EVALUATION OF CORNEAL TOPOGRAPHY IN DETERMINING CENTRATION OF SPECTRUM BIFOCAL CONTACT LENSES

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March 17, 1995

ABSTRACT

The purpose of our research is to assess the clinical usefulness of the EyeSys Corneal Topographer in proper centration and fitting of the CIBA Spectrum concentric near zone bifocal contact lens. Currently, the only available method of assessing centration of the near zone is by subjective evaluation of the retinoscopy reflex while the patient wears the lenses. With the corneal topographer, the corneal maps without and with the contact lens can be compared to locate the near zone and its centration within the pupil.

The sample population for this experiment will be fellow optometry students. A corneal map will be taken of each individual with and without a contact lens, and these results compared to subjective retinoscopy findings to determine the clinical relevance of corneal mapping for simultaneous concentric bifocal contact lens evaluation.

In the optometric practice today, there are many skills to perfect. One of the challenges facing the practitioner is the presbyopic contact lens patient. The need for an easy to fit and usable bifocal contact lens is increasing steadily as the population ages. There are currently several different multifocal contact lens designs on the market and the practitioner must know how to fit each in order to best meet his/her patients needs. This alone may be an overwhelming task because each multifocal lens design works differently and thus requires unique fitting skills and patient education.

One of the many multifocal soft contact lenses on the market is the CIBA Spectrum bifocal lens. Its design is a concentric simultaneous vision bifocal contact lens available with a central near optic zone and a concentric distance zone. The lens is available in several standard parameters; +6.00 to -6.00 dioptric powers with add powers ranging from +1.50 to +3.00 in a central zone of either 2.3mm or 3.0mm. Additionally, Spectrum comes in two base curves, 8.6 and 8.9 with a 14.0mm diameter in a molded 55% water content lens.

As with any contact lens fitting, optimum fit is determined by evaluation of lens movement, centration, visual acuity at distance and near, binocularity etc, with an over-refraction being performed at distance and near as necessary to determine the correct powers for each.

The procedure for fitting as recommended by CIBA Vision Corporation is outlined as follows:

1. Pre-fitting examination
2. Patient selection
3. Initial contact lens selection including base curve, distance/near powers, near zone size
4. Initial lens fitting evaluation
5. Initial visual acuity evaluation
6. Retinoscopy findings
7. Alternate lens selection if necessary
8. Dispensing instructions
9. Initial wearing schedule
10. Specific bifocal instructions
11. Follow-up care

Only lenses that satisfy the patient's visual requirements and meet the criteria of a well-fitted lens (see Appendix I) should be dispensed. A gradual increase in wearing time is recommended provided there is satisfactory physiological response after full adaptation to daily wear. This is evaluated using the slit-lamp after at least four hours of contact lens wear at each follow-up visit.

Patient selection in a multifocal contact lens fitting is crucial. Motivation is a key factor, as is the patient's visual demands, any uncorrected cylinder and the patient's intended use, ie, it is easier to meet the visual demands of a person for social viewing than for critical detail. Patients with moderate to high spherical refractive errors, especially hyperopia, and higher near add corrections of greater than +1.00, often achieve the best results.

Initial lens selection relies on practitioner expertise and patient exam findings for choosing base curve, distance power and near addition. An important factor the doctor must consider is the central zone size selection. Success is best achieved by matching the zone size and the patient's visual preference. For example, to maximize distance visual acuity select lenses with small central zones for each eye, or to maximize near vision select the large zone for each eye, or to balance the visual response at both distance and near, select lenses with dissimilar zone sizes, using the small zone in the dominant eye and the large zone in the non-dominant eye.

Once the contact lens has been chose and placed on the patient's eye, the lens must be allowed to settle for 15-30 minutes. After the lens has settled the fit must be evaluated. This includes assessing lens centration and movement, and making an alternate lens choice if necessary. If proper fit has been achieved, the visual performance of the lens must be assessed. Patients should be warned that initially they may experience shadowing or ghost images, but with adaptation these symptoms become less noticeable. Distance visual acuity and over-refraction is performed first, then near visual acuity with over-refraction is tested (with the distance over-refraction in place). It is important to emphasize that it is not necessary for the patient to use "bifocal spectacle habits" of downgaze to achieve the near add. If 20/20 visual acuity is achievable with best sphere correction, the patient should reach acuities of 20/25 at distance and 20/40 at near initially. Both of these usually improve with adaptation. The CIBA Spectrum bifocal contact lenses should place patients within one-half line of their distance and near spherical equivalent visual acuities under normal circumstances and after adaptation has occurred.

The contact lenses dispensed are determined from the over-refraction found at distance and near and the patient must also be instructed on proper lens handling, cleaning, disinfection and wearing schedule.

If the visual performance of the lens is not as well as expected, and the lens appears to fit well, retinoscopy findings can be used to evaluate lens performance. The retinoscopic evaluation is currently the only method the doctor has to evaluate the near zone centration within the pupil. Many doctors find this difficult and unsatisfactory. The direct ophthalmoscope or retinoscope is used to observe the central zone position as the contact lenses are worn. As the doctor observes the patient's eye with either instrument, the optical effect of the central zone is seen as a change in the intensity of the retinal reflex. Many doctors find it is most noticeable immediately following patient blinks due to movement of the contact lens.

The patient should be given specific bifocal contact lens instructions, as well as a wearing schedule. Distance visual problems will be expected to be most noticeable under bright light conditions, due to pupil constriction. Plano sunglasses for bright conditions may help to reduce the vision fluctuation noted at distance. Also, some patients may notice flare with night vision. Usually patients adapt to this and although the flare may still be present, it is no longer bothersome.

As with any contact lens patient, proper follow-up care is critical. The patient should be told to wear the contact lenses when returning for a follow-up exam and the patient is asked to report any problems occurring related to the contact lens wear. The practitioner must evaluate the lens fit and the patient's vision as well as adaptation and surface deposition or damage.

While many practitioners are able to successfully fit single vision contact lenses with ease, many avoid fitting multifocal contact lenses because of the perceived increase in difficulty. In actuality, the fitting of the CIBA Spectrum bifocal contact lenses is virtually identical to single vision contact lenses with the exception of the assessment of the central near zone size and power. Admittedly, this is not always easy, especially the evaluation of the near zone centration within the pupil. We proposed that the use of a corneal topographer, such as EyeSys, could aid the practitioner in assessing this important factor of lens performance.

METHODS

For our study, we were interested in assessing the centration of the near zone within the pupil as well as the ease of using the corneal topographer to aid in the assessment. Because we were not interested in visual performance of the lens, we chose non-presbyopic sample patients. The subjects were all third year optometry students at Ferris State University, some with an history of contact lens wear, both soft and rigid, and others being spectacle wearers or emmetropes.

The EyeSys Corneal Topographer measures corneal curvature using computerized analysis of placido mires reflected off the cornea. The computer software allows the practitioner to then view this information in several different ways, as well as plot the pupil outline on the topographical map. We chose to view the cornea in a color coded dioptric value map with the pupil margin clearly mapped out.

We began by taking a corneal map of each subject's cornea prior to insertion of the Spectrum bifocal contact lens. We then took a second topographical map with the contact lens in place on the subject's eye. The subjects were not fit with the proper contact lens prescription because we were not evaluating the visual performance, only lens centration, specifically the near zone. Therefore, we chose contact lenses with high add powers to accentuate the change in curvature differences on the corneal topography map.

The corneal topographical maps were then evaluated for proper centration of the near zone within the pupil margins as well as comparing the map findings with subjective evaluation of the near zone using the intensity of the retinal reflex with retinoscopy.

RESULTS

Our results are summarized in Figures 1 through 10. These figures are the color coded topographical maps of the cornea from our 10 subjects before and after instillation of the bifocal contact lenses. From these maps we were able to determine the location of the near concentric zone, and its centration within the pupil. The near concentric zone of the bifocal contact lens corresponds to the steepest area of the topographical maps. For comparison, we selected four of the ten subjects to perform reflex retinoscopy to subjectively evaluate the contact lens centration. In all four cases, subjective evaluation and computerized corneal topography of the near zone location coincided.

DISCUSSION

In the fitting of simultaneous concentric bifocal contact lenses, such as CIBA Spectrum, pupil size and lens centration is critical to patient success. The purpose of our study was not visual performance of the CIBA Spectrum but rather to find an alternate method other than standard reflex retinoscopy in determining the near zone position. We specifically designed our experiment to determine the sensitivity of corneal topography, such as EyeSys, to detect curvature differences between the distance and near zones of concentric bifocal contact lenses. Our results show that corneal topography can be used as an effective and accurate method in assessing lens centration of simultaneous concentric bifocal contact lenses. Using the color coded maps, we were able to determine the alignment of the near zone position with respect to the pupil margins.

APPENDIX I

Criteria of a Well-Fitted Lens

A well-fitted Spectrum bifocal soft contact lens satisfies the following criteria:

1. Full corneal coverage
2. Good centration, a lens decentered > 1mm is less likely to give adequate vision
3. Satisfactory movement, movement > 1mm reduces success
4. Satisfactory lens lag
5. Lens moves "freely" when pushed with lower lid
6. Satisfactory comfort by patient
7. Satisfactory visual response within half a line of best spherical acuity at distance and near

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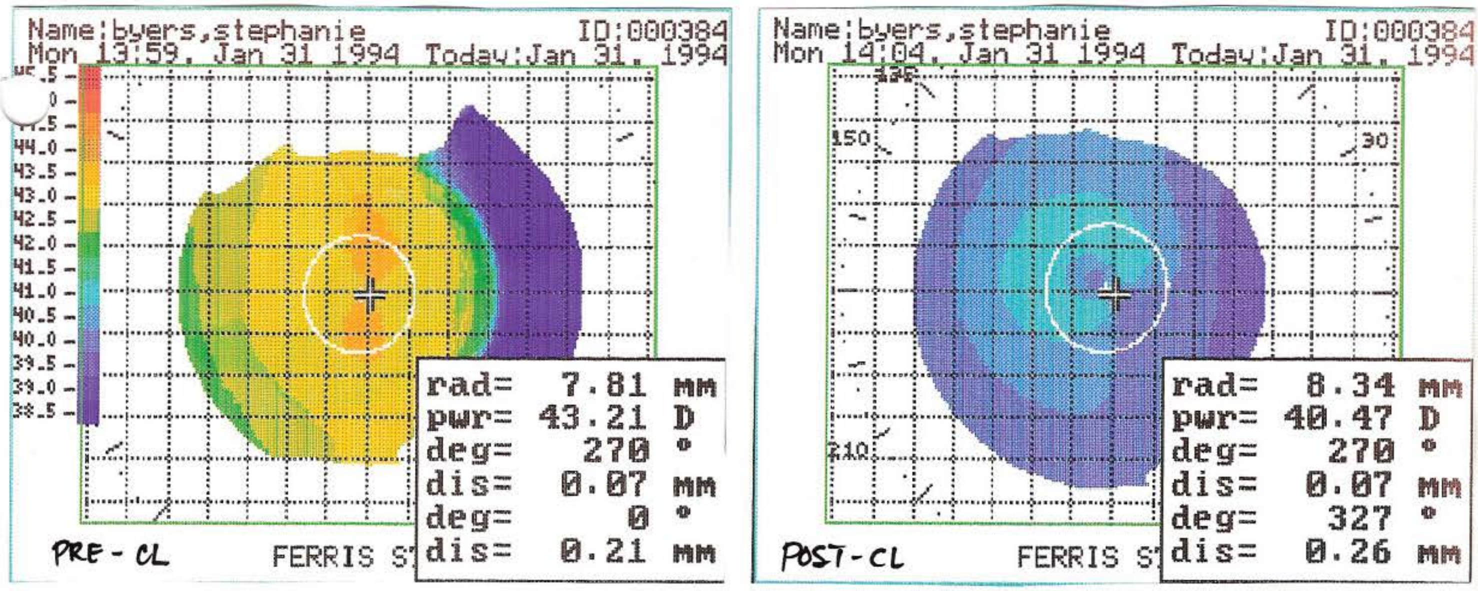
FIGURE 1.



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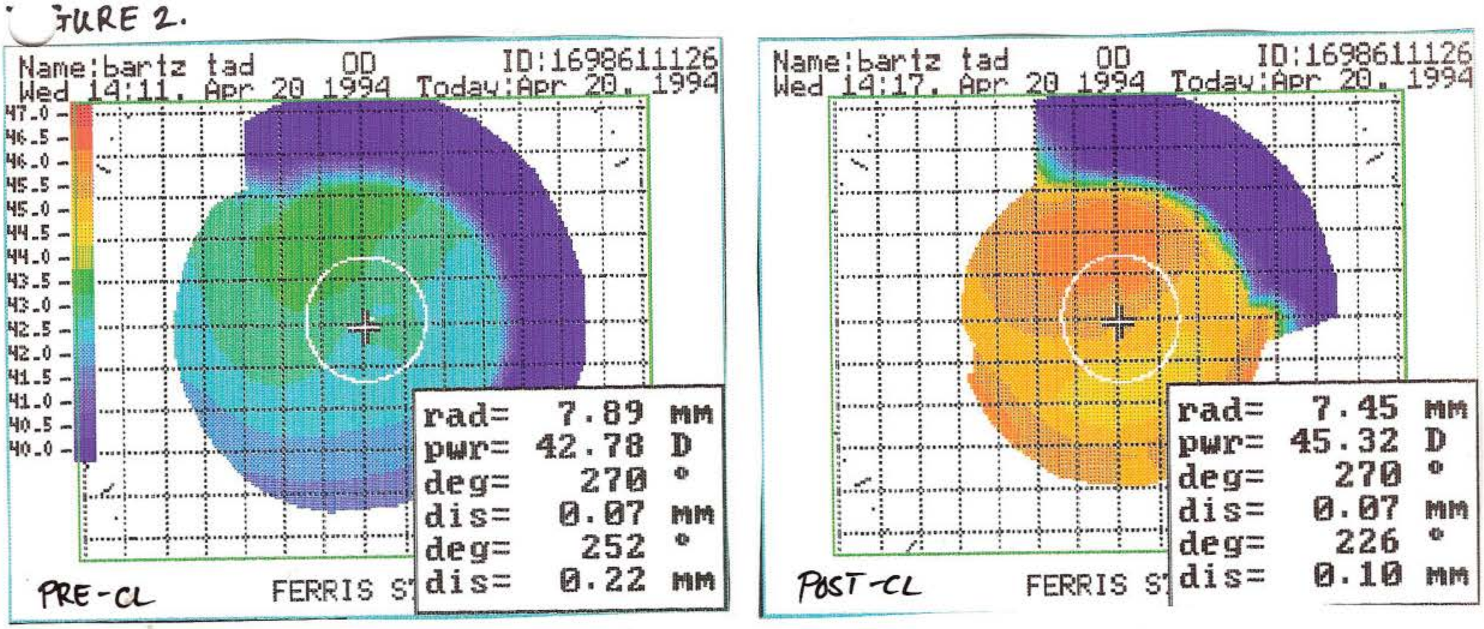

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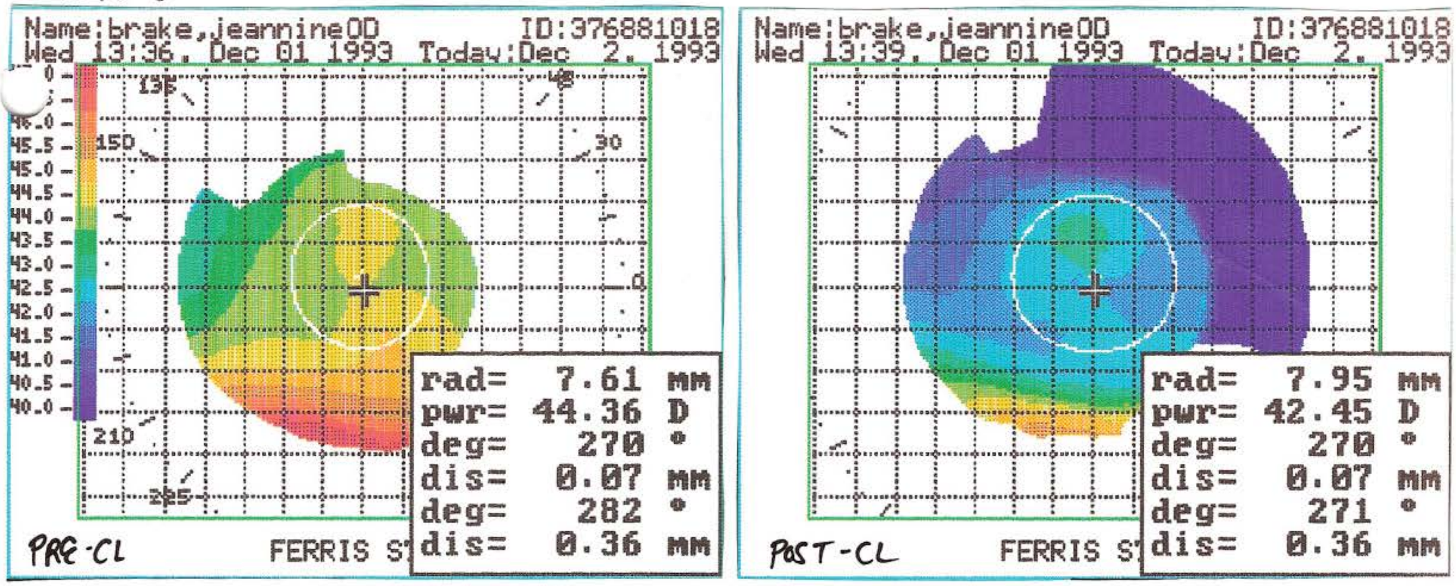

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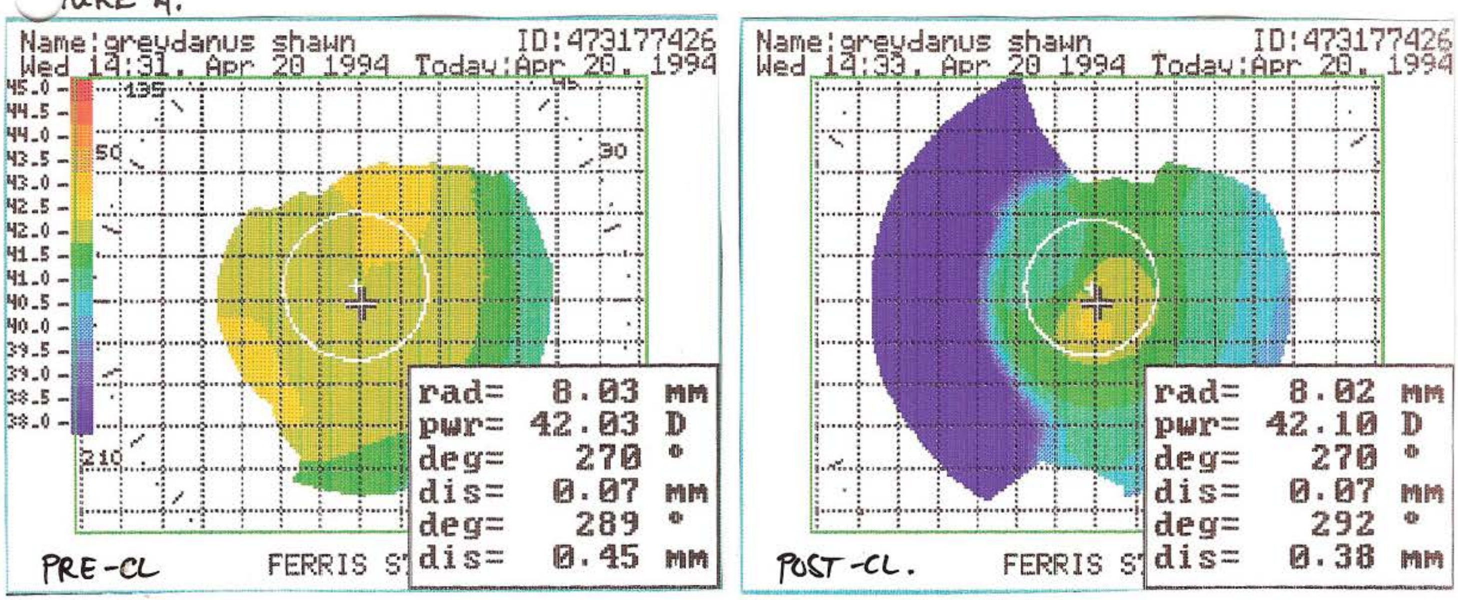

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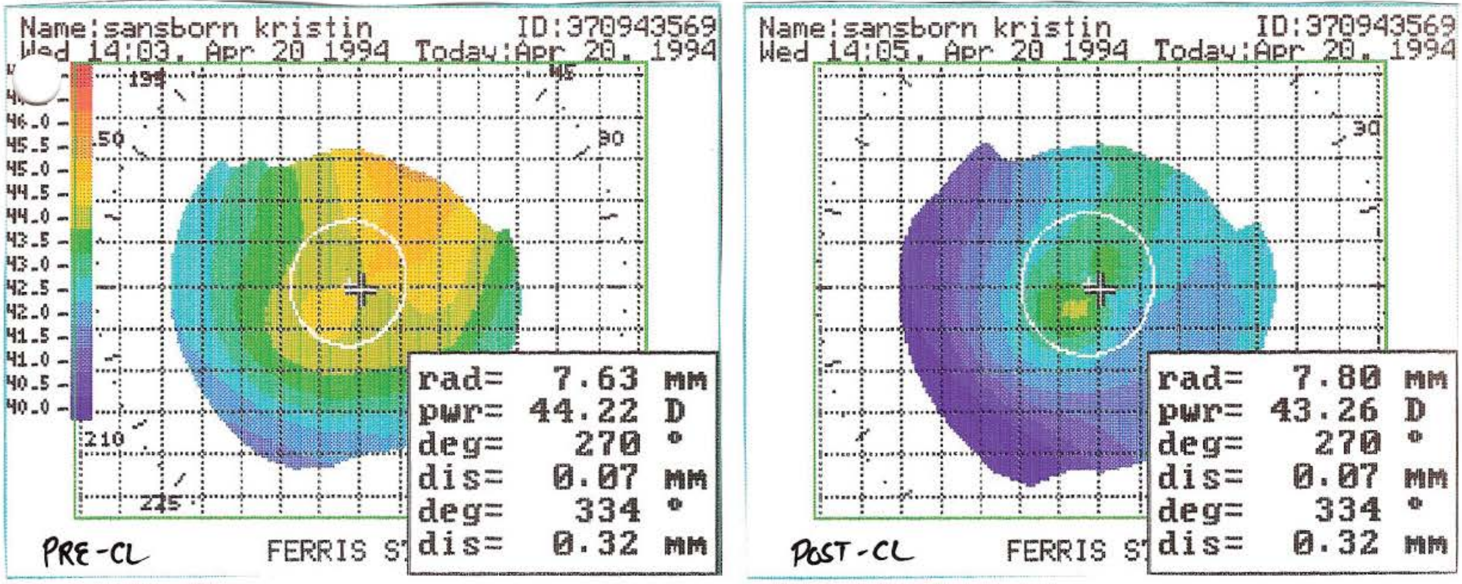

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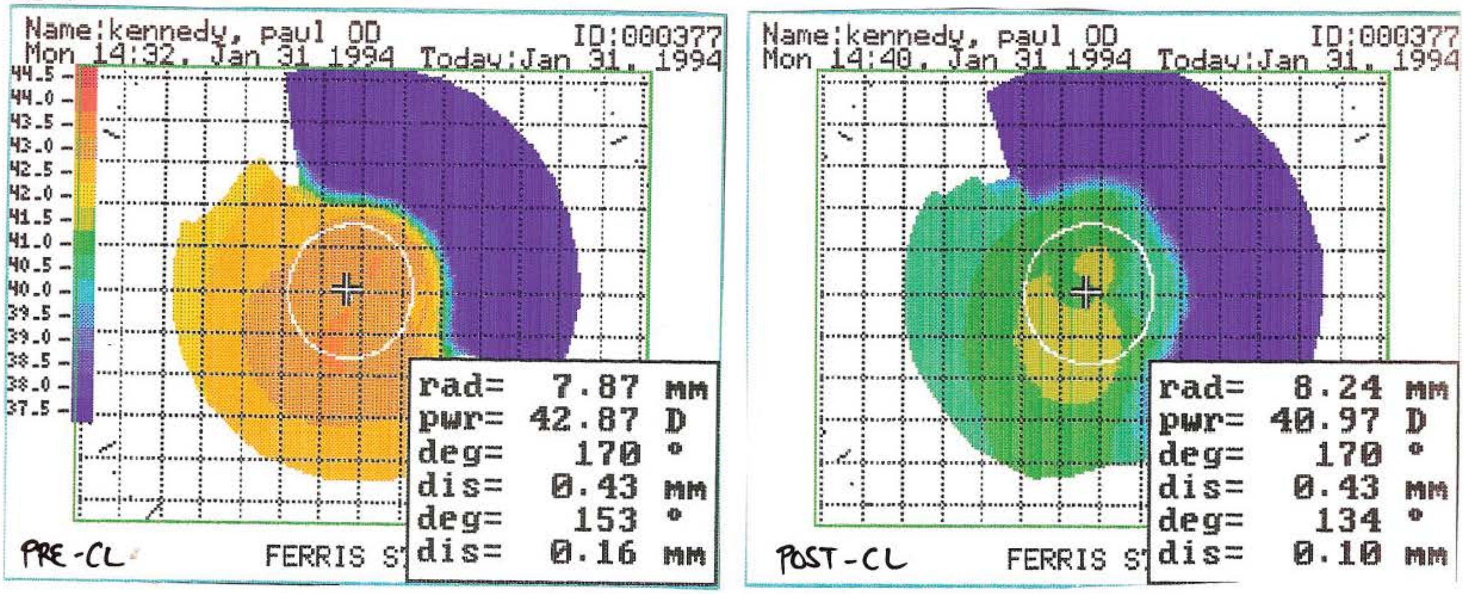

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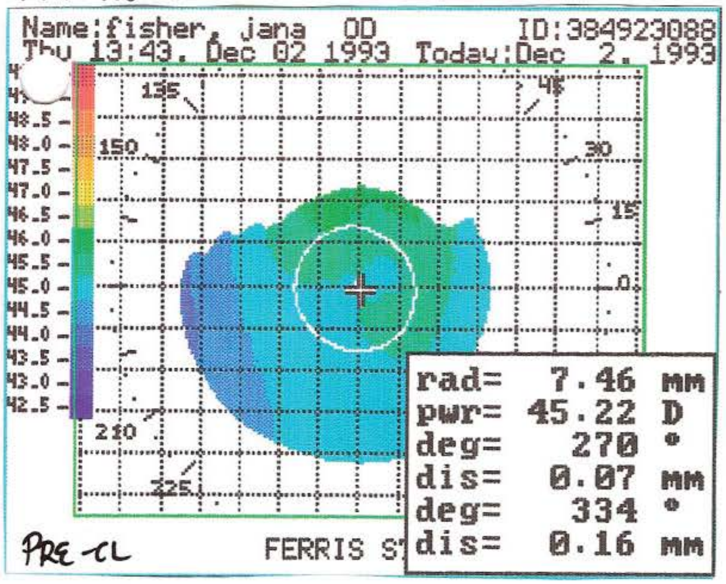

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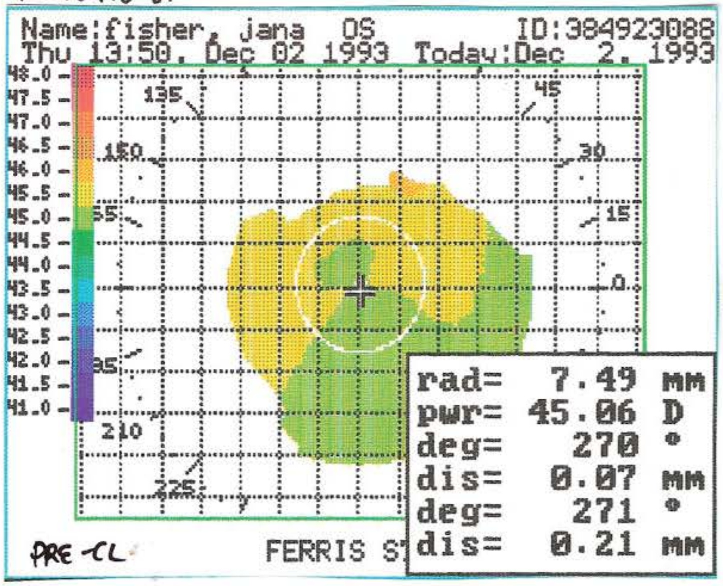

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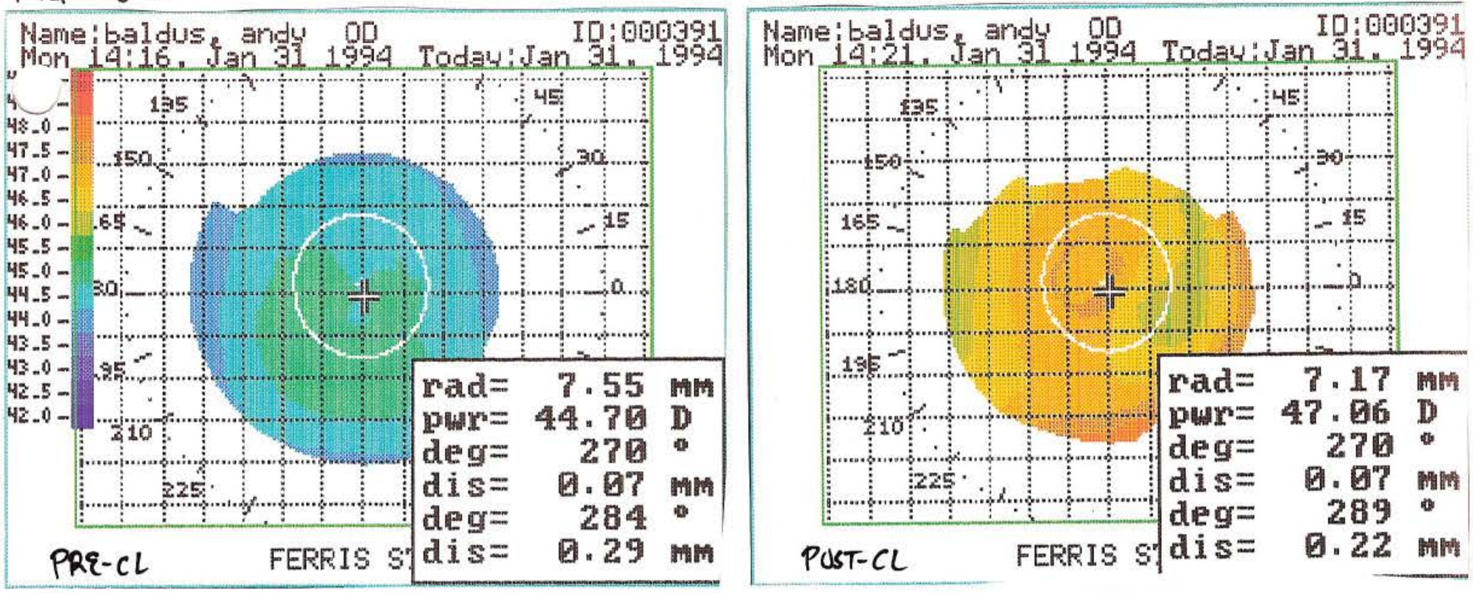

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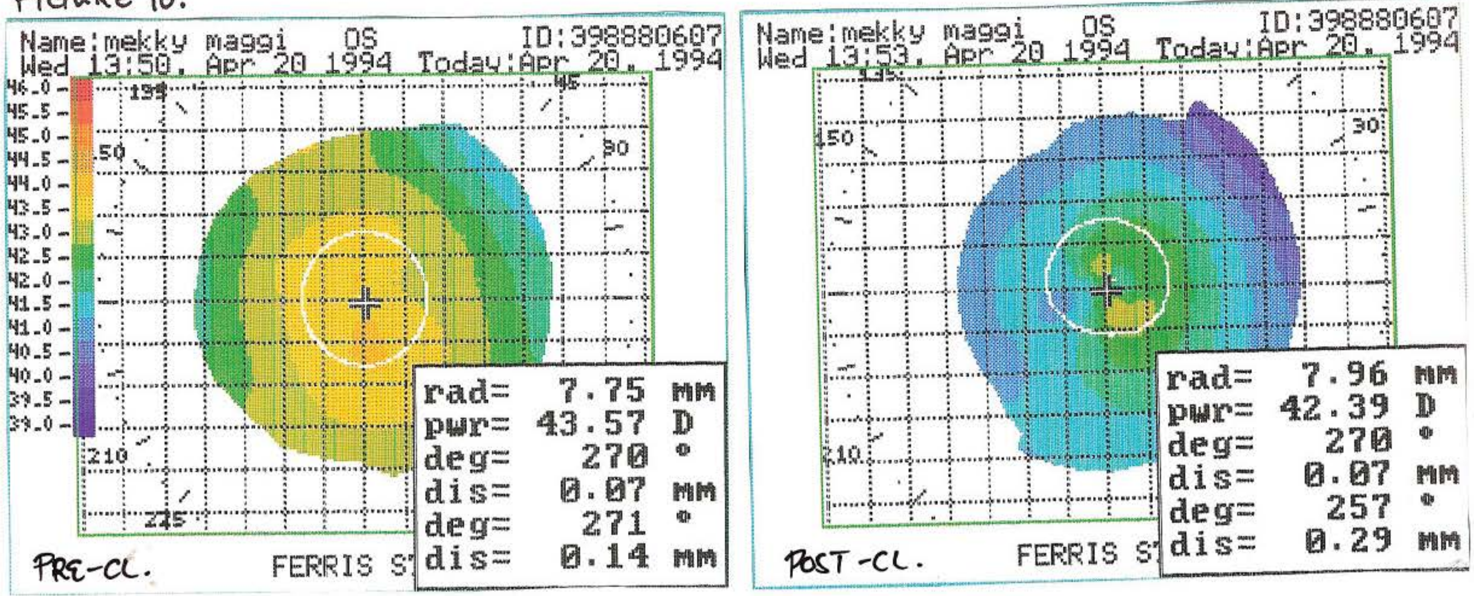

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