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Effects of Improper Insertion of Hydrogel Contact Lenses

by

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March 31, 1990

ABSTRACT

Clinically, most practitioners emphasize the importance of proper hydrogel lens insertion and its correct orientation prior to insertion. The importance of <u>not</u> inserting the lens inside out is overemphasized at times. The "taco test" has been employed by many, yet this test is not always valid. The aim of this investigation is to determine whether or not wearing a hydrogel contact lens inside out has significant adverse affects on the fit, visual acuity, or patient comfort.

INTRODUCTION

Teaching patients how to determine proper hydrogel lens orientation is often emphasized during insertion and removal instructions. The "taco test" is one method being utilized to determine whether a lens is inside out. It consist of holding the lens between the thumb and forefinger. The edges should point inward when squeezed, causing the lens to take on a "taco" appearance. Another method is to place the hydrogel contact lens on the index finger. A right-side-out lens looks like a bowl, with the edges erect. Inside out lenses appear to have a lip formed by the edges bending downward. See figure 1.
The results of these methods are not always dependable for all hydrogel designs. Large lathed cut hydrogel lenses will not noticeably demonstrate a taco appearance when inverted. For example, Cibasofts will not show a noticeable edge difference when inverted. The lettering on the lenses (CIBA) is frequently used to determine proper orientation.

The purpose of this paper is to determine the effects of placing a hydrogel contact lens on the eye inside out. How does this effect centration, movement, visual acuity, and patient comfort? Contact lens literature states the following signs and symptoms of wearing hydrogel contact lens inside out:

1. Comfort decreases and edge sensation is apparent
2. Lenses may tend to fold on the eye
3. Lenses may drop to a low position on the eye
4. Lenses move excessively with a blink
5. Vision may decrease or fluctuate

Data was analyzed from 28 patients (or 55 eyes), wearing various hydrogel contact lens designs, with the hope of showing the adverse effects of wearing hydrogel contact lenses inside out.

FIGURE 1

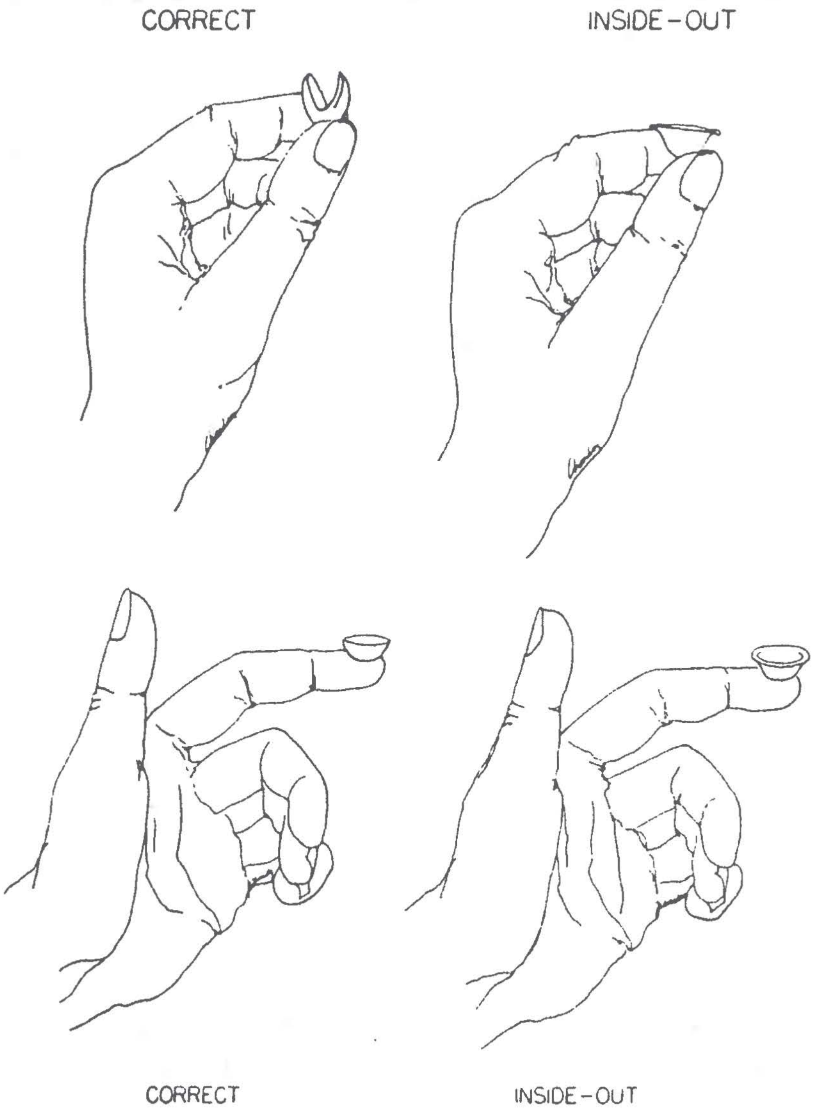


Figure 21.9. Examination to see whether the lens is turned inside out: (*a*) "taco test" – lens that is right side out has the edges pulled in when squeezed. Lens turned wrong side out has the edges pulled away. (*b*) Held on the end of the finger, a right-side-out lens looks like a bowl, with edges erect. An inside-out lens appears to have a lip formed by the edges' bending downward.

Description/methods

Patients (predominantly Optometry students) volunteered for this study being unaware of the purpose or design. Patients were advised to wear their lenses to the appointment and would be required to remove them during the study. The examiner would be re-inserting the lenses.

Snellen acuity was utilized to assess monocular distance visual acuity. Movement and centration were evaluated with biomicroscopy techniques. A 1mm round target was used as a reference to assess the movement and direct illumination was utilized to determine centration. Table 1 demonstrates the grading criteria and format used for the study.

TABLE 1

Visual Acuity:		Snellen (distance-20 ft.)
Patient Comfort:		Subjective and objective
	Grade 0	very comfortable
	1	comfortable
	2	minimum discomfort
	3	moderate discomfort
	4	extreme discomfort
Reflex tearing, blink rate, and patient reaction were utilized to determine objective patient comfort.		
Lens Fit:		
Movement:		
	Grade 1	1/2 mm or less
	2	1/2 to 1mm
	3	1.5 to 2mm
	4	greater than 2mm
Centration:		
	Grade 0	nasal (N)
	1	high (H)
	2	center (C)
	3	low (L)
	4	temporal (T)

Visual acuity, movement, centration, and comfort were assessed initially. The lenses were then removed by the patient or the examiner. Without the patients knowledge, the contact lenses were inverted and re-inserted by the examiner. Visual acuity, movement, and centration were re-assessed after five minutes of wearing the lenses inverted. Comfort was assessed immediately upon insertion and after the five minute interval.

PATIENT HISTORY/PROFILE

Records were compiled on 55 eyes wearing hydrogel contact lenses on a daily wear basis. All patients had to meet the "successful wearer" criteria in order to participate in the study. This consisted of having no contact lens complications for six months prior to the study, no corneal, lid, or conjunctival pathology, and must wear their present hydrogel contact lenses an average of eight hours per day. The lenses must be relatively clean and free of rips or tears.

TABLE 2 Patient Profile:28 subjects (55eyes)

Minimum of six months without hydrogel related complications

Allergies	yes	0	no	28	
GPC	yes	0	no	28	past history 4
Infiltrates	yes	1	no	27	past history 0

Note: one patient had a past history of monocular subepithelial infiltrates and corneal ulcer, therefore that eye was eliminated from the study.

TABLE 3 Contact Lens Data:

Disinfection:(number of patients)
- Thermal - 1
- AO Sept - 14
- Opti-free/Renu - 13

Lens Type:(number of hydrogel contact lenses)

Cibasoft - 27	Optima 38 - 4
New Vues (Ciba) - 4	B&L O4 - 2
Acuvues - 4	Optima toric - 2
WJ D3.X4 - 6	B&L U4 - 2
Hydron Z-4 - 2	Hydrocurve II - 2

Lens Power:(number of hydrogel contact lenses)

+.50 to +4.50	6
pl to -3.00	29
-3.25 to -6.00	18
-6.25 and greater	2

RESULTS

The data revealed unusual and unexpected results. There was little to no ocular irritation associated with inversion of the 28 Cibasoft lenses. The majority of Cibasofts tested demonstrated no significant changes in visual acuity, fit, or comfort when placed on the eye in an inverted fashion, irregardless of the power, base curve, or overall diameter. Unexpectedly, three out of fourteen Cibasoft patients (or 19% of the Cibasofts) arrived for their appointment wearing their lenses inside out without complications and unaware of their contact lens orientation. Only two out of the fourteen Cibasoft wearers (two eyes out of 27 - 7%) noticed minimum discomfort when wearing the lenses inside out. This discomfort was noted only monocularly by these patients, when comparing one eye to the other.

All other lenses involved in the study, including the Ciba disposables (NewVues), demonstrated adverse signs and symptoms, subjectively and objectively, when inverted. The most frequently observed adverse signs and symptoms of wearing a hydrogel contact lens inverted are listed in Table 4.

TABLE 4 Adverse signs and symptoms associated with wearing a hydrogel contact lens inverted.

1. Moderate discomfort to foreign body sensation
2. Increase awareness of lens edges
3. Increase in the edge lift
4. Fluctuating visual acuity proceeding a blink
5. Decrease in visual acuity-noticed less frequently than fluctuating vision
6. Poor centration-most lenses had a tendency to ride high (most likely due to the increase in edge lift)
7. Increase in lens movement
8. Insertion difficulties by the examiner Lenses had a tendency to fold and entrapment of air was common

CONCLUSION

With the exception of Cibasofts, the adverse effects of wearing an inverted hydrogel contact lens are clearly evident. Very few investigations and published literature is available on the effects of wearing a hydrogel inverted. Many interesting questions arose concerning the Cibasofts: What makes Cibasoft so unique? What contact lens parameters are being altered when inverting hydrogels? What role does lens thickness, power, or edge design play? How does Cibasoft's edge design differ from other hydrogels?

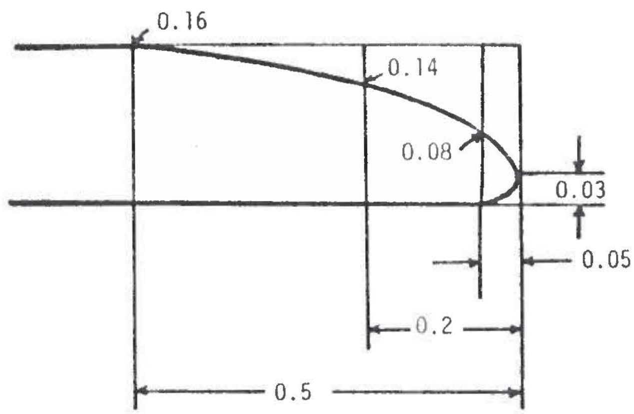
The answer to many of these questions are unknown. Studies conducted in the past have revealed the following hydrogel characteristics:

1. As edge lift increases hydrogels will decenter more, visual acuity decreases, and patient comfort increases.
2. Thicker lenses tend to move more and the edge thickness plays a minimum role in the overall movement of hydrogels.
3. A 1983 study states, "from a subjective response, edge thickness is not a major design criterion for hydrogel contact lens comfort and does not affect the centration and movement of the lens."
4. Another study states,"edge thickness is not a significant factor in lens centration. Overall diameter and base curve determine centration. Edge thickness plays a more significant role in lens movement."
5. Ideal edge as stated by Mandell See Figure 2
   Edge must be rounded and tapered with a wide-flat posterior contour to accommodate the scleral curvature.
6. Mandell also states,"due to the large diameter and minus power of most hydrogels, the edges are relatively thick. To alleviate this problem, use a second curve on the front surface to produce a lenticular design." See Figure 3

Figure 4 provides profiles of spincast and lathe cut edges by B&L.

From the data and literature gathered, along with the help of Ciba Vision, lens design appears to be the outstanding feature seperating Cibasofts from all other hydrogels. The tefilcon material enables Ciba to produce a very thin, flexible lens by a combination lathe/molded process. This produces a lens with two front surface curves (lenticular) with very thin edges. Center, junction, and edge thickness are under tight quality control and the thickness gradient from center to edge is kept at a minimum. The method of manufacture along with an advanced method of edge polishing creates a lens that has nearly parallel back and front surfaces. Due to this design, when a Cibasoft is inverted the radius of curvature does not change and the lens reacts as it would when right side out. Ciba vision has found that when the lens power increases, greater than a -4.50D or greater than a +3.50D, Cibasofts will begin to demonstrate adverse affects when inverted. As the power of Cibasofts increase the center and/or edge thickness increases, making it more difficult to stay within the desired tolerances.

Figure 2



Lens Edge Profile Defined By Mandell

Figure 3

Because of the large diameter of a gel contact lens, it is necessary to have a front bevel, even on lenses of low minus power.

Figure 4

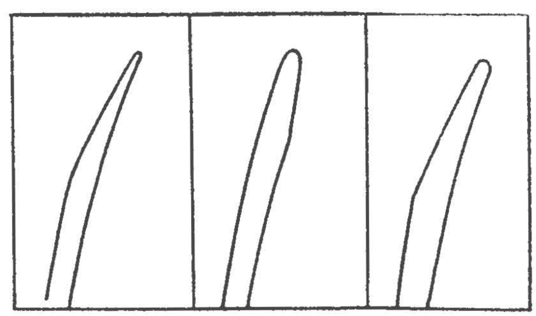


Figure 18.9. Profile of spin-cast edge for B & L series (*left*) compared to lathe-cut edges from B & L 58 (*center*) and B & L 70 (*right*).

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