

## ABSTRACT

The cornea, the sclera (white of the eye) and the bordering limbus are the main structures that constitute the anterior eye surface. The main aim of this work is to accurately describe the shape of the anterior eye surface, focusing on corneo-scleral limbal demarcation, and study how it changes under certain conditions, such as ageing, accommodation and contact lens wear. The use of novel technology played a key role to achieve this goal. A new commercial non-contact corneo-scleral topographer with the potential of measuring anterior eye topography far beyond the limbus, was characterised, validated and further utilised for data acquisition. This technology was directly transferred to overcome the existing need to characterise the real topographical transition between cornea and sclera, since the corneal diameter parameters routinely used in clinical practice often depend on the subjective criteria of the practitioner, leading to inconsistent results. To solve this problem an accurate method to demarcate the topographical human limbus was developed. The algorithm was successfully validated with artificial surfaces and real eyes. Further, this methodology was utilised on a large pool of data to characterise, for the first time, the mean shape of the topographical human limbus. Mean human limbus resulted to be asymmetrical, since on average the horizontal diameter was larger than the vertical one. Regarding aging of anterior eye surface, no statistically significant difference in limbal shape was found between age groups. However, statistically significant differences were found in scleral shape during accommodation process between young and older subjects exhibiting limited accommodation. In addition, the scleral changes found during accommodation process among young subjects were more noticeable in myopes than in emmetropes. Further, it was found that short term soft contact lens wear alters the shape of the anterior eye surface. Changes were found to be significant particularly in the corneo-scleral limbal radius, which substantially increased as a consequence of contact lens wear.

The work presented in this thesis demonstrated that with new technology, such as corneo-scleral topography, it is possible not only to further develop measuring techniques for anterior eye surface, but also to acquire new knowledge of how the accommodation process and contact lens wear affects the anterior eye. The latter could lead to compromised health of the ocular surface.