National Academy of Opticianry

Continuing Education Course

Approved by the American Board of Opticianry

Some Fundamentals for Corneal GP Fitting

National Academy of Opticianry
8401 Corporate Drive #605
Landover, MD 20785
800-229-4828 phone
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National Academy of Opticianry

PREFACE:

This continuing education course was prepared under the auspices of the National Academy of Opticianry and is designed to be convenient, cost effective and practical for the Optician.

The skills and knowledge required to practice the profession of Opticianry will continue to change in the future as advances in technology are applied to the eye care specialty. Higher rates of obsolescence will result in an increased tempo of change as well as knowledge to meet these changes. The National Academy of Opticianry recognizes the need to provide a Continuing Education Program for all Opticians. This course has been developed as a part of the overall program to enable Opticians to develop and improve their technical knowledge and skills in their chosen profession.

The National Academy of Opticianry

INSTRUCTIONS:

Read and study the material. After you feel that you understand the material thoroughly take the test following the instructions given at the beginning of the test. Upon completion of the test, mail the answer sheet to the National Academy of Opticianry, 8401 Corporate Drive, Suite 605, Landover, Maryland 20785 or fax it to 301-577-3880. Be sure you complete the evaluation form on the answer sheet. Please allow two weeks for the grading and a reply.

CREDITS:

The National Contact Lens Society has approved this course for one (1) Continuing Education Credit toward certification renewal. To earn this credit, you must achieve a grade of 80% or higher on the test. The Academy will notify all test takers of their score and mail the credit certificate to those who pass. You must mail the appropriate section of the credit certificate to the ABO and/or your state licensing board to renew your certification/licensure. One portion is to be retained for your records.

AUTHOR:

James Slightom ABOM, FCLSA, FNAO

COURSE LEVEL:

Technical, Intermediate

COURSE DESCRIPTION:

This course will cover some of the fundamentals for fitting corneal GP contact lenses that will be most useful to the fitter and beneficial to the patient being fit. The benefits and features of large diameter GP lenses versus small diameter GP lenses will be presented and discussed. Some particular design features that are useful for fitting highly astigmatic needs and irregular corneal needs will also be covered. The piggyback fitting modality for fitting irregular corneas will be covered.

LEARNING OBJECTIVES/OUTCOME:

At the completion of this course the participant should be able to:

- Describe the benefits of fitting large diameter GP lenses vs. small diameter GP lenses
- Explain what reverse geometry lenses are
- Describe the benefits of reverse geometry lenses
- Calculate the base curves and powers of a bitoric lens
- Explain the pitfalls of fitting corneal GP lenses that are upper lid attached
- Explain the reasons behind fitting GP lenses in a piggyback modality

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SOME FUNDAMENTALS FOR CORNEAL GP FITTING

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BACK TO THE FUNDAMENTALS OF GP FITTING

When professional sports figures struggle in their performance, they turn to their trainers for answers. More often than not the trainers take these athletes back to the fundamentals in order to eliminate bad habits and to relearn the needed skill sets for optimal results. With that in mind, let's review a few of the fundamentals of corneal GP lens fitting.

This article is intended to look at the basic concepts and the practical/useful side of fitting corneal GP lenses. Even though we now have scleral GP lenses when faced with many of our challenging fits, there still is a place and a need for corneal GP lenses.

LARGE DIAMETER VS. SMALL DIAMETER CORNEAL LENSES (Go Big or Go Home)

There are many advantages to fitting a large diameter corneal GP lens as compared to a small diameter lens. However, there are a few instances when smaller diameter GP lenses are needed for the best patient fit such as micro sized corneas. Much more often large diameter lenses are more comfortable for the patient, easier to fit, provide better lens positioning, and produce better visual results than small diameter lenses do.

The days of fitting 9.0 mm lenses on 12 mm corneas need to become a thing of the past. Because these 9.00 mm lenses move more on the cornea, get out of position more regularly, and can be sensed by the upper lids more, many of those small diameter lenses were fit with a more than average upper lid attachment. This reduced the movement of the lenses, made them more comfortable to wear, and prevented de-centering of these smaller diameter lenses… WHAT A MISTAKE THAT WAS!!!!! The result of high riding lenses:

1) A pocket or valley is formed underneath the upper lid (into the sclera) that results in failure of almost any attempt to center a redesigned lens…the new fit almost always displaces high and underneath the upper lids, regardless of any future adjustments made
2) Simultaneous vision progressive multifocal fits become a nightmare….this design needs good centration and good translation to work properly
3) Orthokeratology is usually ruled out because the lenses need to have good centration to work
4) Keeping the patient viewing properly in the optic zone of the lens is more difficult
5) Even when the refit results in better centration, the patient often reports less comfort in the new lenses when compared with their old high riding lenses

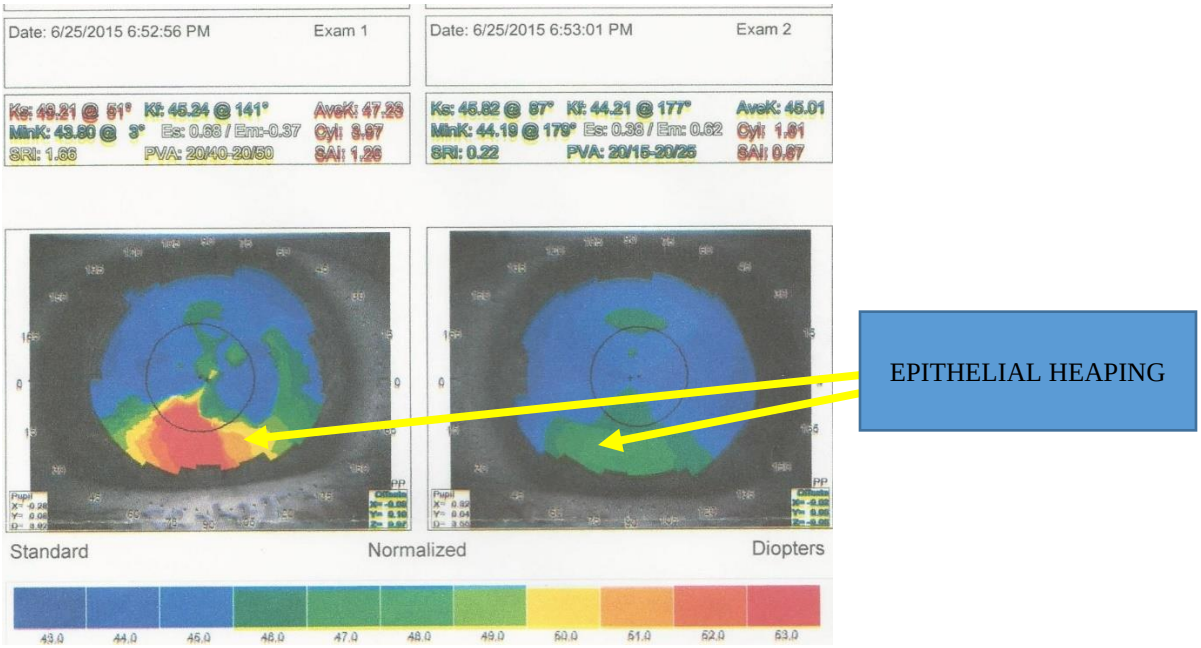


ILLUSTRATION 1

Illustration #1 shows the result of corneal molding due to upper lid attached GP lenses. As the picture indicates, epithelium has “heaped-up” inferiorly. This corneal molding (epithelium displacement) can be resolved by discontinuing the wear of the GP lenses for a few weeks, but the effects of what has occurred underneath the upper lid (that pocket or valley in the sclera) is much more permanent.

If we were to offer first time lens wearers GP lenses made in a 10.5 to 11.0 diameter size fit intra-palpebral rather than a 9.0 to 9.6 diameter size fit in an upper lid attached design, then we would discover the results should produce much greater initial lens comfort for the patient, better centration, and better overall outcomes. The patient acceptance in our GP lens fitting should be dramatically increased. Any future fits for the patient in GP multifocals, orthokeratology, or any design that required good centration would be made much easier and should result in better overall visual acuity.

ASTIGMATISM CORRECTION WITH GP LENS DESIGNS (that pesky astigmatism)

When the cornea is the cause of the astigmatism, GP lenses correct it easier and better than soft lenses. The refractive ability of the tear, formed between the back surface of the lens and the cornea, has an almost identical refractive ability as the plastic does in a GP contact lens. This allows a design that is simply spherical to have the ability to correct a significant amount of astigmatism.

GP lenses with spherical base curves and spherical optic zones fit and work great for up to 1.50 D of corneal cylinder. Aspheric base curves with aspheric optic zones work well, the majority of the time, for up to 2.50 D of corneal cylinder. When we reach 2.50 D or more of corneal cylinder then it is time to consider and design a toric GP lens. The back surface of the GP lens can be made to identically match the cylindrical corneal shape, so the lens fits perfectly.

Bitoric lenses work best, and back torics need to become a thing of the past in single vision GP lenses. Back torics used to be much easier to manufacture when crimping lenses was the only way to make a toric surface on a GP lens, so the labs charged less for a back toric than was charged for a bitoric lens that required crimping both surfaces in the manufacturing process. That made back torics easier to manufacture. Since modern (computer driven) lathes can create toric cuts without crimping lenses, and these lathes can make toric cuts to the micron level of accuracy on both the front and back surfaces of lenses, there is no reason to manufacture a back toric. Exact power needs of the patient are easier to accomplish in bitorics than in back torics.

Axis settings that are oblique or against-the-rule are difficult enough to maintain (both) a stable fit and stable vision when fitting soft toric lenses, but high cylinders in an RX with little if any spherical component is much more difficult to make work in soft toric contact lenses. A soft toric lens that moves only 2 or 3 degrees off axis, in an RX that has almost 100% of the correction need being cylinder, can cause the patient's visual acuity to be compromised. This is where a bitoric GP lens works best. The back surface of the lens can be made to match perfectly to the corneal shape. This eliminates visual fluctuation due to "off" axis orientation, and then any additional cylinder needed can be added to the front surface of the lens, thus providing the best visual acuity.

Example: RX = OD Lens with +0.25 -4.50 X 002, and K's of 40:62/44:37 @ 95 (Illustration 2)

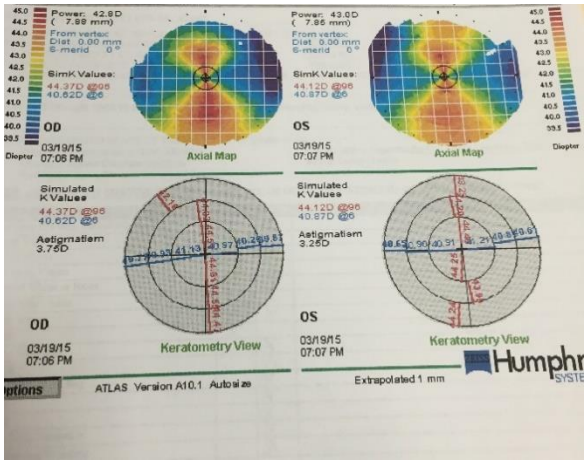


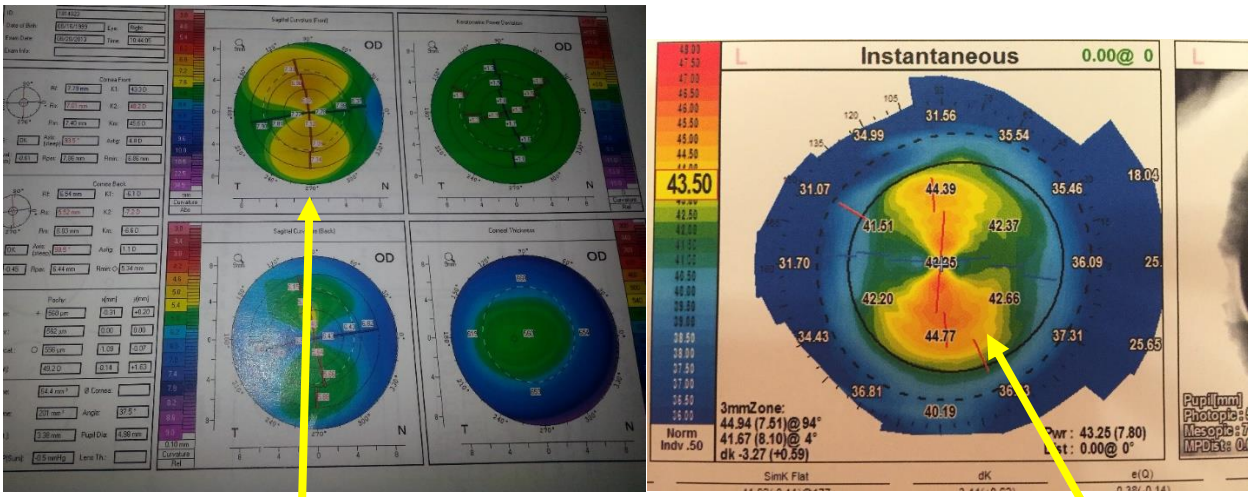
ILLUSTRATION 2

Here is the easy way to calculate the bitoric lens that you want to order:

1) Fit the flat meridian (K) on flat K (40:62 or 8.31 mm)
2) Fit the steep meridian (K) 0.50 D flatter than K (44:37 becomes 43:87 or 7.69 mm)
3) Vertex each power in each meridian (+0.25 = +0.25; -4.50 = -4.25)
4) Apply SAM & FAP principles on the base curve adjustments (+0.25 @ 8.31, & -3.75 @ 7.69)
5) The steeper meridian was fit 0.50 flatter than the K reading so "FAP" applies (-4.25 becomes -3.75)
6) Select the diameter to be ordered (larger makes the fit more stable)
7) Lens to be ordered might be: 8:31/7.69 B.C., +0.25/-3.75 cylinder, 10.0 diameter

The above steps 1 -7 works a high percentage of the time when designing bitoric lenses. However, when working from K's and RX only, it is difficult to know how to properly design a bitoric lens. One patient might have corneal cylinder limited to just a 6.00 mm zone requiring a smaller toric cut, while another might have corneal cylinder that runs the entire length of the cornea (limbus to limbus) requiring a larger toric cut. Since K readings are limited to a 3 mm zone we would not know how large to make the OZ (toric portion of the lens) in order to perfectly match the corneal shape. Topography can provide the information needed to design a better fitting bitoric lens. Illustration 3 shows the topography on the left that should have a large OZ (toric) to provide a good fit for this patient. A small diameter lens with a small (toric) OZ would not be a good choice for the corneal shape on the left. The topography on the right side of Illustration 3 shows a corneal shape that would require a much smaller OZ (toric) needed for the best fit. A large toric OZ selected for the patient on the right would cause major fit issues.

The corneal cylinder is contained within a 6 mm area in the picture on the right vs an almost 9 mm area in the picture on the left.



Large OZ Needed

Small OZ Needed

ILLUSTRATION 3

IRREGULAR CORNEAL FITTING WITH CORNEAL GP LENSES

Now that we have scleral GP lenses which really are an asset when fitting irregular cornea, then why should a corneal GP lens be selected when fitting an irregular cornea? Here might be a few reasons:

1) The manual dexterity of the patient inhibits the use of scleral lenses
2) The higher cost of scleral lenses….fitting fees + lens cost = higher cost
3) Very small corneas and/or extremely small fissures
4) Past failures to achieve a good fit or comfort in scleral lenses
5) The patient has always successfully worn a corneal GP fit and wants to continue in that modality

Think larger diameter GP lenses when fitting irregular corneas. Lens centration and preventing lens tilt are essential when trying to provide the best fit, the best comfort, and the best visual acuity possible for the patient. When a GP lens is tilted on the cornea ("Z" axis tilt), an uneven tear between the back surface of the lens and the cornea occurs. This can induce a significant amount of residual cylinder and/or aberrations that result in less than optimal visual acuity. Larger diameter lenses can center better, and when properly designed, can reduce or eliminate lens tilt on the cornea.

Choosing 10.0 to 11.5 mm diameters in a corneal GP lens for irregular cornea fits can be a good starting point. Be careful not to make the optic zone too large in these large diameter lenses. More chances to go wrong in the fit and this can create an uneven tear layer behind the lens if the OZ is too large. There can be as much as 5, 10, 20 diopters or more difference in the steep portions and flat portions of the corneal shape within a 9 mm area, and making the OZ in sizes of 8 mm, 9 mm or greater can cause real fit and uneven tear issues.

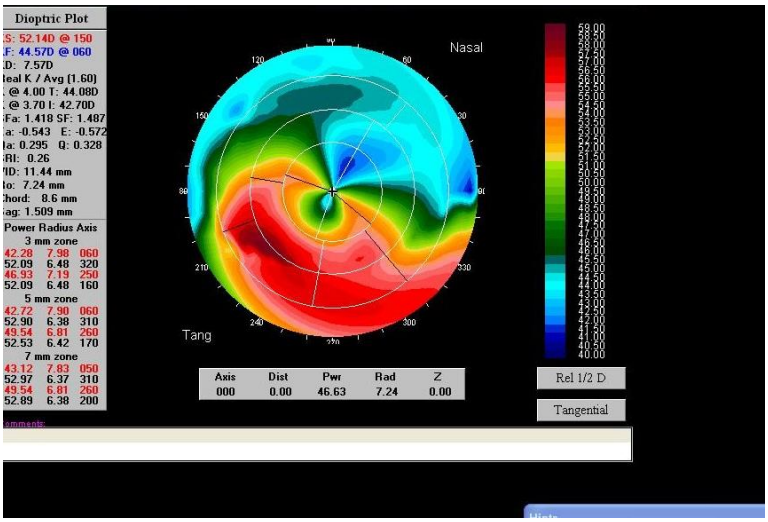


ILLUSTRATION 4

Look at this topography (Illustration 4) that shows how difficult it would be to make an 8 to 9 mm spherical OZ fit evenly on this very irregular cornea. Keep in mind that the total size of cornea shown in this topography is about 9.0 mm. Un-even tear and lens tilt are less likely if the OZ is kept smaller. The standard post-surgical OZ for LASIK is 6.00 mm, and very few patients complain of ghosting or halos with this smaller OZ size. The secret in making certain the 6.00 to 7.00 mm OZ works well is to make certain that the lens positions perfectly centered over the pupil, and the lens is not tilted on the cornea.

The use of reverse geometry in GP lenses has been a very useful tool when fitting irregular corneas. With the secondary curve being made steeper than the base curve, lens tilt is reduced and lens centration is improved. This will produce some additional central vault (additional tear volume) at the optic center of the lens which should not create an issue with the patient's vision. The reverse curve prevents lens tilt, which in turn allows for good visual correction. The amount of tear volume that is acceptable for best fit and vision is between 20 – 40 microns. We know that scleral lenses produce great vision with between 150 to 300 microns of tear volume centrally, so some additional tear doesn't prevent good visual results as long as the tear volume is uniform.

Illustration #5 is a picture of a properly fit reverse geometry lens on a patient with pellucid marginal degeneration and INTACS. It is well centered, centrally vaulted, and is a 10.8 mm diameter corneal GP lens. The amount of reverse curve in this lens is 1.50 D steeper than the base curve and 0.70 mm in width. This is just enough reverse curve to center the lens and prevent lens tilt.

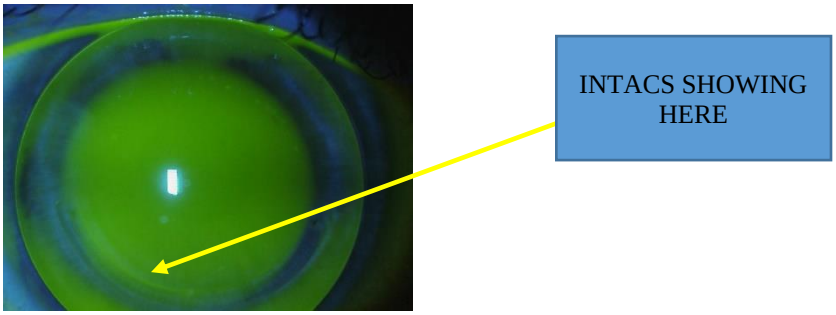


ILLUSTRATION 5

AN OLD CONCEPT BECOMES NEW AGAIN (piggyback modality)

When large diameter GP lenses, regardless of the design, fail to fit properly on an irregular cornea, often an old fitting technique becomes useful…..the much neglected and often forgotten piggyback modality. Here is an approach that works well the majority of the time:

1) A center thickness of 0.20 or greater….thicker lenses conform less to an irregular corneal shape
2) High Plus powers (+5.00 or so) are thicker and the GP lens neutralizes almost all of the plus power (80% or so) when placed on top of the +5.00 soft lens
3) Choose high modulus materials when possible, they are stiffer and conform to the corneal shape less
4) High DK (Silicone Hydrogel) for better oxygen transmission
5) Trials are available in high modulus, high plus power, silicone hydrogel (high DK) soft lenses
6) Hydrogen Peroxide care systems are approved for both GP and Soft lenses, so only one care system is required

With a newly improved surface that the soft lens provides for the GP lens to ride on, the GP lens can move more freely, the fit should become better centered, comfort will be improved, and vision is almost always improved.

Sometimes a trial soft lens will not have the parameters needed to fit the patient when the cornea is extremely irregular or extremely steep, so custom soft lenses are required to be the carrier for the GP lens. These lenses are available and can be custom made in every respect. Base curve, center thickness, power, diameter, peripheral curve design, and these are all options that can be tailored to fit these very challenging corneal shapes.

Here is an actual case of a lens that needed to be custom made for an extremely irregular and steep cornea. This patient had undergone 3 corneal transplants and when several tries at fitting corneal GP lenses and scleral GP lenses had failed, then a piggyback modality was chosen. No standard (trial) soft lens would fit this cornea since it was 84 diopters steep at its steepest point and 50 diopters flat, all within an 8.0 mm area. The topography is shown in Illustration 6.

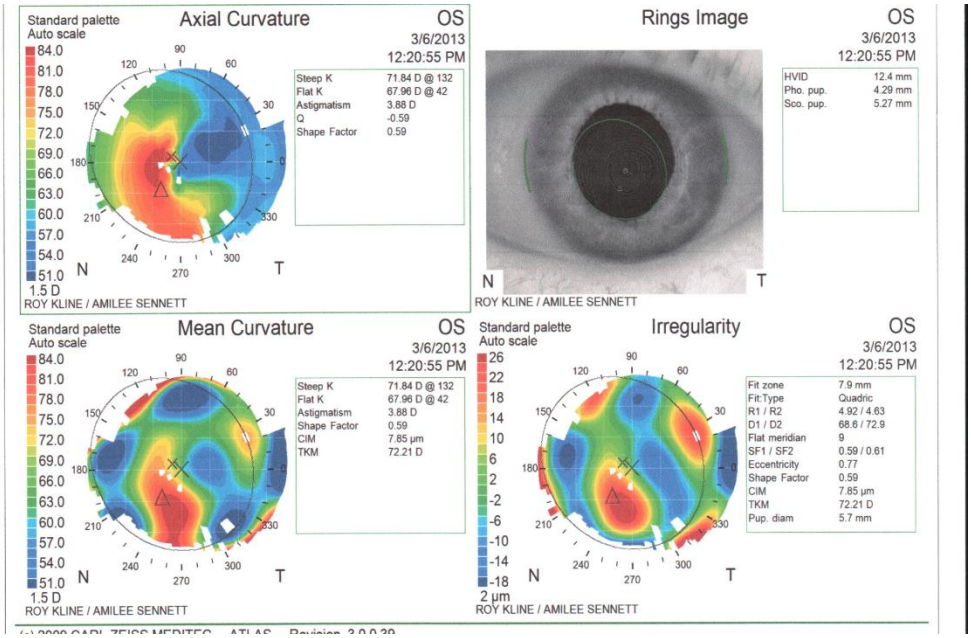


ILLUSTRATION 6

The following is what was fit:

1) A silicone hydrogel custom soft lens in a 15.0 diameter, 8.3 base curve, center thickness of 0.25 mm, plano power, with 4 steps steeper than standard on the PC's
2) A 10.2 mm diameter, reverse geometry GP, 5.40 base curve, -21.00 power, with a 6.2 mm OZ

The visual result was 20/30 acuity, with good comfort throughout a 12 to 14 hour daily wearing schedule. The GP lens moved independently of the soft lens for good even tear exchange, and the very small trapped bubble behind the GP lens posed no issues because of the bandage effect the soft lens offered.

Illustration 7 is a cell phone picture of the fit.

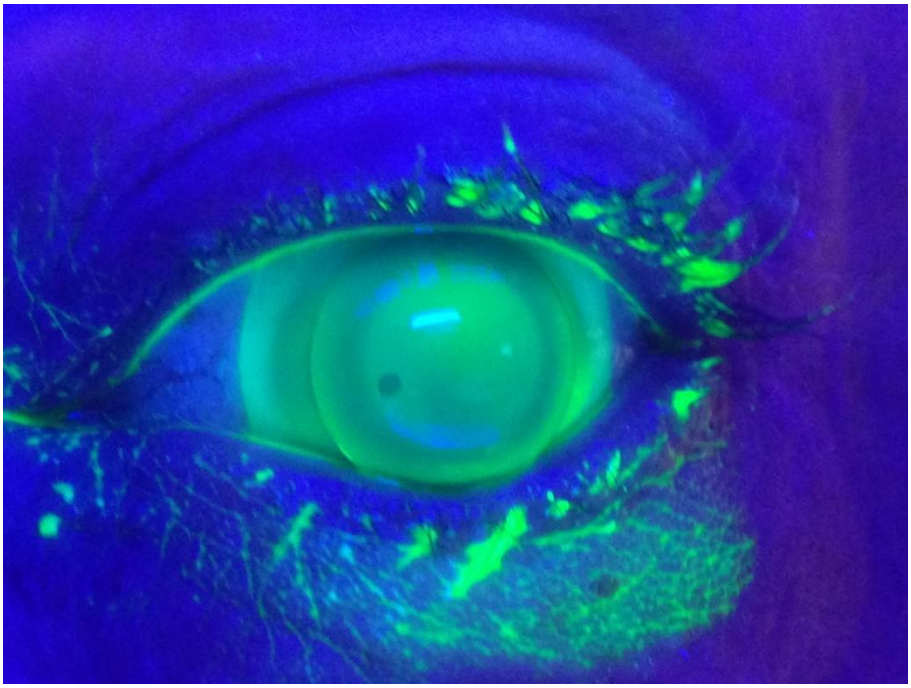


ILLUSTRATION 7

CONCLUSION:

Corneal GP lens fitting is not going away any time soon, and sticking to some fundamental fitting techniques can make the efforts of the practitioner and the results for the patient more successful. Scleral GP lenses are a new, wonderful, and useful tool that can work well when properly fit, however, so might corneal GP lenses.

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