Pupillary Plus and Spherical Aberration Following Orthokeratology

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Introduction

Research in orthokeratology has suggested that two corneal indices may be predictive of the treatment's efficacy in controlling axial eye growth in children.[1-4]

1. The Myopia Defocus Dosage (MDD) which is the dioptric power shift (increase in plus power) from the central cornea to the pupil margin as measured across a chord of 5.0 mm. The higher the MDD (peripheral plus), the less the axial eye growth.[1,2]
2. The magnitude of spherical aberration (SA) throughout the pupil also shows an inverse relationship in that the higher the post-fitting SA the less the axial eye growth.[3,4]

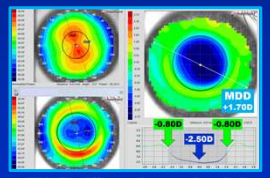
This study set out to determine if there were differences in these indices based on the Rx change created by orthokeratology treatment.

Methods

This retrospective study reviewed case files of orthokeratology patients fit in the BE Retainer lens design (6.0 mm optical zone). Inclusion criteria required that each patient had been successfully fit with a topographical bulls-eye response (Medmont E300 Corneal Topographer) and that the evaluated maps were following full effect (>1 week of consecutive nights of lens wear). Patients with poor baseline or post wear topographies were excluded. 204 eyes were eligible for inclusion in the study. Each eye was categorized based on the apical corneal power (Rx) change when comparing the pre and post wear axial topographies.

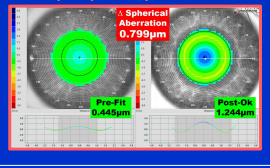
Myopia Defocus Dosage (MDD) was measured by comparing the apical corneal power change to the average power circumferentially at a 5mm pupil.

Spherical Aberration (SA) was measured based on the change in anterior corneal surface wavefront error (Z^0_4).



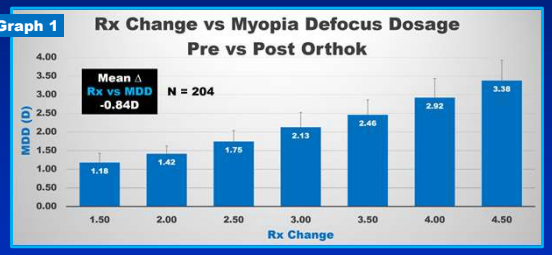
MDD: The difference between the apical orthok effect and the power at a 5mm pupil

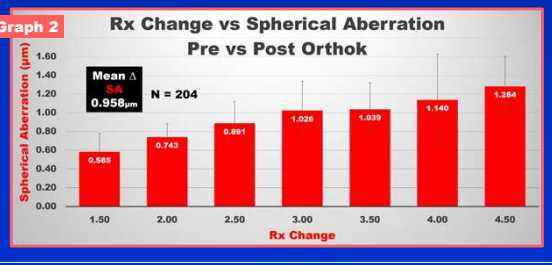
SA: The change in spherical aberration is compared pre-fit vs. post orthok wear



Results

Graph 1 displays the Myopia Defocus Dosage (MDD) relative to a range of Rx changes from -1.50D to -4.50D. Graph 2 presents the Spherical Aberration (SA) for the same range of orthokeratology refractive categories.





Discussion

A positive correlation was found between the magnitude of orthokeratology treatment and the Myopic Defocus Dosage (MDD). The greater the apical power change, the greater the plus power generated throughout the center 5.0 mm of the post-orthokeratology treatment zone.

Similarly, the corneal Spherical Aberration (SA) exhibited a positive correlation with increases in refractive effect. Therefore, as the magnitude of orthokeratology treatment increases, so does the corneal spherical aberration.

If the MDD and SA increase with the refractive change in orthokeratology, does this indicate that low myopes will have reduced myopia control effectiveness relative to higher Rx treatments?

If so, can orthokeratology lens construction be altered to create a stronger myopia control signal across the lower Rx changes?

Can the lens construction be modified to increase MDD and SA for all refractive targets and reduce eye growth even more effectively?

Conclusions

Orthokeratology creates different myopia controlling signals based on the magnitude of the treatment effect. Further study is required to understand if the myopia controlling effect of orthokeratology varies by refractive change. Additionally, research is required to understand if lens design changes can be created to control these signals to improve myopia control outcomes.

References

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