How Much Cornea Does a Corneal Topographer Really Measure?

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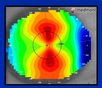
Introduction

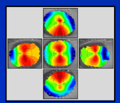
Corneal topography is considered necessary and required instrumentation in the practice of orthokeratology. The typical lens diameter of an orthok lens ranges between 10.5 – 11.0mm, therefore, it would be valuable to have corneal topography coverage to the same diameter for lens construction and post treatment analysis. Previous work has suggested that most topographers capture and analyze a diameter of approximately 8-9mm[1]. However, topography companies publish specifications that suggest their diameter of analysis is >10mm[2,3]. Considering that orthokeratology is primarily fit on children, what is the realistic diameter of topography coverage and analysis? This study set out to better understand the surface area these instruments typically capture in clinical practice.

Methods

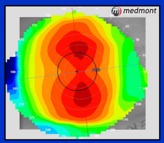
Single Map



This retrospective study reviewed the case files of 148 consecutive orthokeratology patients ordered empirically from Precision/Cardinal GP lens labs in Canada. At the manufacturer's request, the specific period of data collection remains confidential, however it can be assumed to be acquired in early 2020. Inclusion criteria required that all subjects were new orthok patients and imaged using the Medmont E300 Corneal Topographer (Medmont International PTY, Nunawading, Australia). The subjects were separated into two groups based on the user submitted topography capture – "Single" or "Composite". *Single* suggests the subject was imaged using conventional individual topography maps. *Composite* indicates they were imaged using multiple fixations to achieve a larger surface area of capture and analysis[4]. The topographies of 281 eyes on 148 patients were evaluated with the best coverage image used if multiple maps were submitted for each eye. Analysis was performed along the flat and steep meridian at a diameter of 8, 9, 10, 11 & 11.5mm to determine whether actual, and not extrapolated data was acquired.



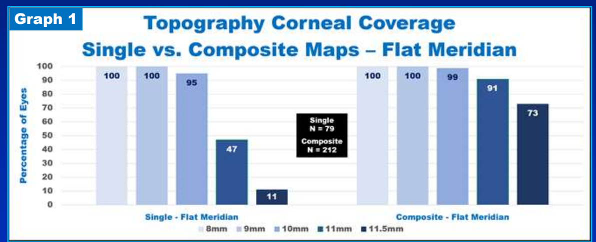
Composite Capture



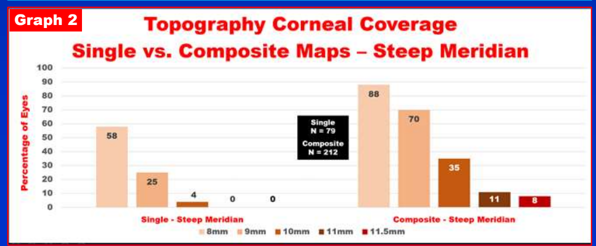
Results

Graph 1 presents the findings for the flat meridian analysis of the Single vs. Composite groups and given as a percentage of positive data captured across each diameter of measure. Graph 2 provides the same analysis across the steep meridian.

Graph 1



Graph 2



Discussion

The findings clearly show the composite mapping outperforms the single map capture in all diameters of measure and on both the flat and steep meridians. However, the data capture along the steep meridian is significantly reduced for both capture methods. 90.8% of patients exhibited a steep corneal cylinder axis between 60 and 120 degrees or a predominance of "with the rule" corneal astigmatism. Lid and eyelash anatomy would be the obvious reason for reduced topography coverage vertically which has been previously reported[4]. Additionally, 81% of subjects were children (≤16 years of age) with steep meridian data at 8mm hindered in 37.9% of kids compared to only 3.7% for adults. This would suggest that children are more challenging to image vertically, likely due to the smaller fissure sizes. A drawback of this study was that topography capture wasn't standardized throughout all submitting clinics. However, these findings are representative of the typical topography maps acquired across a broad cross section of practices.

Conclusion

This study suggests that topography can be captured across the horizontal meridian of the cornea in a high percentage of cases and to a relatively large diameter of coverage. However, the vertical meridian capture area is significantly reduced. In large diameter corneal GP and orthok lens construction, ideal landing and toricity may not be accurately calculated in both meridians for a percentage of cases. Methodology or technology should evolve to improve coverage across the entire corneal surface.

References

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