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**ABSTRACT**

**Background:** Moisture chambers are prosthetic devices coupled to eyeglasses that slow the evaporation of the tears from the ocular surface. The need for moisture chamber glasses is most evident when a patient suffers from Sjögren's syndrome. This disease creates a pathologically dry eye from tear anomalies. Other ocular and systemic conditions can also cause a painfully dry eye.

**Methods:** The concept behind a moisture chamber is to significantly minimize the air flow over the ocular surface. The chamber provides a vapor barrier that functions passively to prevent tear evaporation. This is achieved by using a polyurethane plastic to produce a chamber contiguous with spectacles.

**Results:** The chamber provides a humid environment behind the eyeglass lens and in front of the eye surface. Before deciding to produce a moisture chamber, one should consider the extensive time consumption involved in the production of these facially contoured customized devices.

**Conclusions:** It may take 3–6 hours for a technician who has not previously made a moisture chamber to construct the first one. As the proficiency increases, one may be able to streamline the process to approximately 3 hours. This approach was investigated because of the paucity of available information about the production of moisture chamber glasses and the acute need and benefit by pathological dry eye patients for these special glasses.

**KEY WORDS:** moisture chamber, dry eyes, Sjogrens syndrome, keratoconjunctivitis sicca, eyeglasses

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# How to produce moisture chamber eyeglasses for the dry eye patient

Moisture chambers are a prosthetic device coupled to eyeglasses that slow the evaporation of the tears from the ocular surface.

The need for moisture glasses is most evident when a patient suffers from Sjogren's syndrome. This creates a pathologically dry eye due to tear film anomalies.[1–11] Other conditions can also cause a painfully dry eye.

The concept behind a moisture chamber is to significantly minimize the air flow over the ocular surface. It is a vapor barrier that functions passively to prevent tear layer evaporation. The chamber provides a humid environment behind the eyeglass lens and in front of the eye tissues.

## What to consider before starting

Before deciding to produce a moisture chamber, one should consider the extensive time consumption involved in the production of these facially contoured customized devices. It may take up to 6 hours for a skilled technician, optometrist, or optician who has not previously made a moisture chamber, to construct the first one. As the proficiency increases, one may be able to streamline the process to approximately 3 hours. Obviously, this requires significant fees for the services rendered.

This paper was written due to the paucity of available information about the efficient production of moisture chamber glasses and the acute need by a select population for these special glasses. Present papers in the ophthalmic literature describe techniques that are infeasible and border on the impossible, including wax molds of the face used as templates for chamber contour.[12–14] One paper was found to be closer to our design.[15] Due to the scarcity of providers of this device, individuals have come from all over the nation to the office for them. (Dr. Hart's office is in Hicksville, NY).

## Materials

### How to select the frames and lenses

Select a high quality lightweight metal frame that does not extend significantly past the temporal portion of the orbital rim. One should avoid aluminum frames and universal, unifit or keyhole types of bridges because the frame must be adjustable. Do not use frames with squared or exaggerated corners; the frame should not have unusual edges and curves (geometric shapes). In general, the rounder the shape the better.

The outer frame dimensions should extend approximately so as to be flush with the temporal portion of the orbital rim.

The lens must be plastic. Plus lenses should have a 1mm edge. If the lens is too thick, the weight can induce a major problem because slippage will destroy the seal between the chamber and the flesh. If the lens is too thin, it will cause lens warping, and the plastic barrier

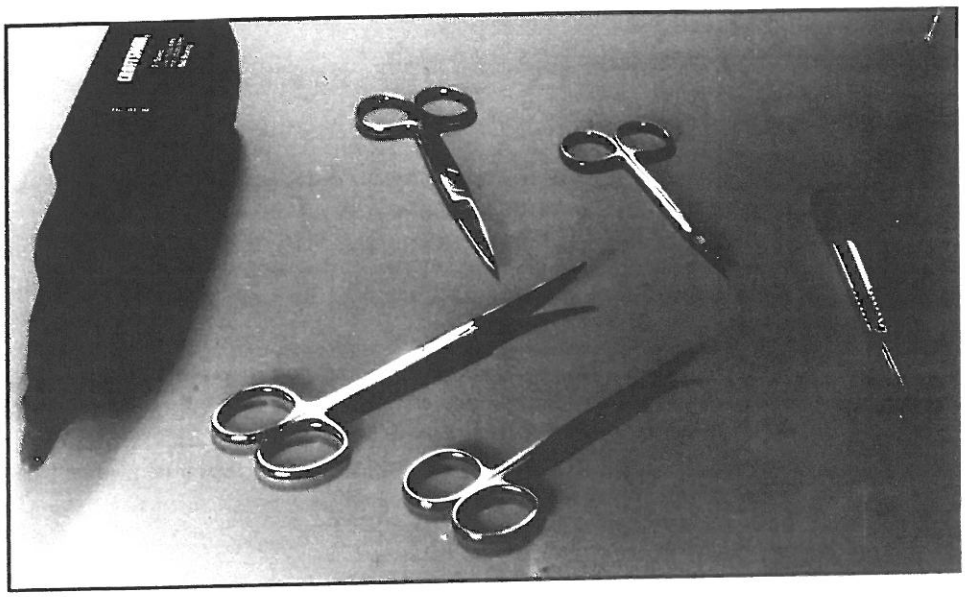


**Figure 1: Curved scissors and a hand held rechargeable drill are used in the customized production of the moisture chambers.**

of the chamber will separate from the frame, necessitating a costly and time consuming repair.

Minus lenses should be of minimal (1.2mm center) thickness (if your laboratory will make the lens). High index lenses, when appropriate, are advisable.

### How to determine the optimal chamber plastic

Several thicknesses of polyurethane plastic were evaluated and the type favored for comfort and durability was 10 mil (10/1000 inch). This chamber material should be medical grade material in a manner compliant with Good Manufacturing Practices as listed in the Code of Federal Regulations. The advantages of this material were that it was flexible enough to ease construction as well as providing maximal patient comfort.

Precut chambers were found to make construction more difficult. Kinking and getting the plastic in straight were the biggest problems. Aligning the material between the frame and lens became easier when we adapted the procedures described below.

### How to have the right tools and instruments for the task at hand

A two speed Craftsman™ rechargeable minidrill rotary tool[a] is used (Fig. 1). Medium grit parabolic-shaped abrasive wheels are used to smooth the edge after trimming so that contact areas do not cause facial irritation.

A scalpel size #21[b] is used to cut out and trim excess materials flush with the frame and lens on the front of the glasses.

Curved tip and straight tip operating[b] and iris scissors[b] are essential (Fig. 1). The contour of the panel is a complex curve, and it is frequently difficult to manipulate the scissors.

## Method

### How to put the pieces together and make the moisture chamber eyewear device

1. Select the proper frame.
2. Prepare the lens and insert into the frame.
3. Evaluate the lens fit in the frame.
   Before starting the fabrication of a moisture chamber, be sure that the patient is satisfied with the tint, alignment, bifocal location, and prescription.
4. Modify the lens for the moisture chamber panels.
   Once the eyeglasses are deemed satisfactory the frame screws are discarded and the lenses are modified (Fig. 2). The lenses should be reduced in diameter by 0.25mm to accommodate the thickness of the panel to be placed between the lens and eyewire groove.
5. Panel Construction.
   5a. To make one of the necessary two panels, cut a rectangle of plastic material approximately 90mm long by 250mm wide.[c] The 90mm is for the anterior to posterior portion; the 250mm is to approximate the lens circumference. Place a hash mark on the lens (Fig. 3a) and roll it along the precut material one complete rotation (Fig. 3b). This length should be marked off and 2mm less than this dimension should be the outcoming cylinder's dimension. These cuts should be made with a metal ruler scalpel so that the edges are straight and square. Roll the panel into a cylinder, tape it with cellophane tape and insert the lens into the cylinder (Fig. 4). The junction of the ends of the material should be placed at the nasal portion of the lens.

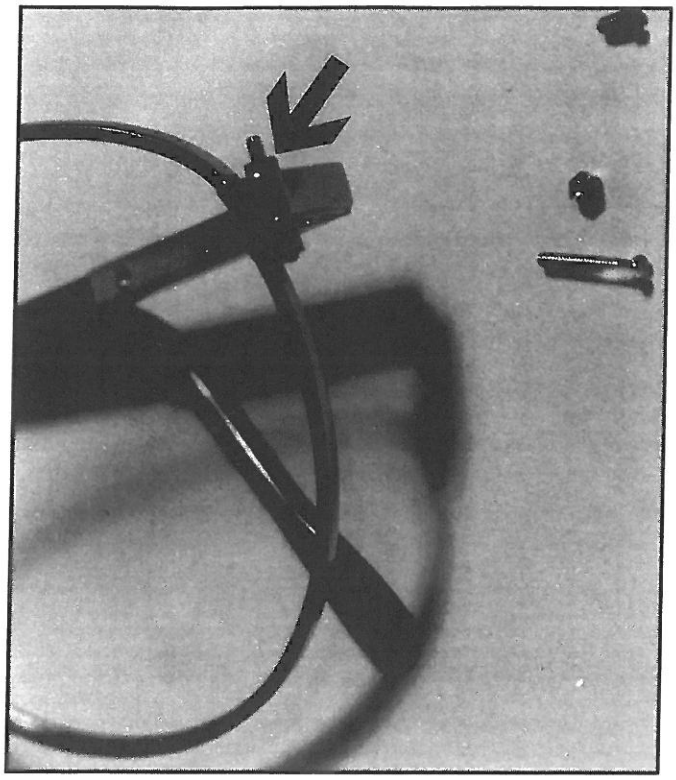
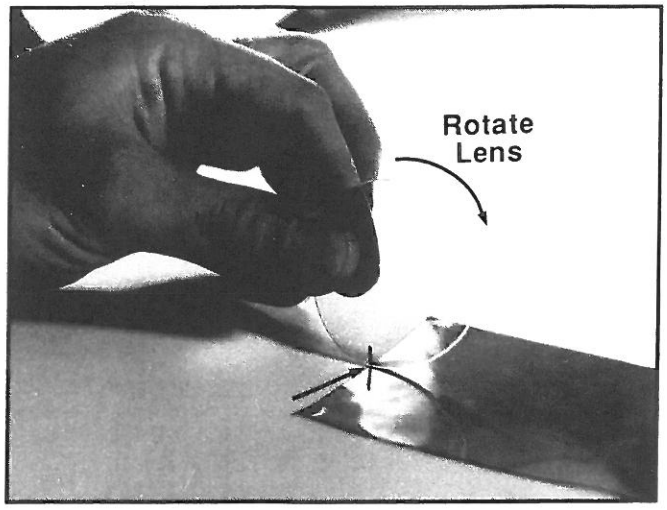


**Figure 2: The eyewear is shown prepared with a hex nut placed on the screw to avoid loosening (arrow). If the chamber falls apart one is at the very beginning of construction again. It is almost impossible to repair a chamber which has dislocated. An alternate method is to take a longer screw and peen it after clipping the screw to size.**



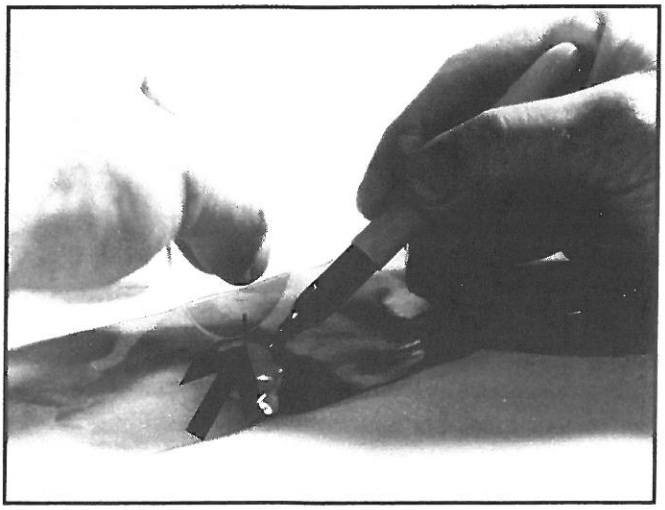



**Figure 3a: and b The properly sized and cut lens is rotated along its entire circumference. To determine when the lens has made one full rotation, a mark (arrow in 3a) is placed on the lens and the lens is rotated on the chamber material. At the end of a rotation, the chamber plastic is marked (arrow) as to where it should be cut in 3b. In a wagon wheel rotation motion, the measurement is made as to the length of plastic needed to go around the lens.**

5b. Align the lens within the chamber cylinder to approximate the proper face form, temple alignment, and pantoscopic tilt of the frame eyewire.

5c. Insert this composite into the frame (Fig. 5). The lens axis should be aligned. The screw used to close the eyewire is a rimless screw with a nut or an extra long screw clipped off at the end after tightening. It is important that the screw does not loosen with usage; therefore peen the end and also apply some adhesive or clear nail polish to the end of the screw. Inserting the panel is perhaps the toughest procedure of the process. The reason for this is that most patients scrutinize the finished product. Kinks and dimples in the chamber are inevitable; however, these can be minimized with patience (Fig. 5).

5d. Trim away excess panel material from the anterior of the device using the scalpel (Fig. 6). Care must be taken to avoid damaging the lens and frame (not to mention our own fingers—careful)! The trimmed cylinder must be flush with the frame and inconspicuous, to maintain optimal cosmetic appearance.

The device is now ready to be contoured to the patient's face.

6. Fitting the moisture chambers to the patient's face.

6a. At this point the cylinder will seem much too deep. The excess material behind the frame must be cut away carefully, a small bit at a time, using the curved scissors. Too much plastic should not be removed at once or the chamber will have to be remade because of overaggressive removal of material.

6b. The patient will try on the frames a multitude of times. Each time the producer of the device will evaluate fit and then trim away a small piece of the panel with the curved scissors (Fig. 7). The final shape of the panel should match the

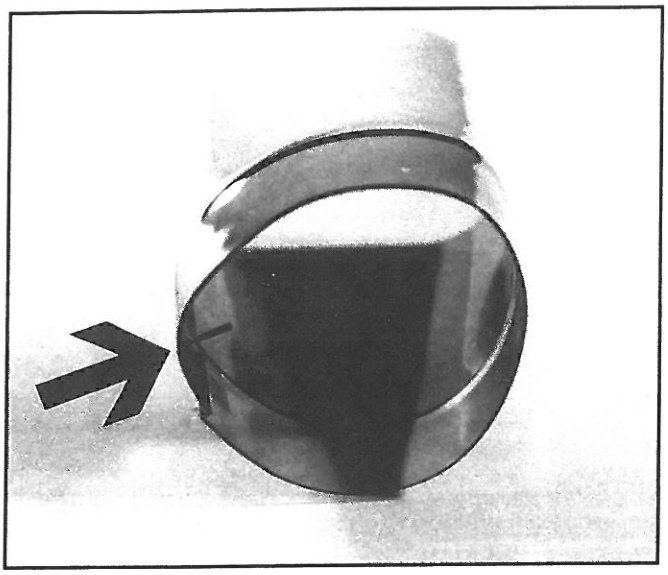


**Figure 4: The lens is inserted into a cylindrical panel keeping the seam (arrow) near the nasal contact point. Conventional cellophane tape is used to hold the cylinder together prior to chamber completion.**

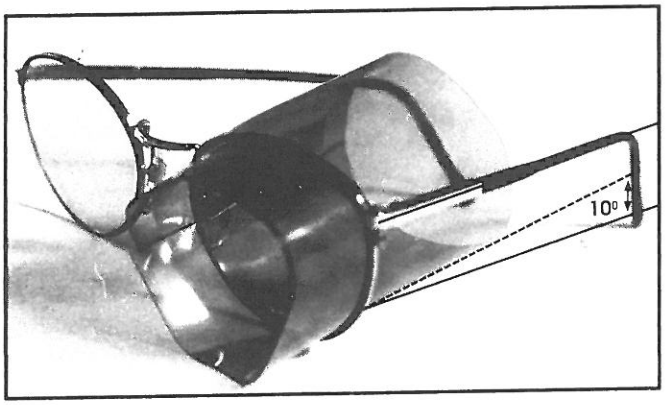



**Figure 5: The chamber is inserted into the frame. Note the minimization of kinks where the eyewire meets the chamber plastic. Adjustment of the glasses must be made to obtain the desired pantoscopic tilt.**

patient's facial contours and anatomy while relaxed (not smiling or talking). The goal is to have the plastic within a millimeter of the skin or a very slight touch. Remember, more chamber plastic can be removed at a later date; however, adding plastic requires redoing the entire half of the chamber. Pulling on the facial skin will reveal if the chamber plastic is touching the skin.

7. Smoothing the edges.

   Once the plastic is properly contoured, the edges must be smoothed. For rough smoothing, the minidrill with the abrasive stone is used (Fig. 8). Maintain caution to avoid unintentionally removing desired material or damaging the lens or frame. 300 grit wet/dry black sandpaper was used to burnish the edges after they have been worked on with the abrasive stone. Burnishing the contact edge between the plastic and skin on the patient's face is essential to provide patient comfort.

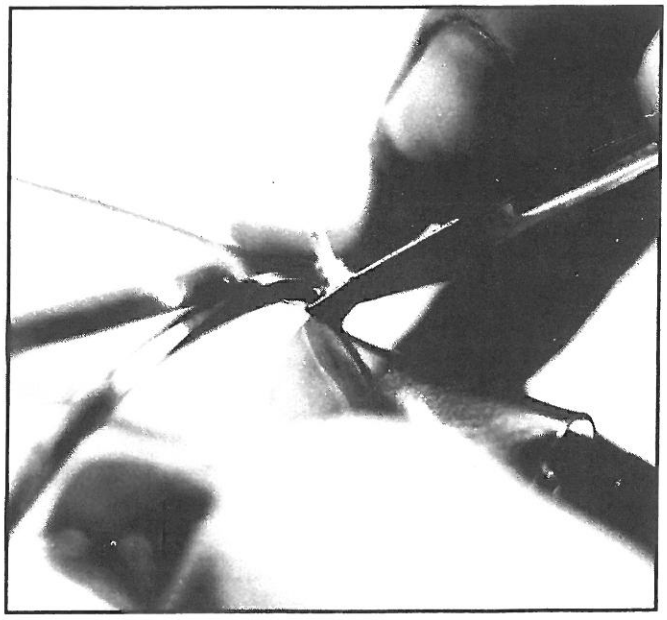


**Figure 6: Trim chamber at eyewire/lens margin. Maintain caution to avoid marring the lens and eyewire. A scalpel is the best instrument for this.**

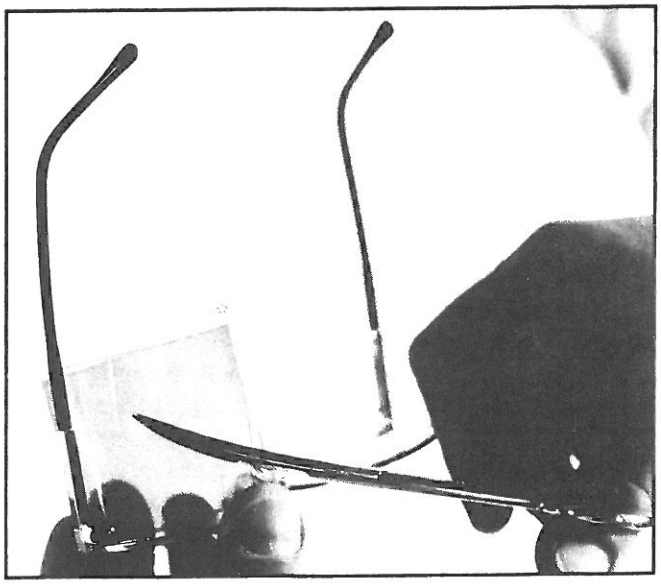


**Figure 7: To trim the plastic, maneuverable scissors are essential.**

## How to manage the flow in the office

Schedule patients at a slow time.

An eye care professional with an active practice cannot take the time necessary to make and fit the

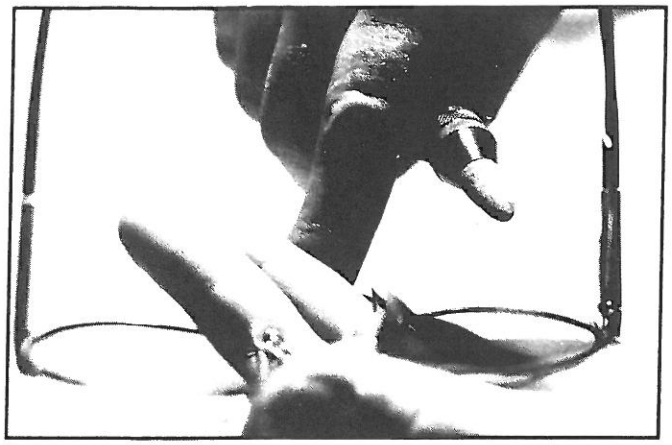


**Figure 8: Smoothing the panel is delicate work. Be careful not to slip with the drill.**

**Figure 9: Note that yellowing of the plastic is inevitable where there is contact with the skin (arrow). The yellowing is probably due to oxidation. The discoloration at the margins of the skin is due to contact with the skin and makeup.**

moisture chambers. Doctors may need to delegate the production of the device to the optician or technician. However, never rush the producer of the device. The device will not come out correctly without the key necessities–patience and ample time.

The patient's first visit is similar to an "ordinary" visit to purchase a new frame. Select a suitable frame, take the measurements, prescribe the lenses, and price the product. The eye care professional must estimate the fees based on 3 hours of work.

The second visit is brief. The patient must come in and check that the bifocal is correctly positioned, the lens tint acceptable, and other problems, if any, evaluated. The frame and lenses should be adjusted for a proper fit to the patient's facial features now. (note: minor facial swelling can result in changes in fit).

Between the second and third visits, the chamber should be completed (insert the lens in the frame with the chamber included) except for the contouring to the face (Fig. 5). Plenty of time should be allocated for this activity. It may take an hour and should be done when there is extra time. It should not be done in a rush.

The third visit is the longest. The chamber is contoured to the face. This may take 2 hours. Sometimes too much is removed and too large a gap remains, requiring the chamber to be totally redone. Tell the patient to bring a lunch bag, a pair of glasses for reading and reading material to keep occupied while various aspects of chamber construction are being completed.

A follow-up visit may be necessary if any discomfort exists; additional trimming may be necessary. The edge will have to be resmoothed. This should take about a half hour. Nose pads, face form and pantoscopic tilt may be adjusted to achieve a tighter or looser fit.

### How to instruct the patient

1. Do not fold the temples.
2. When not wearing the device, place it in a holder or box that will hold the glasses.
3. Glasses may fog; however, ski stores sell antifog substances that may help minimize the problem. If fogging continues to be a problem, then another option is to permit more air circulation inside the chamber; however, the effectiveness, especially outside in a strong wind, is compromised to a variable extent.
4. Soap and water will clean moisture panels.
5. Over time, a yellowing of the plastic where it meets the face will occur (Fig. 9). The discoloring is to be expected and is irreversible ■

## References


1. Jones LT. The lacrimal secretory system and its treatment. Am J Ophthalmol 1966; 62:47–60.
2. Norn M. Pollution keratoconjunctivitis: a review. Acta Ophthalmol (Kbh) 1992; 70:269–73.
3. Farris RL, Gilbard JP, Stuchell RN, et al. Diagnostic tests in keratoconjunctivitis sicca. CLAO J 1983; 9:23–8.
4. Lucca JA, Nunez JN, Farris RL. A comparison of diagnostic tests for keratoconjunctivitis sicca: lactoplate, schirmer and tear osmolarity. CLAO J 1990; 16:109–12.
5. Farris RL, Stuchell RN, Nisengard R. Sjogren's syndrome and keratoconjunctivitis sicca. 1991; Cornea 10:207–9.
6. van Bijsterveld OP. Diagnosis and differential diagnosis of keratoconjunctivitis sicca associated with tear gland degeneration. Clin Exp Rheumatol 1990; 8(suppl 5):3–6.
7. Gifford SR, Puntenney I, Bellows J. Keratoconjunctivitis sicca. Arch Ophthalmol 1943; 30:9207–16.
8. de Roetth A. On the hypofunction of the lacrimal gland. Am J Ophthalmol 1941; 24:20–5.

9. Bruce GM. Keratoconjunctivitis sicca. Arch Ophthalmol 1941; 26:945–64.
10. Doughman DJ. Clinical tests. In: Holly FJ, Lemp MA eds. The preocular tear film and dry eye syndrome. Int Ophthal Clin, Boston: Little Brown, 1973, 199–217.
11. Balik J. The lacrimal fluid in keratoconjunctivitis sicca: a quantitative and qualitative investigation. Am J Ophthalmol 1952; 35:773–82.
12. Tautin FS, Hauser R, Ryan D, et al. Fabricating spectacles with a sectional facial moulage. Prosthetic Dent 1981; 45:183–5.
13. Savar DE. A new approach to ocular moisture chambers. J Pediatr Ophthalmol Strabismus 1978; 15:51–3.
14. Savar DE, Runacre P, Godfrey CM. Moisture chamber spectacles. A guide to their construction. Arch Ophthalmol 1979; 97:1347–8.
15. Davis RH, VanOrman EW. Making moisture-chamber spectacles. Am J Ophthalmol 1982; 94:256–7.

## Footnote

a. Rotary tool obtained from Sears, #61007 and the parabolic shape abrasive wheels were Sears, #25049.
b. The scalpel can be purchased from Henry Schein, Woodbury, New York, #780885. Curved tip and straight tip operating and iris scissors are Henry Schein #1005880 & #1008118 for curved and straight iris scissors, respectively and #1003874 & 1004549 for curved and straight operating scissors, respectively.
c. Since this manuscript was accepted for publication, Eagle Vision, Inc. has committed to providing precut sheets of polyurethane material suitable to produce moisture chamber spectacles in the manner presented in this text.
d. Personal communication from Kenneth Berk, OD, NYNY, March 1994.

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## Appendix A

### How to help your patients get reimbursed for this prosthetic device

A form letter of medical necessity for moisture chamber reimbursement. This will intermittently obtain third party reimbursement for the device.[d]

Your letterhead

Date:

To Whom It May Concern:

*Patient name* has been diagnosed to have keratoconjunctivitis sicca (diagnosis code 710.2) a dry eye condition that results from inadequate moistening of the eye with the tears. In order to preserve the moisture in the eye, a prosthetic device called moisture chamber spectacles are necessary (procedure code #V0370, special ophthalmic device). These custom-made spectacles have plastic side shields which enclose the eye and prevent excessive tear evaporation. This prosthetic device is considered a therapeutic device and is not just for vision correction.

Moisture chamber spectacles are considered a therapeutic device for keratoconjunctivitis sicca or dry eye which is a condition suffered by *Patient's name* .

Please afford our patient all the benefits to which he or she is entitled.

Sincerely,

*Dr. Your name*