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Abstract
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USE OF SOFT CONTACT LENSES AS A MEANS FOR CORNEAL RESTABILIZATION
AFTER DISCONTINUING HARD CONTACT LENS WEAR

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Joel Postma

Gerald McMullin
ABSTRACT

The study consisted of 11 symptomatic full-time hard contact lens wearers who were refitted with hydrogel lenses in a corneal restabilization program. The purpose of this study was to determine the degree of problems the eye care practitioner could expect if he or she should choose such a program. The study showed that the hydrogel lens problems encountered depended on the amount of corneal deformation induced by the hard lenses.
On occasion, long term wearers of rigid contact lenses reach a period of corneal exhaustion when contact lens use must be discontinued or the contact lenses must be refitted. The decision for discontinuation may be the result of patient dissatisfaction or may be the recommendation of an eye care professional for ocular health reasons. The clinical characteristics for this group, according to Polse,\(^5\) are prolonged spectacle blur, irregular corneal curvature, changes in corneal curvature of one diopter or more, persistent edema, consistent staining, and/or patient discomfort.

When it is necessary to discontinue contact lens wear, it is often difficult to prescribe adequate correction for the patient because his corneas are in a state of continuous change or fluctuation. The hard contact lens masks the corneal distortion which it induces. Lens withdrawal allows the corneal curvature to fluctuate as the cornea attempts to stabilize. This corneal distortion (usually a high amount of with-the-rule astigmatism) and fluctuation of corneal curvature often makes spectacle correction unsatisfactory.\(^1,4,8\) The cornea changes that take place seem to be a function not only of the duration of contact lens wear, but also of the length of time contact lens wear has been discontinued.\(^2,4\)

Several studies by Rengstorff\(^2,3,4,8\) considered the changes associated with contact lens withdrawal. He found that the smallest changes occur with patients who have worn contact lenses no longer than one year, and the greatest changes occur with those who have worn lenses for three years or longer. He also found that the period of greatest fluctuation occurs within the first seven days of lens removal. After this the changes are less dramatic and tend to diminish until stabilization occurs at some time between three and five weeks.
These changes in refraction and corneal curvature seem almost totally unpredictable for a given individual and make remedial vision care measures difficult. Three remedial programs currently used are discussed by Nolan and Bush. One of the most popular means for remediation involves refitting the patient with a better fitting hard lens. The theory behind this program is that a better fitting lens will allow oxygen access to the cornea and the cornea will stabilize as a result. This refitting program considers several variables including the fit of the present lens, refractive status and corneal curvature before the initial contact lens fitting, and the types and degrees of corneal changes.

Another remediation program consists of removing the patient's lenses completely and allowing the cornea to stabilize before refitting with an appropriate hard or hydrogel lens. A third means of remediation consists of the gradual reduction of hard lens wearing time, allowing corneal changes to take place more slowly. This program is based on the premise that fewer corneal changes will occur when the lens withdrawal is gradual.

This study used a variation of the refitting program for attaining corneal stabilization. The subjects were refitted with hydrogel lenses instead of hard lenses in an attempt to investigate the viability of hydrogel lenses in corneal restabilization and at the same time provide the patients with functional visual acuity. It was the purpose of this study to determine the degree of problems the eye care practitioner could expect should he choose such a program.
METHODS

This study included 11 subjects who met the following criteria:
1. Hard contact lens wear for one year or more.
2. The following signs and symptoms as a result of contact lens removal:
   a. fluctuations in visual acuity of one or two Snellen lines between readings taken immediately after hard lens removal and those taken one hour and twenty-four hours later;
   b. prolonged spectacle blur (one hour or longer with acuity less than 20/20);
   c. distorted keratometry mires.
3. No ocular pathology or systemic disorders.
4. No use of drugs which may affect the eyes.

The 11 subjects were selected from the patient population at Pacific University College of Optometry. They were experiencing problems which indicated that some program of restabilization should be administered.

Following the screening of prospective subjects, those who met the criteria for the study were fit with appropriate hydrogel lenses. These lenses had to fulfill the requirements of a good retinoscopic reflex, good centering with no more than 1-2 mm of movement, and an over-refraction with good visual acuity. At the time of the initial hydrogel lens dispensing and at each subsequent contact lens check, records were kept of these fitting criteria in addition to the biomicroscopic findings (edema, injection, etc.) and the records of the post-refractions, keratometry, and subjective symptoms. If at any time during the study the hydrogel lens did not meet the standards of these fitting criteria, a new hydrogel lens was provided which did meet the requirements.
Throughout the study the subjects' corneal changes were closely monitored. Each subject had a contact lens check-up every 2-3 weeks. When three consecutive post-refractions yielded variations of not more than $\pm 0.25$ D of sphere and cylinder power, with the cylinder axis varying no more than $\pm 0.06^\circ$, it was considered that refractive stability had been attained. Corneal curvatures were considered stable when the keratometry power did not change more than $\pm 0.25$ D in any meridian, with the axis varying no more than $\pm 0.06^\circ$, on three consecutive check-ups. (The keratometers used were calibrated prior to all measurements.) After stabilization was attained, the subjects were refitted with hard, soft, or gas-permeable hard contact lenses and/or with spectacles.

RESULTS AND DISCUSSION

All but three subjects were able to maintain functional visual acuity through the hydrogel lenses during their corneal restabilization program. However, the degree of success varied depending upon the severity of the corneal deformation and upon the visual demands of the individual subjects.

As a result, the subjects were grouped according to how successful they were with the hydrogel regimen. Group I subjects were very successful in maintaining good visual acuity, Group II subjects were able to attain a functional visual acuity which varied from satisfactory to poor, and Group III subjects were not able to see well enough out of the hydrogel lenses to use them in their corneal restabilization program. (See Table 1 for test results on each group.)
<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Cornea restabilization period</td>
<td>4 to 6 weeks</td>
<td>8 to 23 weeks</td>
<td>8 to 10 weeks</td>
</tr>
<tr>
<td>Number of soft lens changes during restabilization</td>
<td>0 to 1 change</td>
<td>1 to 2 changes</td>
<td>not appropriate</td>
</tr>
<tr>
<td>Spherical fluctuation over the time of restabilization (range and average)</td>
<td>.25 to 1.25 D (.78 D)</td>
<td>.25 to 1.25 D (.71 D)</td>
<td>.50 to 3.75 D (2.25 D)</td>
</tr>
<tr>
<td>Cylinder fluctuation over the time of restabilization (range and average)</td>
<td>0 to .75 D (.28 D)</td>
<td>.75 to 2.50 D (1.75 D)</td>
<td>.75 to 2.25 D (1.29 D)</td>
</tr>
<tr>
<td>Axis fluctuation over the time of restabilization (range and average)</td>
<td>10 to 90° (33°)</td>
<td>5 to 180° (30°)</td>
<td>10 to 135° (40°)</td>
</tr>
<tr>
<td>Cylinder* at start of restabilization (range and average)</td>
<td>sphere to 1.50 D (.68 D)</td>
<td>sphere to 3.50 D (.90 D)</td>
<td>.50 to 1.50 D (.91 D)</td>
</tr>
<tr>
<td>Cylinder* at end of restabilization (range and average)</td>
<td>.50 to 1.25 D (.81 D)</td>
<td>1.25 to 4.00 D (2.31 D)</td>
<td>sphere to 2.00 D (1.00 D)</td>
</tr>
<tr>
<td>Delta 'K'** at start of restabilization (range and average)</td>
<td>.50 to 2.00 D (1.26 D)</td>
<td>.62 to 2.50 D (1.37 D)</td>
<td>.25 to 2.50 D (1.39 D)</td>
</tr>
<tr>
<td>Delta 'K'** at end of restabilization (range and average)</td>
<td>.50 to 2.00 D (1.50 D)</td>
<td>.50 to 3.00 D (1.96 D)</td>
<td>.25 to 2.00 D (1.29 D)</td>
</tr>
<tr>
<td>Type of contact lens the subject wore at the end of the study</td>
<td>3 hydrogel; 1 toric hydrogel</td>
<td>All wore gas-permeable hard lenses</td>
<td>1 wore glasses; 2 gas-permeable hard lenses</td>
</tr>
<tr>
<td>Patients' subjective symptoms and feeling of the regimen</td>
<td>Comfort good; happy about the regimen</td>
<td>Aware of lenses; unhappy with acuity and time involved</td>
<td>Not able to function with soft lenses; very concerned about their vision</td>
</tr>
</tbody>
</table>

*Post-refraction cylinder.
**Delta 'K' is the difference between the keratometer meridians.
The four subjects in Group I did not have as much corneal distortion as did the subjects in the other two groups. As a result, the Group I subjects did not experience as much corneal curvature fluctuation and visual acuity variation during their corneal restabilization period. These subjects were also the quickest to regain stabilization (four to six weeks). Only two of the subjects required a lens change during the restabilization process to maintain a good fit, an indication that in general the subjects' corneas did not undergo large changes in curvature during restabilization. For the subjects in this group, the hydrogel lenses provided good acuity and comfort. As a result, all members of Group I chose to remain in hydrogel lenses following their corneal restabilization.

The subjects in Group II experienced more problems with visual acuity while wearing hydrogel lenses. They had more corneal deformation and induced astigmatism which caused poor acuity through the lenses. In an attempt to mask some of the induced astigmatism, this group was fitted with thicker, higher water contact hydrogel lenses than Group I. These thicker lenses may have reduced the amount of oxygen accessible to the cornea, for it took the subjects in this group an average of 12 weeks to attain corneal stabilization compared to an average of five weeks for Group I subjects. Group II post-refractions showed greater fluctuations of sphere, cylinder, and axis than did the post-refractions of Group I. As a result, Group II subjects had significant decreases in acuity (ranging from 20/30 to 20/70) during the corneal restabilization program. In the over-refractions, the cylinder ranged from 1.00 D to 4.00 D. Because of their variable refractions and acuities, the subjects in this group had difficulty in tasks requiring quick visual performance, and in most cases they experienced poorer performance in both their occupational and home environments. (The experimenters attempted to fit these subjects with
toric hydrogel lenses during the restabilization period, but it was difficult to get the toric lenses to orient properly because the corneal curvatures were so variable. Another problem was that by the time lenses arrived from the lab, corneal toricity had changed so much that the lenses no longer fit.)

As a whole, the time required for Group II to attain corneal stabilization averaged 12 weeks, but the range was from 8 to 23 weeks. Very few lens changes were made during the first three weeks of restabilization with the hydrogels because the post-refractions were too variable to meet the fitting criteria. After three weeks, it was possible to make lens changes to meet the needs of the changing corneas.

Only one subject in Group II felt that he had acceptable vision with the hydrogel lenses. However, none of the subjects decided to stay with hydrogels following their corneal restabilization. They were fitted with gas-permeable hard lenses (Polycon) at the end of the study.

Group III consisted of three subjects who were unable to gain satisfactory visual acuity from the hydrogels. The unsatisfactory visual acuity was due to the extreme refractive fluctuations that they experienced during the first week of lens withdrawal. After one week they discontinued the use of their hydrogel lenses and wore either no correction or spectacle correction until corneal restabilization was complete. Hydrogel lenses did not prove to be a viable remedial program for these subjects. Following restabilization they were fitted with gas-permeable hard lenses (Polycon) to mask the corneal toricity and to "provide a superior physiological environment for the cornea."?

Although the three groups did vary in the amount of corneal deformation and fluctuation, they all appeared to follow a similar pattern of change in keratometry measurements. All subjects showed a slight increase in delta 'K' and a steepening of the flattest corneal meridian at stabilization. This was
expected since Rengstorff\textsuperscript{2-4} found that hard contact lens withdrawal usually results in more with-the-rule astigmatism (an increase in delta 'K') and an initial flattening followed by a steepening of the cornea.

All three groups also showed an improvement in the quality of the keratometry mires after restabilization. This was an informal indication that corneal stabilization was taking place.

CONCLUSION

It appears from this study that the use of hydrogel contact lenses for corneal restabilization may be a viable, if a somewhat limited, option for the eye care practitioner. The main difficulty with using the hydrogel lenses appears to be in finding a fit that would be appropriate for corneas with severe deformation (induced astigmatism) and/or constantly changing corneal toricity. It was found that hydrogel lenses work best if the induced astigmatism is not too severe and if the patient can tolerate a less than ideal visual acuity for the number of weeks that it takes for his cornea to stabilize.

It is possible that corneal restabilization may be better effected by using Polycon lenses for patients who have greater than 1.00 D of induced astigmatism and who need sharp visual acuity during the restabilization process.

The eye care practitioner continues to be faced with the problems of finding a restabilization program to meet the needs of his patients who wear hard contact lenses and show signs of corneal exhaustion. Whether the practitioner chooses to use hydrogel lenses, PMMA lenses, or gas-permeable hard lenses (CAB or Polycon) in a refitting program will depend on the amount of corneal deformation and the degree of visual acuity demanded by the patient. This study did show that for some patients the hydrogel lens can be a suitable alternative in the refitting program of corneal restabilization.


