

# Changes in keratometry following trabeculectomy

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## Abstract

The results of keratometry following trabeculectomy are presented. In contrast to the effects of wound gape after cataract extraction, trabeculectomy produces a reduction in the vertical corneal radius. An initial corresponding increase in horizontal radius is found immediately postoperatively, but this is not apparent by two and seven weeks after surgery. A possible explanation for these findings is proposed.

Corneal astigmatism following cataract extraction is now well recognised.<sup>1-4</sup> The aetiology is thought to be the result of wound compression or wound gape<sup>2,4</sup> and also may be related to the size of the incision.<sup>3</sup>

Since 1968<sup>5</sup> trabeculectomy has become the operation of choice for glaucoma. However, there have been no reports of its effects on astigmatism. I wish to present the findings of a study of the short-term changes in corneal curvature following trabeculectomy.

## Material and methods

Ten consecutive patients undergoing trabeculectomy were enrolled. There had been no previous ocular surgery to the eye studied. All gave verbal consent for this investigation.

Trabeculectomy was performed under either local or general anaesthesia. A limbal based conjunctival flap was raised and reflected forward. A square partial-thickness scleral flap (approximately 5×5 mm) was dissected towards the limbus, and a wedge of tissue was excised from beneath this. A peripheral iridectomy was performed, and the scleral flap was secured with either two or five 9/0 virgin silk sutures. The conjunctiva was closed with a continuous 6/0 catgut suture.

Keratometry readings were taken of the central cornea by means of the Allergan Humphrey autokeratometer. Both eyes were carefully aligned with reference to the markers on the headrest of the instrument, and the machine was focused according to the manufacturer's instructions. Readings were taken preoperatively, then at one and three days and two and seven weeks postoperatively. At the same

times the visual acuity and intraocular pressure were recorded.

To assess any variations that may have occurred because of technique three keratometry readings were also obtained from a control group – a baseline value and also readings at one and three days after the initial measurement. Again, these eyes were required to have had no previous surgery.

All postoperative keratometry readings were compared with the preoperative values by the paired *t* test. Results are given as mean (SD).

## Results

The 10 patients undergoing trabeculectomy consisted of five men and five women. Their mean age was 67.2 (7.4) years. All required drainage surgery for poorly controlled chronic open-angle glaucoma. One patient was unable to fixate on the alignment target of the keratometer on the first postoperative day but was otherwise able to complete this study. Therefore the number of subjects for the first postoperative day is nine, while it is 10 for all other times.

Table 1 shows the mean vertical and horizontal corneal radii (in mm) and the angle of the vertical meridian (in degrees) for the study group. The postoperative vertical radii are all significantly less than the preoperative value ( $p < 0.05$  at 1 day,  $p < 0.02$  at 3 days and 2 weeks, and  $p < 0.05$  at 7 weeks). The horizontal radii are greater than the preoperative reading at days 1 and 3 ( $p < 0.005$ ), but there is no significant difference between values at 2 or 7 weeks in comparison with those obtained preoperatively. The angle of the vertical meridian showed no postoperative change from the baseline reading.

Six patients had the scleral flap closed with two sutures and four with five sutures. Although these numbers are too small for meaningful statistical analysis, there did not appear to be any differences in either group's behaviour in comparison with that of the overall group.

There was no correlation between the keratometry readings and the intraocular pressure at each time interval. There was also no correlation between the final visual acuity and the change in both vertical and horizontal corneal radii. Since mydriatic drops were used over the first two weeks postoperatively, only the final visual acuity was compared with the preoperative value, and there was no significant difference.

The control group consisted of five patients

Table 1 Mean (SD) vertical and horizontal corneal radii (mm) and angle of vertical meridian (degrees) in the trabeculectomy group

	Vertical radius	Horizontal radius	Vertical angle
Preop.	7.71 (0.29)	7.73 (0.25)	95.0 (22.5)
1 Day	7.36 (0.52)	8.03 (0.32)	100.9 (13.3)
3 Days	7.43 (0.39)	8.06 (0.31)	91.9 (18.6)
2 Weeks	7.60 (0.33)	7.79 (0.33)	94.0 (16.9)
7 Weeks	7.53 (0.36)	7.72 (0.21)	102.4 (16.5)

Table 2 Mean (SD) vertical and horizontal corneal radii (mm) and angle of vertical meridian (degrees) in the control group

	Vertical radius	Horizontal radius	Vertical angle
Baseline	7.68 (0.27)	7.70 (0.19)	104.4 (32.1)
1 Day	7.68 (0.27)	7.69 (0.19)	110.8 (23.0)
3 Days	7.71 (0.27)	7.69 (0.21)	101.0 (31.9)

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(three women and two men) who were undergoing cataract extraction to the fellow eye. Their mean age was 68.4 (13.0) years. Table 2 shows the results for this group. There were no differences between any of these values in comparison with the baseline readings.

### Discussion

Wound gape following cataract extraction has been shown to produce an increase in the vertical corneal radius.<sup>2,4</sup> Since trabeculectomy also produces a form of wound gape, a similar change would be expected postoperatively. The surprising finding in this study was that there was in fact a reduction in the corneal radius in the vertical meridian.

An explanation for this difference in behaviour in comparison with cataract extraction may be the result of the partial-thickness scleral flap created during trabeculectomy. The wound gape that may follow cataract extraction is placed between sutures, with no more than conjunctiva over it. In trabeculectomy the surgically produced gap is overlaid by a scleral flap. This is capable of spreading any support from the sutures inserted into it over the whole of the wound gape. In cataract sections, however, any tension produced by the sutures is to either side of the site of wound gape, with little, if any, support given by the overlying conjunctiva. In addition the more posterior placement of the incision in trabeculectomy may also help to explain the observed difference in behaviour in comparison with cataract extraction.

This cannot be the entire explanation, as the reduction in corneal radius following cataract surgery has been shown to be the result of wound compression by overtight sutures.<sup>1,2,4</sup> However, as in this study, the scleral flap sutures in trabeculectomy are not usually inserted under undue tension.

The lack of any difference between scleral flaps sutured with two or five stitches suggests that this spreading of tension is the result of the scleral flap itself rather than the number of sutures, and it offers support for the above explanation. However, the numbers in these two subgroups are small.

The corresponding changes in the horizontal radii following trabeculectomy also suggest a

different mechanism of astigmatism from that after cataract extraction. In the present study there was a decrease in the vertical radius and an increase in the horizontal radius during the first three days postoperatively. However, at two and seven weeks postoperatively the change in the vertical radius was not accompanied by a corresponding change in the horizontal radius. A previous study of postcataract astigmatism found that 45.2% of cases showed a similar decrease in the vertical radius with an increase in the horizontal radius at one week.<sup>3</sup> However, by one month 42.2% showed an increase in vertical radius with a corresponding decrease in horizontal radius, whilst none had a decrease in vertical radius and increase in horizontal radius.

Although the changes in curvature affected the central cornea and achieved statistical significance, they were not reflected in any marked change in visual acuity by the end of the study. No assessment of the changes in refraction were made, but for the same reason these are unlikely to be of any major importance.

No noteworthy changes occurred in the control group, which suggests that the observed changes were not due to poor technique in the use of the autokeratometer.

In conclusion, the changes in corneal curvature after trabeculectomy do not appear to behave in the same manner as they do after cataract extraction. However, this is a small scale study, and further research is required to confirm these findings. In addition, long term studies are needed to investigate whether these changes continue to evolve, as has been shown to occur after cataract extraction.<sup>6</sup>

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