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VAULTING CORNEO-LIMBUS – A SCLERAL LENS BRIDGE TOO FAR?

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The original scleral lenses (SGP), fitted over a hundred years ago, were designed to vault over the cornea and limbus and to land on the conjunctiva over the sclera. Among current SGP practitioners there appears to be a general agreement on the validity of this approach, so the philosophy of the desired SGP fit has not changed in this respect (Figure 1). Yet the SGPs available to practitioners come in sizes typically ranging between 13 and 20 mm in overall diameter. This reality may be interpreted to mean that there is a huge individual variation in the corneo-limbal diameter or that there is a disagreement on what this dimension truly amounts to. The purpose of this article is to establish what it is that we know and what still needs to be determined.

METHODS

Current literature was reviewed and a cadaver eye from a US eye bank was obtained to initiate research on the morphology and the associations of the regional tissues, which are derived from the outer coat and the uvea. Scanning and transmission electron microscopy observations utilized a Gatan 3View instrument. Tissues were prepared using a protocol established in our laboratory.[1]

RESULTS

Current anatomical literature indicated that for corneal dimensions we depend on one source and that the limbus width has only been estimated and not measured (Table 1). Microscopic anatomical assessment suggested that internally the limbus is limited to trabecular meshes and that the apex of the filtration angle recess is peripheral to the limbus (Figure 2). The anterior limitations of the limbus were difficult to establish microscopically because of inherent postmortem epithelial changes.

FIG. 1 OCT image illustrating a scleral gas-permeable lens vaulting without touching the central and peripheral cornea in this field of view. This cornea has a history of radial keratotomy. Published with permission from Dr. Thomas Arnold, Sugarland, Texas.

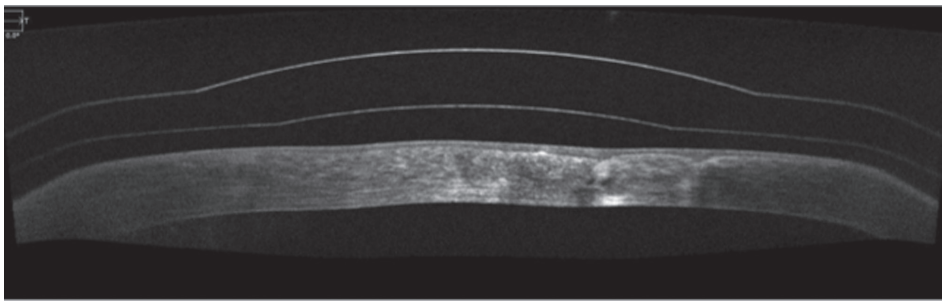

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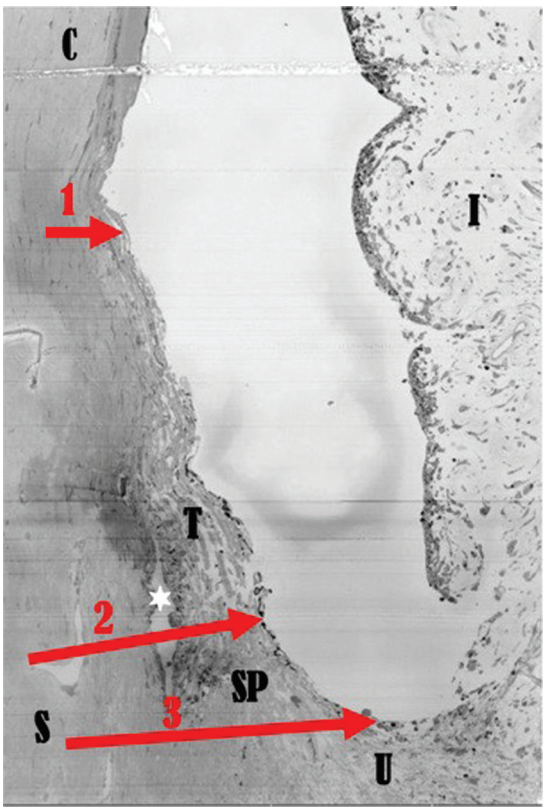
FIG. 2 Angle recess. This view shows the tissues contributing to the filtration angle. Red arrows - 1 indicates the most anterior trabecular meshes and represents the most central region of the posterior limbus; 2 indicates the most peripheral extreme of the trabecular meshes and demarcates the peripheral border of limbus; 3 indicates the angle recess apex and is peripheral to the limbus and is formed by uveal tissue (U). White asterisk indicates the canal of Schlemm; I - iris; C - cornea; T - Trabeculum; S - sclera. Wide field transmission electronmicrograph of a human specimen. Published with permission from Jan Bergmanson; *Clinical Ocular Anatomy and Physiology*, 25th Edition, 2018



DISCUSSION AND CONCLUSIONS

The present study highlighted the antiquity and insufficiency of the information currently available. For corneal dimension we depend on studies conducted a century ago and limbus has yet to be measured. Therefore, the corneo-limbal dimension, over which we need the SGP to vault without contacting the ocular surface, has yet to be accurately determined. Before this determination may be made, it is concluded, the anatomical components of the region must first be defined to establish reference points for such measurements. Ultimately, these morphological reference points may be utilized for clinical *in vivo* measurements.

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TABLE 1 Corneo-Limbal Dimensions According to Current Literature

Reference	Corneal Diameter	Limbal Width
System of Ophthalmology: The Anatomy of the Visual System (Duke-Elder and Wybar, 1961)	11.7 × 10.6 mm	1 mm
Histology of the Human Eye (Hogan and Alvarado, 1971)	11.7 × 10.6 mm	1 mm
Physiology of the Eye: An Introduction to the Vegetative Functions (Fatt and Weissman, 1992)	11.7 × 10.6 mm	not stated
Wolff's Anatomy of the Eye and Orbit (Bron, Tripathi and Tripathi, 1997)	11.7 × 10.6 mm	1.5 × 2 mm
Clinical Anatomy of the Eye (Snell and Lemp, 1998)	11.7 × 10.6 mm	1.5–2.0 mm
The Human Eye: Structure and Function (Oyster, 1999)	11.7 × 10.6 mm	1.5 mm
Biomedical Foundations of Ophthalmology (Smolek and Klyce, 2000)	11.7 × 10.6 mm	not stated
Clinical Anatomy and Physiology of the Visual System (Remington, 2012)	12 × 11 mm	1.5–2 mm
Gray's Anatomy: The Anatomical Basis of Clinical Practice (Douglass and Lawrenson, 2016)	11.7 × 10.6 mm	not stated
Clinical Ocular Anatomy and Physiology (Bergmanson, 2018)	11.7 x 10.6 mm	1 mm
Anatomy of the Eye and Orbit (Freddo and Chaum, 2017)	11.7 × 10.6 mm	1–2 mm

After and updated from Bergmanson, Marinez, Clin Exp Optom, 2017,100, 522-528.

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