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Opinion *Volume 5 Issue 2*

Specialty Contact Lenses for Extreme Clinical Cases: The Benefits of Free Form Technology

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Opinion

In the clinical practice of every contact lens fitting specialist, there are times when one encounters cases so complex that they call into question the adage, "there is a remedy for everything." Such was the situation I faced in managing a wearer with a history of multiple penetrating keratoplasty, combined with IOL implantation. The case was further complicated by the advanced age of the wearer, who was over 70, and his urgent need to renew his driver's license. Thus, the challenges extended beyond the technical complexities of creating the lens, encompassing broader considerations in the clinical management of the case as a whole. The severe reduction in visual acuity not only compromised the wearer's ability to drive but also had a significant impact on his quality of life and personal autonomy, putting him at risk of further loss of independence.

Clinical Case

Two Eyes, Two Different Challenges.

Left Eye

The initial examination with slit-lamp biomicroscopy and anterior segment OCT immediately highlighted a substantial difference in the condition of the two eyes. The left eye showed the effects of a penetrating keratoplasty, marked by considerable asymmetries both at the corneal level, within a 12 mm diameter, and at the scleral level, with angular and elevational irregularities. Another noteworthy aspect was the significant laxity of the scleral-conjunctival tissue, attributable to the wearer's advanced age, leading to a pronounced predisposition for evident conjunctival prolapses.

Initial Tomographic Analysis: The elevation map (top right in Figure 1) highlights, through the red area, the highest corneal portions, forming a "crescent" of tissue protruding outward. Conversely, in the temporal portion, the map shows blue zones, indicating a drastic reduction in corneal height. It may be helpful to imagine this scenario as a "tiny man" standing atop the red peak, peering down into the depths of a vast ocean. The elevations and depressions, expressed in microns, provide a quantitative representation of the observed condition.

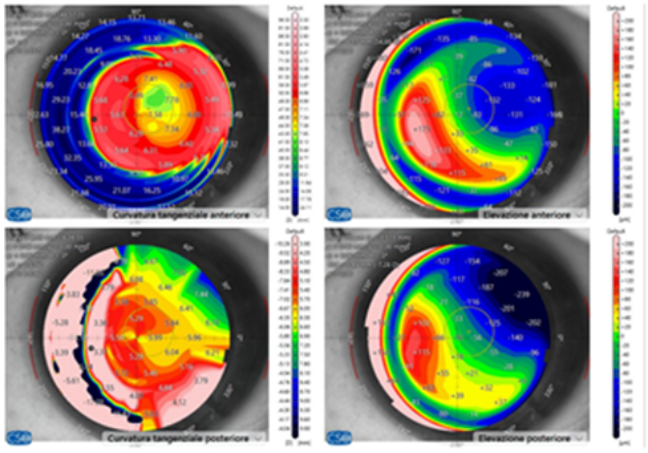


Figure 1: Formation of crescent of tissue in corneal.

Right Eye

In this case as well, the initial biomicroscopy immediately highlighted the severity of the condition (Figure 2). The images reveal significant slopes and an anterior protrusion of the corneal surface. The elevation map shows a red "crescent," corresponding to the most protruding corneal portion. The tangential curvature map (Figure 3), on the other hand, illustrates the curvature distribution, immediately revealing a circular red zone in the center of the cornea, indicative of a particularly steep curvature radius. These data are essential for selecting the lens design to approach this fitting.

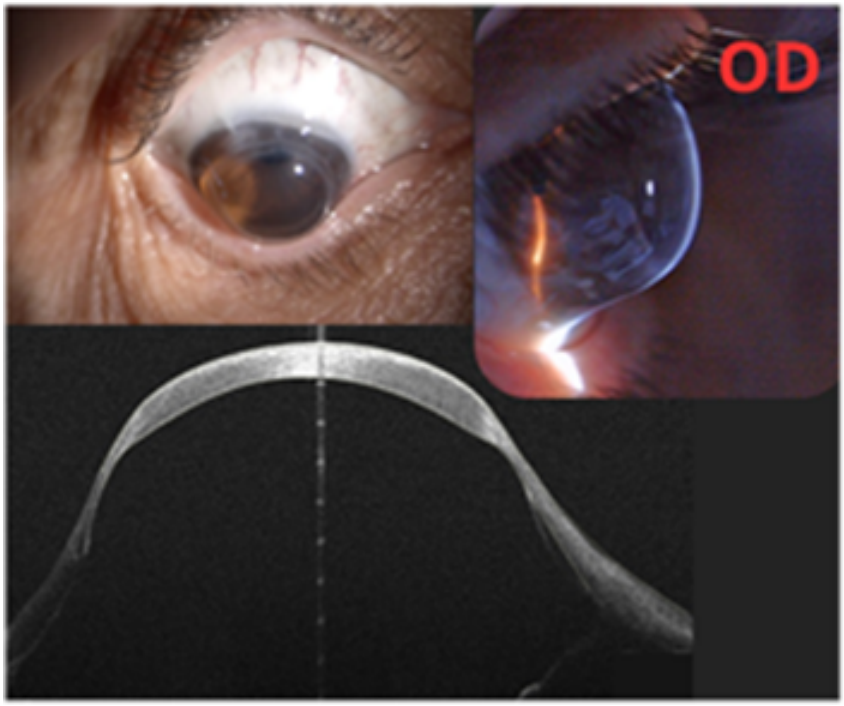


Figure 2: Slopes and an anterior protrusion of the corneal surface.

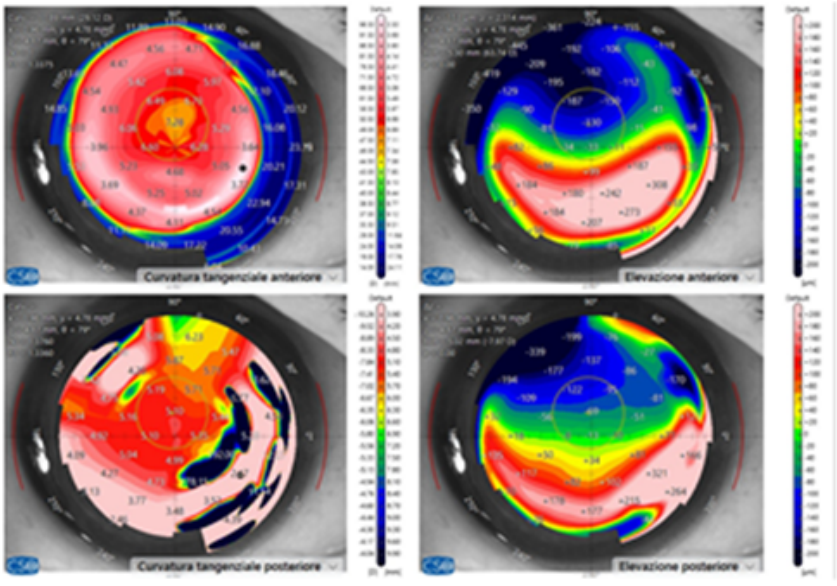


Figure 3: Tangential curvature map.

Scleral Profiles Analysis

Left Eye

The analysis of the scleral morphology, conducted through anterior segment OCT, revealed a high variability both in terms of elevations and in the slope of the peripheral region. For better context, I provided the profile trends of the 8 hemi-meridians in both two-dimensional and three-dimensional environments (Figure 4).

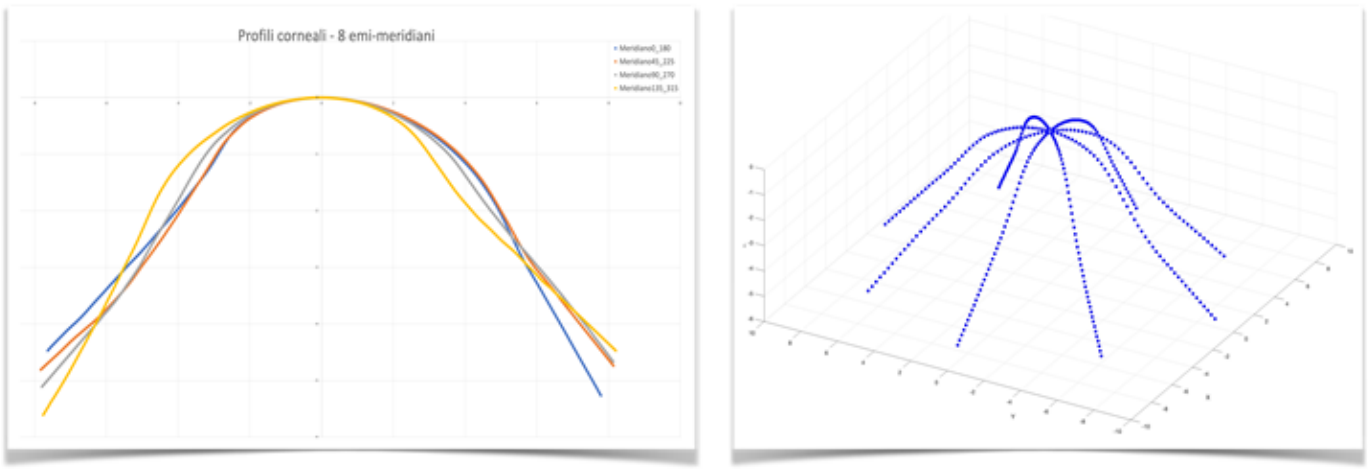


Figure 4: Analysis of the scleral morphology.

Management of the Left Eye (OS): A Solution with Free Form Technology

The first step I usually take when approaching a new case is to apply a standard trial lens, selected from a trial set. In this particular case, I used a 16.00 mm scleral lens with a double peripheral ellipticity and differentiated angular profiles. This choice is driven by the average scleral shape, which generally shows a gradual slope variation, with a steeper inclination toward the temporal region and a flatter one toward the nasal side. However, given the multiple surgeries undergone by the eye, it was predictable that its irregularity would not fall within the parameters of a standard peripheral profile. Nevertheless, I proceeded with the application of the initial test lens to obtain a preliminary assessment.

Limitations of this Choice

As expected, a trial set inspection lens, however optimized, cannot accurately represent the complex profile of an eye that has undergone numerous surgical procedures. The primary limitations encountered were related to variations in scleral slopes and elevations, central asymmetries, and lens misalignment. The accompanying photo (Figure 5) shows the unsatisfactory alignment of the test lens. Nonetheless, this evaluation still revealed a significant improvement in visual acuity, increasing from less than 2/10 to over 10/10, taking into account the necessary over-refractions.

Figure 5: The unsatisfactory alignment of the test lens.

Final Choice

Given the high variability of ocular profiles, I deemed it appropriate to select a customized scleral lens (Figure 6), created using Total Free Form topographic mapping technology. After sending the map to the manufacturing company, I received a custom-designed lens that provided an immediately excellent result. Despite the initial success, I chose to make further adjustments based on my clinical experience to ensure optimal fitting not only in the short term but also over the long run. Specifically, I opted to reduce limbal clearance to enhance lens support and minimize the risk of conjunctival prolapse.

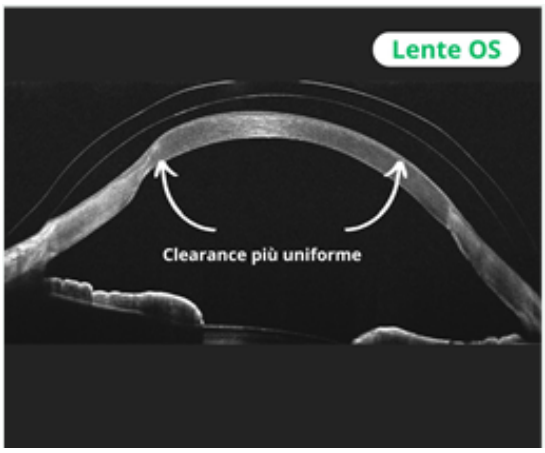
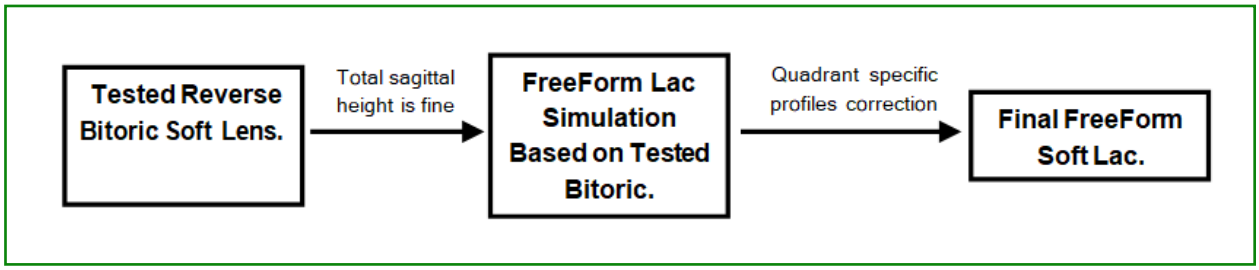


Figure 6: Customized scleral lens.

Management of the Right Eye (RE): A Solution with Free Form Technology

As anticipated, the right eye posed a significant challenge, both structurally and refractively. Due to the high sagittal depth and minimal corneal thickness, a scleral lens was not only unsuitable from a safety perspective but also technically unfeasible. The steep curvatures required for lens adaptation would have prevented the CNC lathe tool from completing the necessary cuts. My initial choice, therefore, was a custom-made, high-permeability silicon hydrogel bitoric reverse lens, designed to be as thin as possible. Once applied, though the sagittal coverage was optimal, issues of visual instability emerged, caused by tear menisci forming beneath the optical zone. These menisci, resulting from pronounced asymmetries in the central and paracentral corneal zones, created variable tear-filled pockets that affected lens flexure and, consequently, the refractive outcome. The solution was identified through a careful OCT profile evaluation with the lens in situ, allowing me to pinpoint the meridians most affected by asymmetry. Based on these insights, I crafted a soft Free Form lens, precisely modeled on the test lens profile. Once the Free Form lens was replicated, I requested specific micrometric adjustments in selected quadrants to eliminate the menisci and ensure stable vision.

The decision-making flow is illustrated in the following diagram:



The final outcome materialized in a soft lens with a sagittal depth of 6550 µm, enabling complete coverage of corneal asymmetries. This eliminated tear-filled gaps beneath the lens and allowed for visual acuity up to two letters at 6/10.

Photos follow (Figures 7,8):

Figure 7: Elevation by using soft bitoro and FreeForm soft.

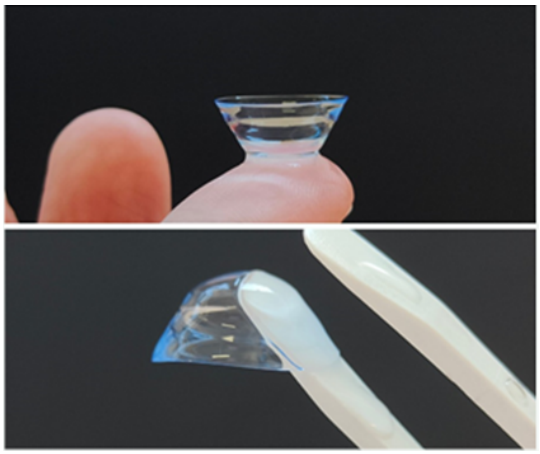


Figure 8: Determining impact of the solution.

The Determining Impact of the Solution

The solution implemented had an extraordinary impact on the life of the wearer, a 72-year-old man who started with a severely compromised vision, with an acuity of less than 1/10. Thanks to the application of the lenses, his binocular vision improved to 11/10, a result that significantly enhanced his quality of life. This change restored his ability to perform daily activities that had previously been out of reach, such as taking his grandson to school and, most importantly, renewing his driving license, thus regaining his independence. The wearer's emotion, deeply grateful for the outcome, was palpable and underscored how this intervention truly transformed his life. This case offers us an important reflection on the value of our work: similar situations remind us that every hour spent managing complex cases can lead to life-changing results for individuals with severe visual impairments. Certainly, we often encounter extreme cases that require a considerable investment of time, but it is crucial to ask ourselves: what impact will the hours dedicated to these cases have on the lives of those who rely on our expertise? The answer to this question is clear and should serve as the driving force behind our dedication, motivating us to give our best in everyday practice.

Free Form: Modern Technology, but How Should We Interpret It?

This term refers to the geometry of a contact lens whose design is based on data obtained from an acquisition tool. It is the anatomical shape of the eye itself that precisely defines how the lens should behave at various points. This is a modern, high-tech approach that translates into a powerful tool for the application of contact lenses. It allows us to obtain a lens that, even in its initial version, closely resembles the final product, with critical areas properly managed.

However, this should not turn into a "leap of faith." The experienced contact lens fitter has always been, and will continue to be, the highest form of intelligence for problem-solving, thanks to their experience, ability to foresee, observe, and adapt solutions. The combination of exceptionally advanced technology and experience, along with clinical observation, enables us today to produce solutions with a level of success never before imagined. The true power of this combination lies in the opportunity to profoundly transform the lives of wearers who trust us. Fully utilizing these resources is our responsibility, and it is what allows us to make a significant change in the daily lives of those who seek our expertise.