

Anterior Surface Elevation Changes in Orthokeratology

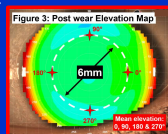
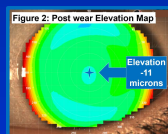
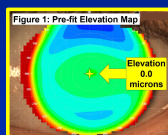
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Introduction

Orthokeratology lenses create topographic changes in corneal shape which can temporarily reduce myopia and create a signal to slow down eye growth in children¹. Research has also been performed to understand the changes in elevation across the central cornea². This study set out to determine if elevation changes across the central treated area are regulated by the magnitude of effect.

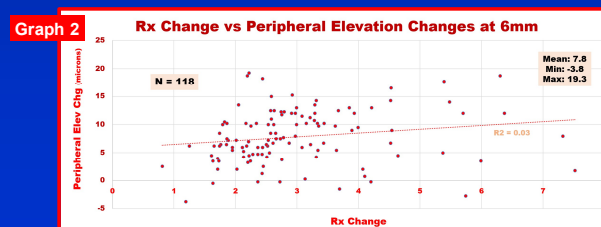
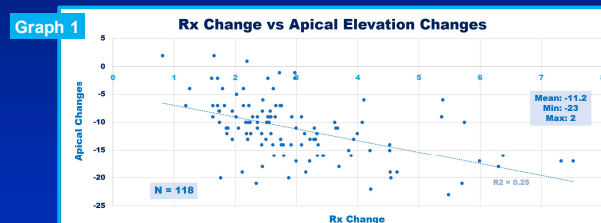
Methods

This retrospective study analyzed the files of consecutive myopic orthok patients achieving a healthy physiologic and visual response after their full effect visit (7+ days). Inclusion criteria required that all patients had quality baseline and post wear maps and a topographical bulls-eye was present (Medmont Topographer). 118 subjects were eligible with right eyes only being analyzed. The elevation display was employed on the baseline map, and if necessary, the "Best Fit Sphere" (BFS) radius was manipulated to target an elevation of zero microns at the corneal apex (Figure 1). The same BFS was used on the post wear map to evaluate changes in elevation at the corneal apex (Figure 2). Additionally, the elevation at 3mm from center was collected at 0, 90, 180 and 270 degrees (Figure 3). This latter analysis was meant to coincide with the mean changes created by the deepest depth of the tear reservoir on a 6mm optical zone diameter orthok lens.



Results

Graph 1 displays the Rx change relative to the elevation changes at the corneal apex (center of topography). Graph 2 presents the Rx change versus the mean peripheral elevation changes at a 6mm diameter.



Discussion

This study exhibited statistically significant changes in elevation at both the corneal apex and at a 6mm diameter ($P < 0.001$). There was a mean reduction in elevation of $11.2 \pm 5.23 \mu\text{m}$ at the corneal apex (Range: +2 to $-23 \mu\text{m}$). At the 6mm diameter, there was a mean increase in elevation of $7.8 \pm 4.74 \mu\text{m}$ (Range: -3.8 to $+19.3 \mu\text{m}$).

However, a tight correlation between the magnitude of Rx change and the elevation at the corneal apex or at a 6mm diameter was not present ($R^2 = 0.25$ and 0.03 respectively).

Previous optical pachymetry studies on this topic found similar mean changes at both measured points². This might suggest the elevation map method used in this study is adequate to analyze the manipulation of tissue. However, these findings failed to show a relationship between the magnitude of treatment and the elevation changes in orthokeratology. Additional research should determine if a link exists between the Rx effect and anterior surface height.

Conclusions

This study supports previous elevation findings both centrally and peripherally following orthokeratology treatment. Further study is required to better understand how the magnitude of effect influences the tissue response.

References

1. Vincent SJ, Cho P, Chan KY, Fadel D, Ghobari-Moghadam R, González-Mejome JM, Johnson L, Kang P, Michaud L, Smeard P, Jones L. CLEAR - Orthokeratology. Cont Lens Anterior Eye. 2021 Apr;44(2):240-269. doi: 10.1016/j.cla.2021.02.003. Epub 2021 Mar 25. PMID: 33775378.
2. Alberti A, Savinelli SA. The effects of overnight orthokeratology lens wear on corneal thickness. Invest Ophthalmol Vis Sci. 2003 Jun;44(6):2518-23. doi: 10.1167/iovs.02-0880. PMID: 12768951.