Orthokeratology Treatment Zone Size and its Relationship to High Order Aberrations

Randy Kojima, Steve Turpin, OD, Patrick Caroline, Beth Kinoshita, OD, Matt Lampa, OD, Mark Andre

Pacific University College of Optometry, Forest Grove, Oregon

Introduction

Orthokeratology (OK) treatment is considered one of the principle optical interventions to control axial eye growth in children. The topographical goal in OK is to provide a centered treatment zone. That zone provides both correction of foveal refractive error and peripheral myopic defocus.

However, do all centered treatment zones provide the same degree of myopia control? Recent research has suggested that higher order aberrations may provide the ability to quantify OK treatment efficacy in controlling axial eye growth .[1]

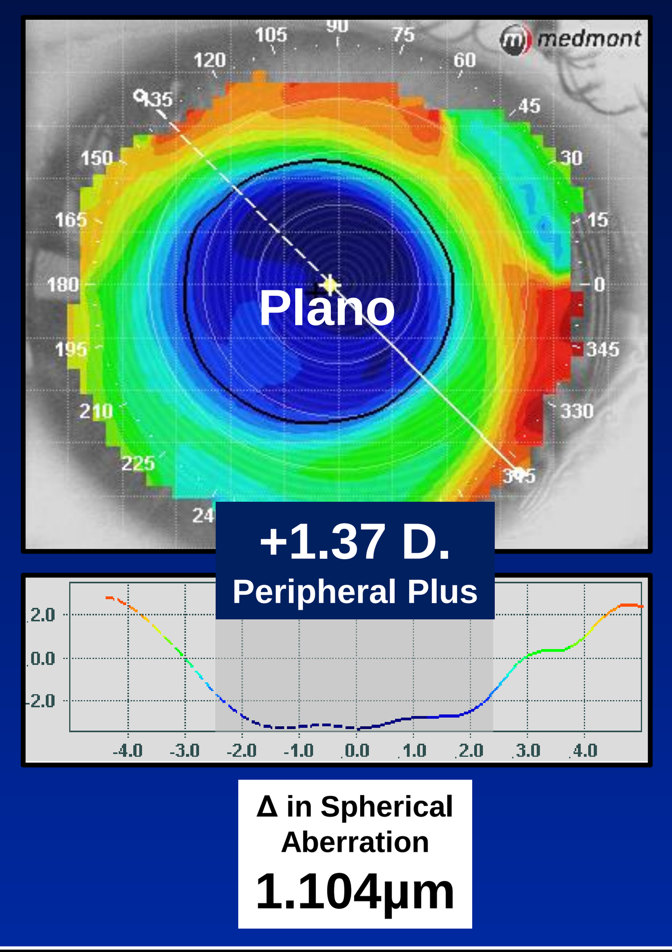
This study will explore the relationship between treatment zone size and its effect on 4th order, corneal spherical aberration in orthokeratology.

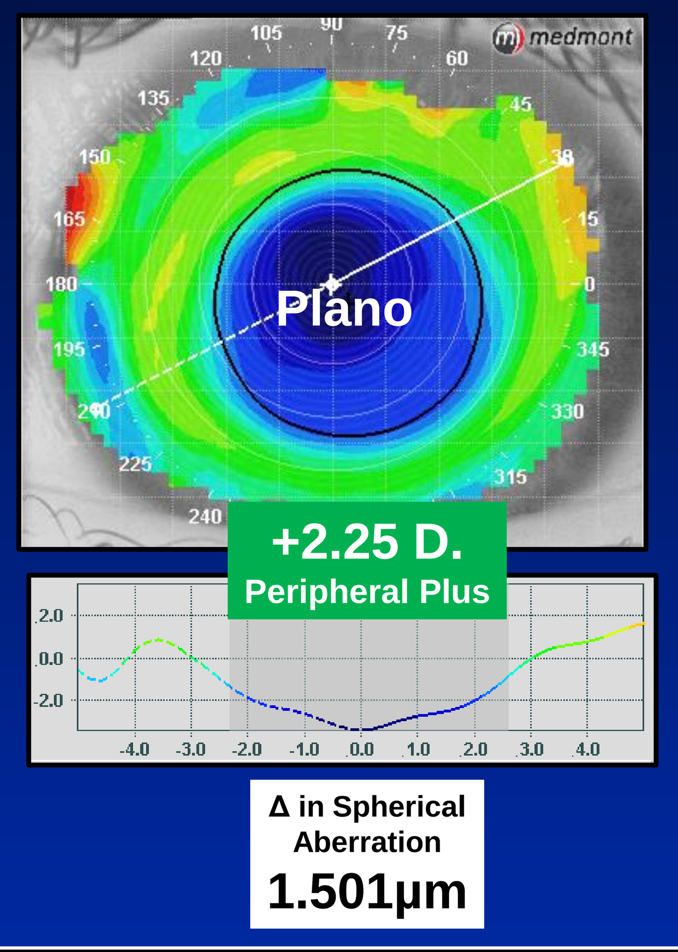
Methods

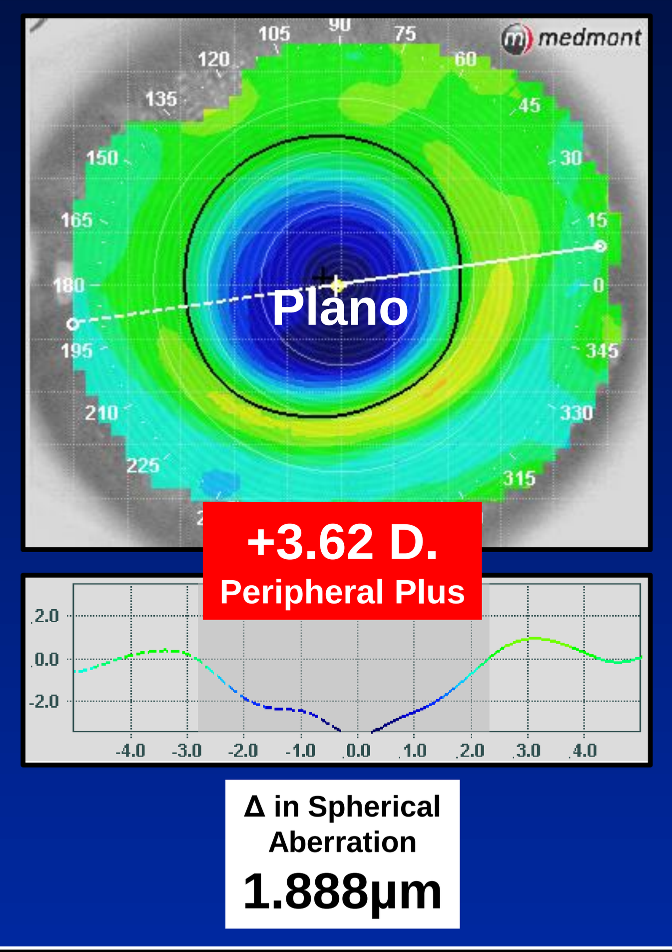
Retrospective data was collected on 40 subjects with a pre fitting Rx of -3.00 D. (±0.25 D.) who had undergone successful overnight OK. All subjects were analyzed using the Medmont E300 Corneal Topographer (Nunawading, Australia) both pre and post treatment. The Rx change at a chord of 5.0 mm was measured along opposing hemi-chords (2.5mm from the visual axis). This measurement was collected from the axial subtractive map along the flat meridian. Additionally, pre and post wear corneal spherical aberration values were recorded from the topographer.

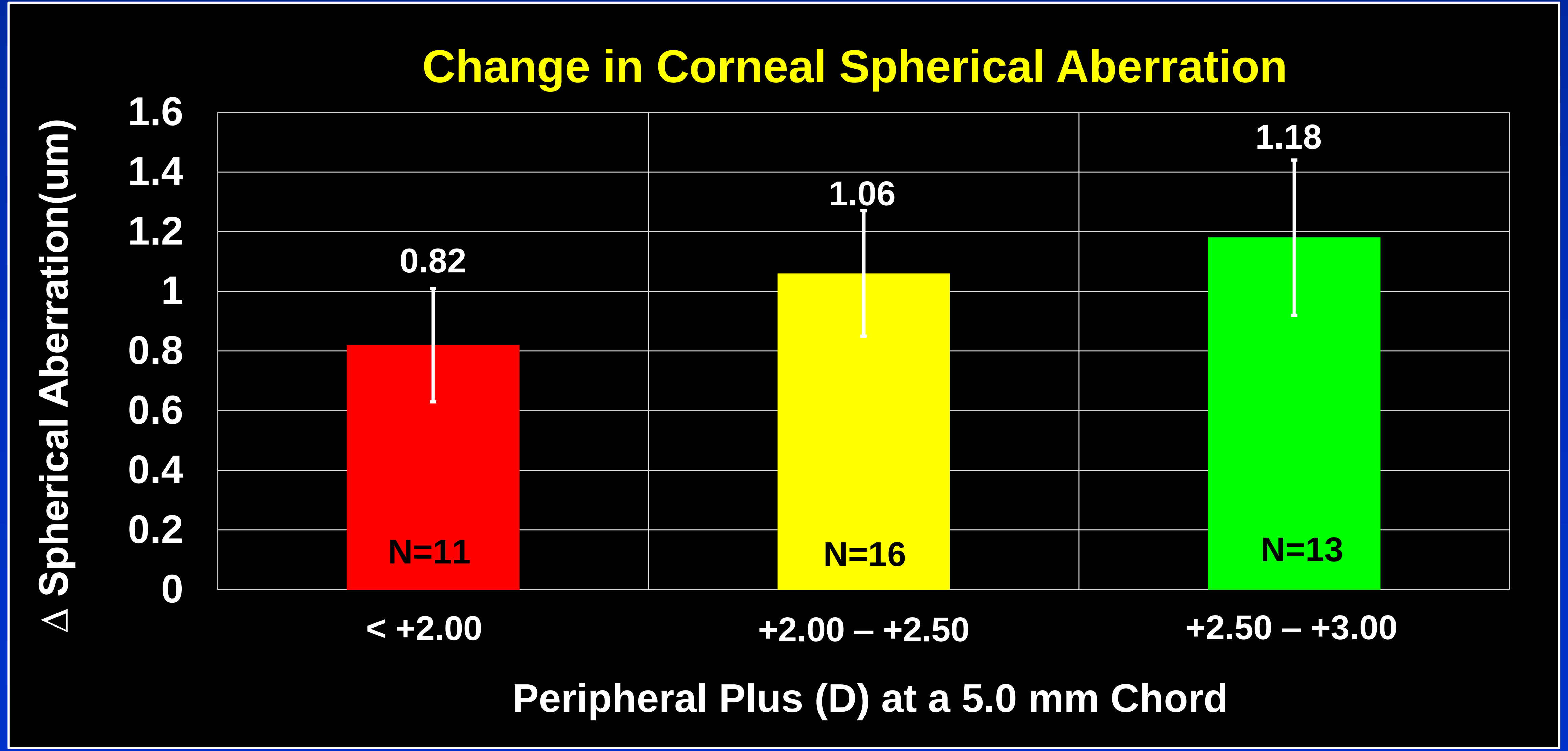
Results

The results suggest that as the treatment zone diameter decreases, the peripheral plus within the 5.0 mm chord increases. This is illustrated in the three images within the middle panel. And, as the peripheral plus increases, the difference in corneal spherical aberration increases as shown in the adjacent graph.









Discussion

This study found an inverse relationship between the size of the treatment zone and the resultant spherical aberration. The smaller the treatment zone, the higher the change in positive spherical aberration. If the hypothesis is correct that, "*higher positive spherical aberration is advantageous in myopia control*" then, theoretically, smaller treatment zones may provide greater myopia controlling effects.

However, a number of important questions remain unanswered:

1. Is axial eye growth directly affected by changes in higher order aberrations, or are there other optical/environmental factors that influence axial eye growth in children?
2. Which higher order aberration(s) potentially influence axial eye growth?
3. If positive corneal spherical aberration affects axial eye growth, what is the minimum value required ? Does that value vary between patients?
4. Is there a corneal spherical aberration value that begins to reduce distant foveal acuity?

It is clear that more answers are needed to better understand the complex optics involved in the myopia control process.

Conclusions

Our study results appear to indicate that practitioners should be aware of the relationship between treatment zone size and peripheral plus/corneal spherical aberration when constructing OK lenses for myopia control.

References

1. Corneal higher-order aberrations induced by overnight orthokeratology
Hiraoka, et al., Amer. Journal of Ophthalmology, March 2005, Volume 139, Issue 3, Pages 429–436