

Practice Development Educational Series

Orthokeratology and Myopia Management - where are we today?



WELCOME!
THE WEBINAR WILL BEGIN SHORTLY

ORTHOKERATOLOGY AND MYOPIA MANAGEMENT -
WHERE ARE WE TODAY
PRESENTED BY MARIA LIU, OD, PHD, MPH, MBA, FFAO

Orthokeratology & Myopia Management - where are we today?




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UC Berkeley, School of Optometry

Berkeley Optometry

Financial Disclosure

I receive consulting fee from:
Paragon Vision Sciences
Essilor China

No financial interests in products mentioned in the lecture

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Heterogeneous Anti-Myopia Efficacy of OrthoK

Study or Subgroup	Orthokeratology			Control			Weight	Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total			
Charm 2013	0.19	0.21	12	0.51	0.32	16	6.9%	-0.32 [-0.52, -0.12]	
Chen 2013	0.31	0.27	35	0.64	0.31	23	11.1%	-0.33 [-0.49, -0.17]	
Cho 2005	0.29	0.27	35	0.54	0.27	35	16.7%	-0.25 [-0.38, -0.12]	
Cho 2012	0.36	0.24	37	0.63	0.26	41	21.8%	-0.27 [-0.38, -0.16]	
Kakita 2011	0.39	0.27	42	0.61	0.24	50	24.2%	-0.22 [-0.33, -0.11]	
Santodomingo-Rubido 2012	0.47	0.18	29	0.69	0.32	24	13.0%	-0.22 [-0.36, -0.08]	
Walline 2009	0.25	0.22	28	0.57	0.51	28	6.3%	-0.32 [-0.53, -0.11]	
Total (95% CI)			218			217	100.0%	-0.26 [-0.31, -0.21]	

Heterogeneity: $I^2 = 0.00$; $Chi^2 = 2.37$, $df = 6$ ($P = 0.88$); $I^2 = 0\%$
Test for overall effect: $Z = 9.90$ ($P < 0.00001$)

Reasonable consistency but significant individual variability!

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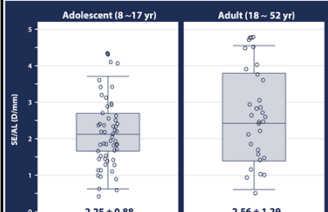
Source of Variance of Effect Size

- Issues in defining anti-myopia efficacy
 - Absolute vs. relative efficacy (nonlinear for baseline AL & stage of myopia)
 - Confounding effects from physiological axial growth
- Complex genetic vs. environmental contributions to myopia etiology
 - Stronger genetic predisposition, less responsive to intervention
- OrthoK-specific challenges
 - Exact mechanisms unclear
 - Treatment lacks specificity (i.e. treatment dosage difficult to measure)

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Confounding from Physiological Ocular Growth

Annual Physiological AL increase
4-8yr: 0.30 ± 0.17 mm (n=243 eyes); 8-12yr: 0.12 ± 0.12 mm (n=404 eyes)



	Hypothetical Dataset		
	AL(mm) Baseline	Post-TM	Change
Physiological	23.00	23.12	0.12
Control	23.00	23.50	0.50
Treatment	23.00	23.25	0.25

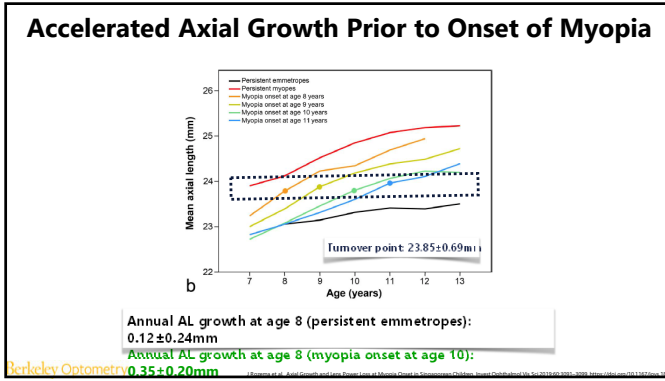
Myopia Control Efficacy
— Without considering physiological AL growth : $\Delta 0.25$ mm; 50%
— After accounting for physiological AL growth : 66%

3D progression/mm axial elongation is NOT TRUE!

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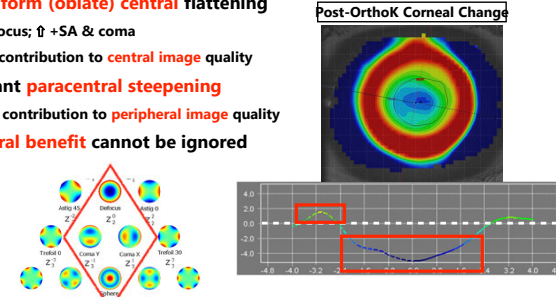
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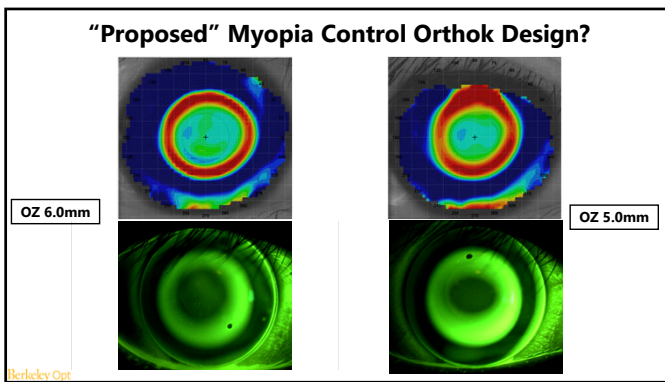


Multifactorial Anti-Myopia Mechanisms of OrthoK

- Non-uniform (oblate) central flattening**
 - \uparrow + defocus; \uparrow +SA & coma
 - Higher contribution to **central image quality**
- Significant paracentral steepening**
 - Higher contribution to **peripheral image quality**
- Behavioral benefit cannot be ignored**

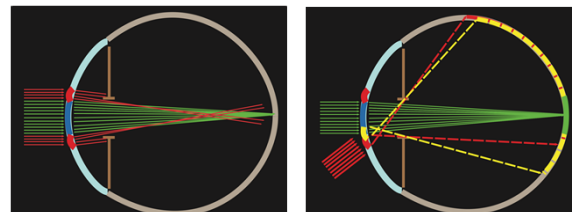


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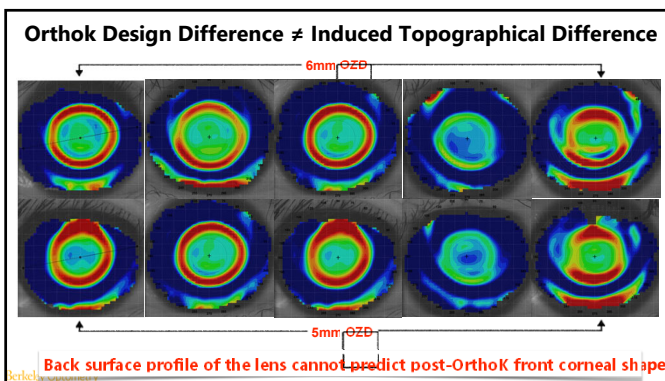
Little Impact of Pupil Size on Peripheral Defocus

- Paraxial rays** : little impact from pupil size, projecting to central retina
- Marginal (peripheral) rays** : large impact from pupil, projecting to central retina
- Oblique rays** : little impact from pupil size, projecting to peripheral retina



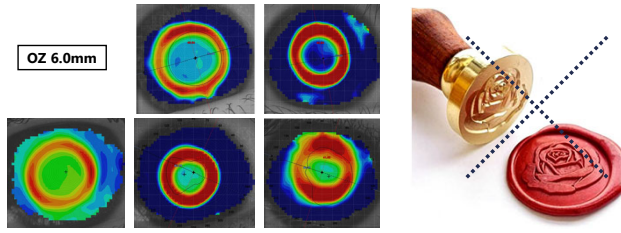
Paracentral Steepening Does NOT need to be inside the pupil to have a significant effect to peripheral

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OrthoK Lacks Treatment Specificity

- Same design induces drastically different post-TM corneal shape



OZ 6.0mm

Within-design difference as important as inter-design difference!

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Baseline Myopia & Controlling Efficacy of OrthoK - Confounding from Age

- The earlier the onset, the more genetic predisposition, less responsive to interventions
- Central flattening vs. paracentral steepening, not necessarily 1:1 relationship

Comparing OrthoK efficacy btw a 6yr -1D vs. a 12yr -4D is meaningless!

Paracentral steepening not a sole property of target corrector, but also highly parameter dependent!

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Post-OrthoK Corneal Shape as Treatment Variable in Myopia Control Studies of OrthoK

- Central flattening**
 - Size of **treatment zone** (not OZ of the lens)
 - Grading of **non-uniform** treatment
 - Quantification of **asphericity** of treatment zone
- Paracentral steepening**
 - Width** (area of + defocus)
 - Magnitude** (amount of + defocus)
 - Location** (eccentricity of + defocus)

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Summary

- Myopia-inhibiting effect subject to significant variability**
 - definition of "anti-myopia" efficacy needs further improvement
 - AL elongation** not only myopia progression- but age-dependent
 - various **response** to treatment
- Myopia-controlling dosage induced by OrthoK**
 - comes from both **central** non-uniform flattening & **paracentral** steepening
 - lacks design-specificity, hence post-treatment **corneal shape** as exposure
- Anti-myopia efficacy independent of baseline myopia**
 - earliest intervention** possible to minimize risk of excessive scleral stretching

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The eye sees only what the mind is prepared to comprehend.

Henri Bergson

Questions?

Specialty Vision Products

Presented by:
Andy Jackson, Director, Specialty Vision Products

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ABB Contact Lens Specialty Vision Products

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- **Optometry Student Challenge – 5th Year**

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[1] J. Z. G. Z. & Z. Z. (2016). Investigation of the Effect of Orthokeratology Lenses on Quality of Life and Behaviors of Children. Contact Lens Association of Ophthalmologists, Inc. 44(5). Retrieved May 16, 2019. [2] Paragon Vision Science, Consumer Survey. Data on File, July 2019.

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