers of polygonal cells, identified as superficial, intermediate and basal, and provided of an evident peripheral cytoskeleton. The Bowman layer is particularly thin (~ 250 nm) and is placed between the basal cells and the first stromal lamella. The stroma is formed by 26-40 lamellae of collagen fibers, among which only occasional keratocytes are present, generally in the posterior part. The endothelium is formed by a single layer of flat polygonal cells, 1-1.5 μm thick. The morphometric analysis showed mild differences between the central and the peripheral cornea; furthermore, the epithelium/stroma ratio is 0.89, while it is 0.09 in the human cornea. It can be concluded that, even if the general organization of the zebrafish cornea is similar to that of mammals, there are also several significant differences, such as the presence of a very thin Bowman layer, the reduced thickness of the stroma and the absence of the Descemet membrane. Therefore, caution is required when findings obtained from zebrafish as an experimental model are applied to normal or pathological corneas in other species, such as rodents or humans.

References

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