Enhance your SMILE with Orthokeratology: A Case Report on the Use of Orthokeratology to Treat Myopia Regression After SMILE Surgery

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BACKGROUND

Despite recent advancements in laser refractive procedures, including the introduction of small-incision lenticule extraction (SMILE), some post-refractive surgery patients still experience myopic regression over time. While the mechanism of regression following refractive treatment is not fully understood, the process is clearly multifactorial, involving the corneal epithelium and stroma.[1]

Amongst numerous treatment modalities for myopia, orthokeratology (orthoK) is capable of satisfying patients' visual needs with low risk, thereby benefiting the same group of highly motivated potential refractive surgery candidates. OrthoK is a non-surgical, reversible treatment for myopic refractive error which flattens the cornea temporarily using a specially designed reverse-geometry contact lens. Although orthokeratology is primarily fit on adolescents to deter myopia progression and to provide refractive correction, it is proven to correct myopia in both adult and pediatric patient populations. For post-refractive surgery patients who are interested in continued freedom from daytime glasses or contact lenses, orthokeratology is a reasonable alternative to enhancement surgery. Successful management of post-refractive surgery myopic regression with orthokeratology has been reported.[2] This case study explores the visual performance of a post-SMILE patient who was successfully treated with orthokeratology.

CASE

A 24-year-old Asian female presented to the University Eye Center complaining of distance blur OS five years s/p SMILE surgery OU. Pre-SMILE, she successfully wore Paragon CRT® lenses:

	OD	OS
Refraction	-5.25 -0.50 x 180	-5.25 -1.75 x 180
Lens Parameters	9.20 – 525 - 32	9.20 – 550 - 31
BCVA	20/20	20/20

Table 1: Patient's pre-SMILE refraction and orthoK parameters

The patient discontinued contact lens wear, as directed, for six months before proceeding with SMILE OU.

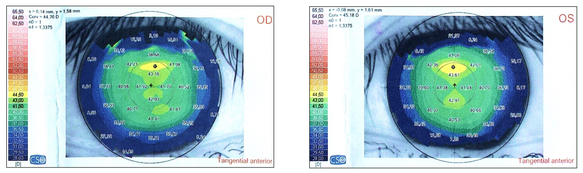

Figure 1: Pre-SMILE tangential topography maps

Post-SMILE Regression

Despite a successful outcome post-operatively (20/20 vision OD, OS), patient's myopia had progressed in the left eye alone over the last two years. Uncorrected visual acuity (UCVA) was 20/20 OD, 20/40 OS and manifest refraction was plano OD and -1.50 sph OS at the time of initial consultation.

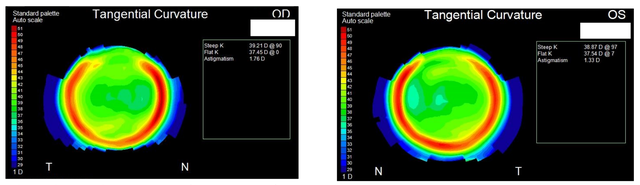

Figure 2: Post-SMILE, pre-orthoK topography maps

Patient was motivated to pursue orthokeratology to address her declining distance acuity OS, as she had worn Paragon CRT® lenses prior to SMILE surgery.

Lens 1 (Initial Lens)

Based on patient's refraction and topography, the following Paragon CRT Dual Axis® lens was ordered empirically upon consultation.

	BC	RZD	LZA	Diameter
Lens 1	9.40	475/550	31	11.0

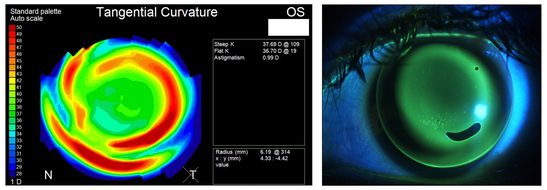

Figure 3: Lens 1, Day 1 topography and slit lamp photo OS

	Day 1
UCVA	20/40
Refraction	-1.00 sph

Table 2: Lens 1, Day 1 refraction OS

Day 1 follow-up of Lens 1 revealed superior temporal decentration, excessive pooling in the RZD and a significant over-refraction. The lens required the following modifications: reducing the RZD and flattening the BCR to decrease the sagittal depth, achieve better centration, and address the lack of treatment.

Lens 2

	BC	RZD	LZA	Diameter
Lens 2	9.60	450/525	31	11.0

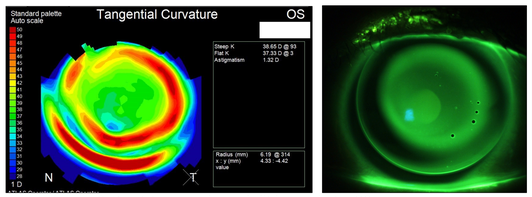

Figure 4: Lens 2, Day 1 topography and slit lamp photo OS

	Day 1	Week 1
UCVA	20/30	$20/25^{+2}$
Refraction	-0.75 sph	pl -0.75 x 90

Table 3: Lens 2, Day 1 and Week 1 refraction OS

While the second lens improved vision significantly, the treatment zone still exhibited superior temporal decentration. Therefore, BC was further flattened and lens diameter increased in an attempt to provide better uncorrected VA and improve lens centration.

Lens 3 (Final Lens)

	BC	RZD	LZA	Diameter
Lens 3	9.70	450/525	31	11.5

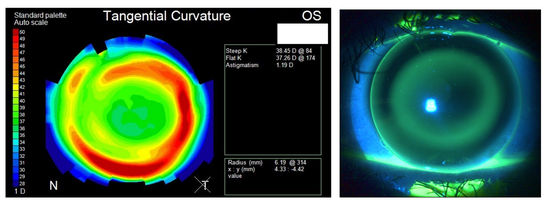

Figure 5: Lens 3, Day 1 topography and slit lamp photo OS

	Day 1	Week 1
UCVA	$20/25^{-2}$	20/20
Refraction	-0.75 sph	plano

Table 4: Lens 3, Day 1 and Week 1 refraction OS

An ideal fluorescein pattern with an adequate and centered treatment zone was achieved with the final lens. Patient was pleased with the level of uncorrected vision and enhanced stability of refractive state throughout the day.

DISCUSSION

Fitting post-refractive surgical patients with orthokeratology can be challenging because of their iatrogenic, oblate corneal shape. In this case, proper centration, fluorescein pattern, and desired myopia reduction were achieved with the customization of a Paragon CRT Dual Axis® lens. This case study also investigated the effect of orthoK treatment on additional factors which may affect visual performance. At each follow up visit of the final lens, patient's contrast sensitivity was assessed with Pelli-Robson contrast sensitivity chart and corneal aberrations were measured on the OPD-Scan III Wavefront Aberrometer.

	Post-SMILE, Pre-OrthoK	Lens 3 (Final lens)	
		Days 1	Week 1
Corneal Spherical Aberration	0.020	0.037	0.056
Corneal Higher Order Aberration	0.109	0.139	0.157
Log Contrast Sensitivity	1.68	1.64	1.60

Table 5: Patient's contrast sensitivity and corneal aberrations

After 1 day and 1 week of final lens wear, an increase in both corneal spherical aberration and higher order aberration were observed, as well as a slight decrease in contrast sensitivity. These progressions are supported by previous research on orthokeratology, which has been shown to induce corneal aberrations causing a decrease in contrast sensitivity function.[3] Changes in these parameters, particularly the increased aberrations and reduced contrast sensitivity, can affect overall visual performance. It is important to note that patients may experience symptoms not only from orthoK treatment but from previous refractive surgery. Pre-SMILE corneal aberrations and contrast sensitivity were not acquired for this case but would have been interesting data for comparison's sake.

Fortunately, our patient maintained superb subjective vision throughout the day. Close follow-up is indicated in post-refractive surgery patients to address possible visual complaints and to monitor the status of their post-surgical cornea. More research is warranted on long-term visual performance of post-refractive surgery patients treated with orthoK, and the role of corneal aberrations and contrast sensitivity in success.

CONCLUSION

It is possible to successfully fit post-SMILE patients with orthokeratology to correct myopia secondary to regression, despite the relatively flat central corneal curvature with respect to the steeper mid-peripheral cornea. This case suggests that overnight orthokeratology is a safe and effective alternative to enhancement surgery.

REFERENCES

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ACKNOWLEDGEMENTS

Special thanks to Paragon Vision Sciences, Inc. for generously providing the lenses for this case study and, in particular, Kelly Voltz, OD, FAAO, for her invaluable advice and guidance throughout the case.