



Deposits on worn orthokeratology contact lenses: a quantitative evaluation of their thickness before and after lens care

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Background/Purpose

Owing to potentially serious consequences, infectious keratitis remains the most concerning complication related to orthokeratology (OK) lens wear. Although there are various possible reasons, poor lens care compliance is considered to be one of the key risk factors for contact lens-related infectious keratitis. An additional complication resides in the complex nature of the reverse-geometry back surface design of OK lenses. Such designs provide an ideal place for deposits to adhere to the lens' back surface, especially along the reverse zone. At GSLS 2019, we reported a quantitative method to assess lens deposition on OK lenses using a novel image analysis software method. In this study, evaluate the thickness of lens deposits on worn OK lenses and the cleaning effect of two contact lens care solutions on the thickness of lens deposits.

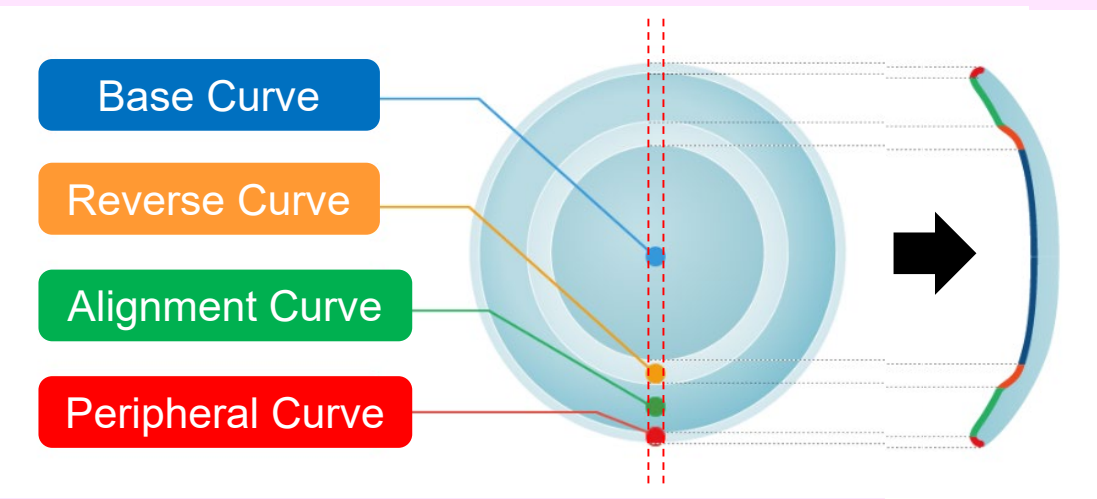
Methods

Experiment 1

- 1) Photographs from three worn orthokeratology lenses (MY Emerald, Technopia, Japan) were taken using a stereoscopic microscope (OLYMPUS, SZX16, Japan).



- 2) The lenses were treated to fix the lens deposits.
3) Subsequently, the lenses were embedded in resin and cut cross-sectionally at two parallel central portions as shown below. The central strip portions of the lenses were observed using scanning electron microscope (SEM) set at a x20,000 magnification and the thicknesses of lens deposits measured at both sides of the reverse curve of the central strip portion.

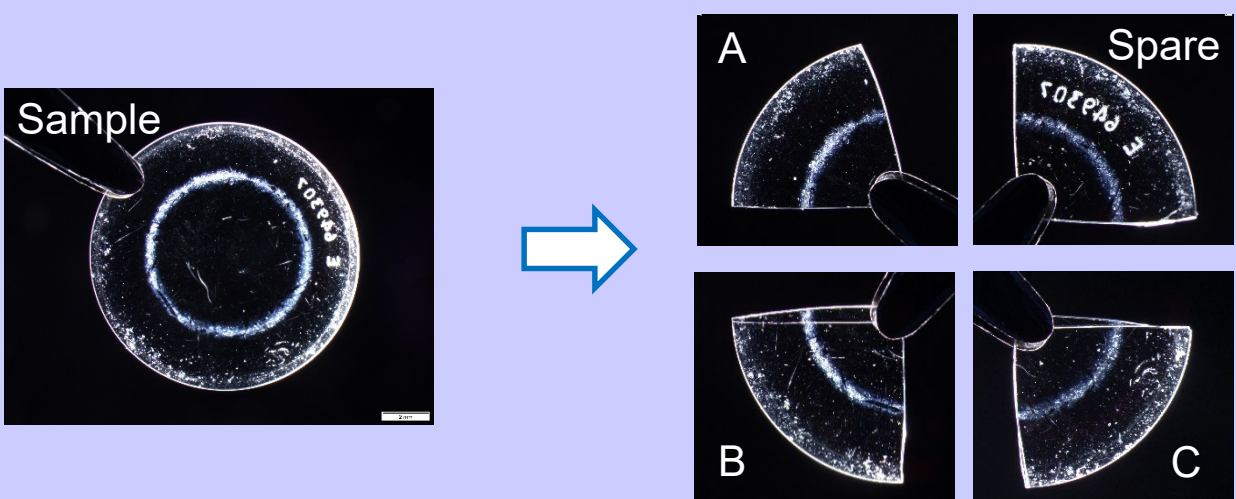


Analysis conditions

- ✓ Acceleration voltage: 10.0 kV
✓ Detector: BED-C (reflection electron images)

Experiment 2

- 1) A fourth worn OK lens with considerable deposits was photographed using a stereoscopic microscope (OLYMPUS, SZX16, Japan).
2) Subsequently, the lens was divided into four pieces and three of them were used for analysis (i.e., A, B and C) as shown below.



- 3) Thickness of lens deposits was measured without cleaning (pre-cleaning), after cleaning with O₂ Care® (Menicon Co., Ltd.) which included a rubbing step (post-daily lens cleaning), and after soaking in Progent® (Menicon Co., Ltd.) (post-intensive cleaning) in samples A, B and C, respectively using the same method as in Experiment 1.



Without Cleaning

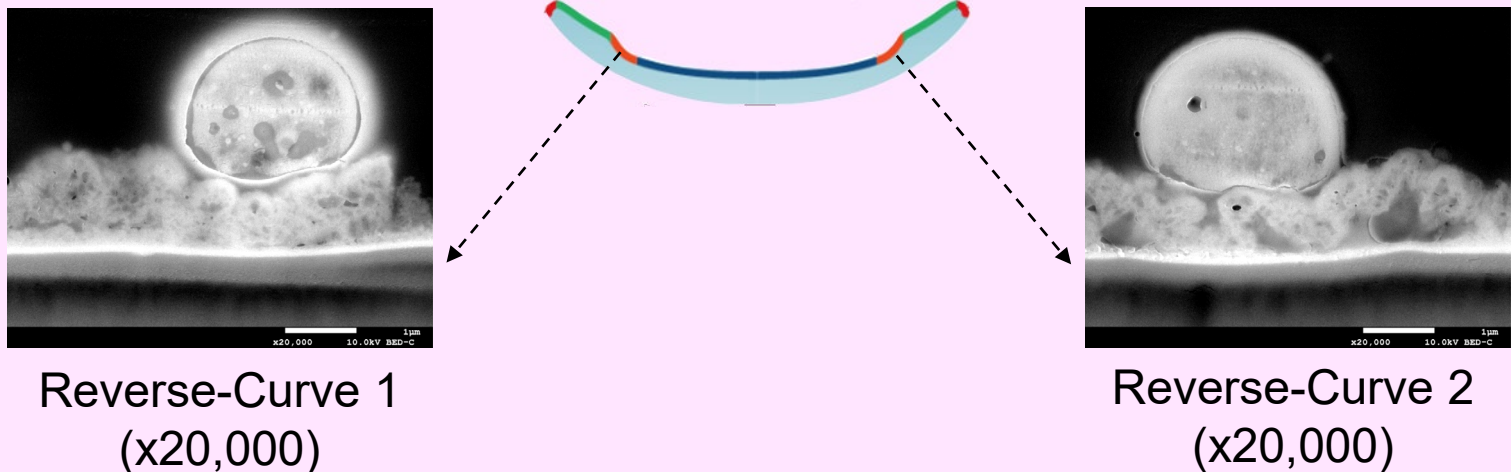
Cleaning with O₂ Care®

Soaking in Progent®

Results

Experiment 1

- ✓ Lens deposits found at the two sides of the reverse curve of Sample 1



- ✓ Thickness of the lens deposits (n=3)

	External Appearance	Reverse Curve 1 (μm)	Reverse Curve 2 (μm)	Mean (μm)	
Sample 1		2.95	3.05	3.00	4.3
Sample 2		4.77	5.54	5.16	
Sample 3		6.22	3.51	4.87	

Discussion

To the best of our knowledge, this is the first study to quantify the thickness of lens deposits on worn OK lenses and the effects of lens cleaners on the thickness of lens deposits. The OK lenses evaluated in this study showed relatively thick lens deposits, which were partially removed with the use of O₂ Care® daily cleaner that included a rubbing step, and were completely cleaned with the use of Progent® intensive cleaner. Successful removal of lens deposits from worn OK lenses is particular importance to reduce the adhesion of *Pseudomonas aeruginosa* to the lens surface of OK lenses^{1,2}, particularly taking into account the latter microorganism has been reported to be the most common causative organism of OK-related infectious keratitis³. As such, adequate patient education on the importance of lens cleaning is critically important for safe OK lens wear.

References

1. Butrus SI, Klotz SA. Contact lens surface deposits increase the adhesion of *Pseudomonas aeruginosa*. *Curr Eye Res*. 1990;9:717-24.
2. Klotz SA, et al. Contact lens wear enhances adherence of *Pseudomonas aeruginosa* and binding of lectins to the cornea. *Cornea*. 1990;9:266-70.
3. Watt K, Swarbrick HA. Microbial keratitis in overnight orthokeratology: review of the first 50 cases. *Eye Contact Lens*. 2005;31:201-8.

Experiment 2

- ✓ External appearance of each sample pre-cleaning and following the two cleaning conditions

	Sample A	Sample B	Sample C
Pre-Cleaning			
Post-Cleaning			

- ✓ Thickness of lens deposits pre-cleaning and following the two cleaning conditions

