Clinical & Refractive Optometry is pleased to present this continuing education (CE) article by Dr. Langis Michaud entitled **A Customized Contact Lens Fit.** In order to obtain a 1-hour Council of Optometric Practitioner Education (COPE) approved CE credit, please refer to page 130 for complete instructions.

A Customized Contact Lens Fit

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Introduction

Frequent replacement and disposable soft contact lenses are currently the most prescribed modalities. Unfortunately, many of the lenses offered on the market are only available in one base curve and one diameter, leaving the practitioner with limited options to fulfill his patients' specific needs. This one-size-fits-all approach is certainly common and profitable for the industry. However, with this approach, either the practitioner or the patient is penalized by the limited range of parameters available.

For any patient showing ocular characteristics off-standards, or with an ametropia exceeding the habitual range of +6.00 to –8.00, there are very few options. Most of the time, the clinician has to rely on customized conventional contact lenses or consider fitting the patient with gas-permeable lenses. If the decision is made to go with customized soft contact lenses, the practitioner should expect some problems along the way: reproducibility/availability; lower Dk/t material penalizing ocular health, and non-compliance by the patient due to the need to adopt a more complicated care regimen, to name a few of them. Although they can be considered a viable option, they do not constitute the optimal solution.

This reality is changing with the upcoming O_2Optix Custom (CIBA Vision) contact lenses. For the first time, a manufacturer is introducing to the market a customized, highly permeable soft disposable contact lens with an expanded range of powers and diameters. This will be welcomed by patients and many practitioners in their daily quest to reach the best — and most suitable — outcomes for their patients.

The following Case Report illustrates a customized contact lens fit with a conventional lens, as the O_2Optix Custom lenses were not available at the time of the patient's visits. The rationale behind the selection of the appropriate base curve and diameter could be easily applied to the selection of any other customized fit. For instance, this method, inspired by the work of Patrick Caroline and Mark André, could be considered a structured basis for the selection process of the appropriate O_2Optix Custom parameters.

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The Caroline-André Method

After a study of more than 200 normal eyes, Caroline and André found that the most important factors defining the relationship between the cornea and the contact lens were the corneal diameter (11.8 mm on average) and the corneal shape factor. They realize that for the same central curvature, the cornea offers a different saggital (sag) value if its visible diameter varies. The larger the cornea, the higher the sag value, and the steeper the ideal contact lens should be. Accordingly, for the same diameter of visible cornea, the sag will be lowered if the central curvature is flatter. Therefore, two patients with the same keratometry (K) readings should be fitted differently according to their respective visible corneal diameters.

Based on these findings, Caroline and André have developed a fitting approach relying on the "effective K." This is not to be confused with the conventional way of defining the base curve of the lens by flattening by 4 diopters the average keratometric values, since the effective K is defined by taking into account not only this averaged central curve, but the diameter of the cornea as well.

The best coverage offered by a contact lens occurs when it exceeds the cornea by 1 mm on every side. When this occurs, the lens is properly draped across the ocular surface and never rocks the corneal limbus, which remains covered in all gazes, all the time. This guarantees the patient's comfort.

In order to design a customized lens base on these principles, Caroline and André propose the following easy step-by-step method of determining the appropriate parameters.

- Step 1: Evaluation of the visible corneal diameter in mm (VCD: white-to-white distance)
- Step 2: Calculation of the average central K in dioptres (AK)
- Step 3: Calculation of the effective K (EK)
  - For each VCD 0.2 mm lower than 11.8, subtract 1.00 D of the AK

Table I Fitting factor for the diameter

Final diameter of the lens (mm)	Fitting Factor (mm)
12.00	0.00
12.50	0.10
13.00	0.30
13.50	0.50
14.00	0.70
14.50	0.90
15.00	1.10
15.50	1.30
16.00	1.50
16.50	1.70

Table II Step-by-step calculation of a customized contact lens

	OD	OS
Step 1: VCD (mm)	13	13
Step 2: AK (D)	42.75	42.50
Step 3: EK	13.0 – 11.8 = 1.2 mm 1.2 / 0.2 = 6	
For a larger cornea than 11.8:	EK (D) = AK + 6 = 48.75 = 6.92 mm	 = 48.50 = 6.96 mm
Step 4: VCD + 2 mm	15 mm	15 mm
Step 5: Optimal base curve compensated with the fit factor (FF) for 15.0 mm lens diameter = EK (mm) + FF	6.92 + 1.10 = 8.02	8.06
Final Order: Base curve	8.00 mm	8.10 mm
Diameter	15.00 mm	15.00 mm

  - For each VCD 0.2 mm higher than 11.8, add 1.00 D to the AK

  Convert diopters in mm for the result
- Step 4: Determine the contact lens diameter that offers optimal coverage of the anterior surface
  - Add 2 mm to the VCD value
- Step 5: Determine the optimal base curve of the lens
  - Apply a fit factor that will compensate for the diameter (Table I)

The following case illustrates this approach.

Subjective

ID is a Caucasian 34-year-old male seen for the first time at the University Clinic for a contact lens fitting. He wishes to wear his lenses 7 days a week, 12 hours per day. He works as an electrician, sometimes in a dusty environment. His visual demands are mostly at near, except when he drives. His case history is unremarkable for his general health, medication, and family background.

Objective

The following results were obtained:

- Manifest refraction: OD –1.50 –0.25 x 30 6/6 (20/20); OS –1.25 –0.50 x 180 6/6 (20/20)

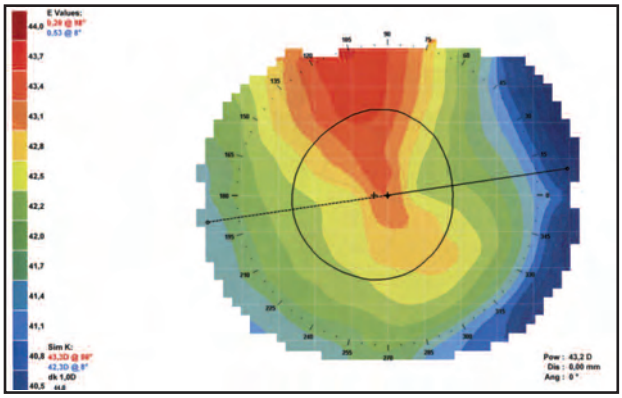

Fig. 1 Topographic map of the right eye showing a slight asymmetric astigmatism

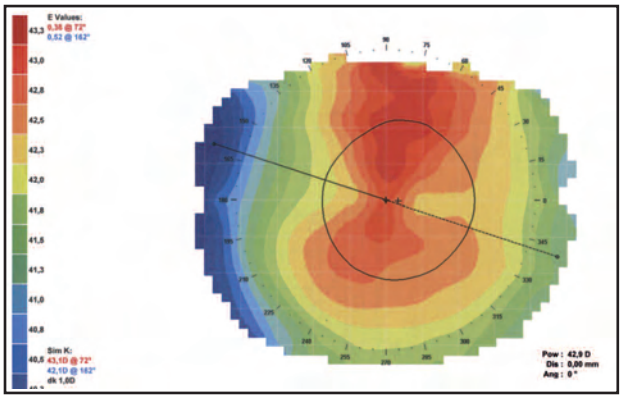

Fig. 2 Topographic map of the left eye showing a regular astigmatic cornea

- Anterior segment: Within normal limits OU except for a 0.2 mm x 0.3 mm subepithelial corneal scar on the left eye, at 1 mm temporal near the limbus
  - VCD: 13 mm OU
  - Pupillary diameter: 7 mm OU
  - Interpalpebral aperture: 10 mm
- Fundus examination: IOP and visual fields were all within normal limits
- Topographic maps:
  - OD (Fig. 1): Slight asymmetry on low toric cornea; Sim Ks: 42.25 x 43.25 @ 98; E values: 0.29 @ 98; 0.53 @ 8
  - OS (Fig. 2): Regular low toric cornea; Sim Ks: 42.00 x 43.00 @ 72; E values: 0.38 @ 72; 0.52 @ 162

Assessment

This patient presents a straight-forward case with no expected challenges: a low myope to be fitted with spherical contact lenses, with good ocular health, and motivated to wear his lenses extensively. Due to the planned wearing schedule, the material selected should offer higher oxygen permeability. Frequent replacement lenses in silicone hydrogel should be considered the first choice to meet these criteria.

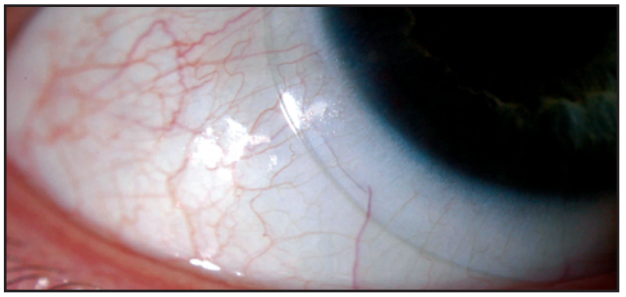

Fig. 3 Photo of the right customized lens. Note the appropriate amount of draping over the corneal diameter allowing more comfort to the patient

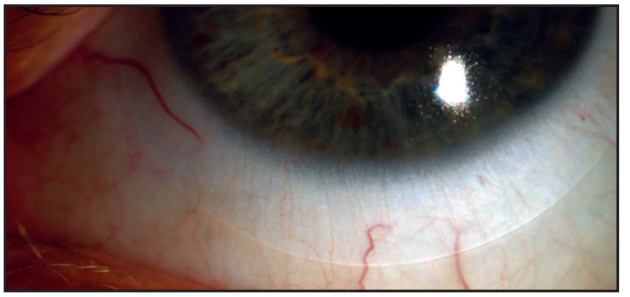

Fig. 4 Photo of the left customized lens. In superior gaze, note the appropriate coverage of the eye surface. A minimal 1-mm draping over the entire cornea helps to give a proper centration to the lens.

Plan

Considering the low toricity of the cornea, we decided to first try contact lenses with higher modulus. We therefore selected a balaficon, a hydrophilic contact lens on the right eye (PureVision, Bausch & Lomb) and lotrafilcon, a soft silicone hydrogel lens (Night & Day, CIBA Vision) on the left eye for the initial fit. Initial parameters derived from the topographic maps were 8.6/14.0 mm OD (the only one available) and 8.4/13.8 mm OS. After 10 minutes of wear, we assessed the lenses and found both of them decentered superiorly, leaving the inferior limbus exposed just after the blink. The lenses were rocking the inferior limbal area when the patient looked up in any direction.

We decided to move to larger lenses. The only frequent replacement larger lenses available were hema lenses. Solus 55a (Solus) with a 14.5-mm diameter and Frequency AS (CooperVision) with a 14.4-mm diameter were tried without positive results. Initial base curves of these lenses were 8.7 mm for the Solus lens and steep curve for the aspheric one. After stabilization, the lenses were evaluated as decentered superiorly and temporally, almost similarly to the previous ones. The limbal area remained covered all the time but the inferior edge of the lens was very near the limbus. The fit was considered border line but the patient was not comfortable with these lenses and did not want to try them any further.

We decided to design a custom-made lens for each eye based on the Caroline-André Method. Our calculations are summarized in Table II. The lenses were ordered from Laboratoires Blanchard (Sherbrooke, Quebec). We selected Benz 55 material, a very resistant but comfortable material, offering very little dehydration through the wearing period. The DK/t value is 20, lower than desired. These lenses are therefore considered as the best compromise available and were ordered with a power of –1.50 D OU.

It might surprise the average practitioner that an 8.0/15.0 mm lens would fit on these corneas. The rationale is normally to select a flatter base curve with a large diameter for a lens. This was not the case here and the final parameters should be understood based on the sag value discussed earlier. The 8.0/15.0 mm represents the lens that closely matches the sag of the patient's cornea and is therefore the best option.

Delivery and Follow-Up

The lenses were delivered two weeks later and the patient felt immediately comfortable with these lenses on. The lenses were evaluated as well centered, with extensive coverage of the ocular surface (Figs. 3, 4). The lenses moved 0.25 mm upon blinking, but the push-up was normal with no resistance noted. This is the expected behaviour for customized lenses. They do not move much and remain very stable in any gaze. Visual acuity was 6/6 (20/20) for each eye.

The patient was instructed in the insertion and removal of the lenses. Sensitive Eyes (Bausch & Lomb) solution with weekly enzymatic treatment was recommended as the care regimen. A follow-up visit was planned 2 weeks later.

The patient was very happy with his lenses. He felt comfortable for the entire day, wearing the lenses for more than 14 hours per day, 7 days a week. Anterior segment examination revealed no adverse effects from the contact lens wear. A few dots of micropunctate staining (Grade 1) were noted on the inferior cornea of each eye. The surface of the lenses began to show slight protein adsorption. The patient admitted to not having done the enzymatic treatment since delivery. We reinforced the importance of the cleaning and planned to see him for follow-up in 6 months.

Conclusion

This case illustrates that patients with off-standard parameters need customized contact lens designs. The Caroline-André Method offers a simple and easy way to determine the appropriate parameters when a customized design is needed. Practitioners should think about a customized design each and every time a fit with frequent or conventional regular lenses is considered sub-standard or border line. This is especially true with the availability of silicone hydrogel frequent replacement custom lenses on the market. ❑