Fitting contact lenses after keratoplasty

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The treatment of keratoconus parallels the progression of the cone. At first spectacles may be satisfactory, but as the cone worsens corneal and, later, scleral contact lenses are required to maintain satisfactory vision. In the advanced stage, when a contact lens can no longer be tolerated or an adequate visual acuity cannot be attained, keratoplasty is indicated. Hopefully, this is the final solution, but often it is not. Even when a clear corneal graft results the patient may still require spectacles or contact lenses to achieve reasonable vision.

Usually the result of penetrating keratoplasty for keratoconus is favourable. Castroviejo (1966) stated that a transparent graft and functional improvement should be expected in 90 per cent of cases. In this paper the outcome in cases of keratoconus treated with penetrating keratoplasty at the contact lens department, Moorfields Eye Hospital, is reviewed.

Patients and methods

One hundred cases in which penetrating keratoplasty resulted in clear grafts were reviewed. Cases that had developed eye complications (10 per cent) and those that resulted in less than 6/18 vision were considered to be unsuccessful and were excluded from the study.

The keratoplasties were of 7 mm diameter in three-quarters of the cases and of 8 mm diameter in the remainder. The smaller graft was preferred but was used only if the cone could be completely excised and the line of incision would not pass through the pupillary area. There was no significant difference in the corneal astigmatism resulting from a 7 mm graft than that from an 8 mm graft, and there was no significant difference in the final visual acuities. The surgical technique was similar in all cases except for the method of suturing with Perlon monofilament nylon, which was used as a continuous suture in some cases and as a continuous suture in conjunction with four interrupted sutures in others. Interrupted sutures were removed between one and three months after operation, depending upon the amount of corneal vascularization and the patients' comfort. Continuous sutures were not removed before three months after operation.

All of the patients had worn contact lenses, mostly scleral lenses, before keratoplasty. The indication for a corneal graft was poor visual acuity (6/18 or less) in

40 per cent of cases and the inability to wear contact lenses owing to intolerance or insurmountable fitting problems in 60 per cent. Two-thirds of the patients were men and one-third were women. Contact lenses were fitted without hesitation after keratoplasty in cases that required them.

Results

The visual acuities attained in the 100 eyes are shown in Fig. 1. These acuities were those achieved with the visual aid preferred by the patient—spectacles, corneal contact lenses, scleral contact lenses, or no aid at all. Therefore they were not necessarily the best acuities attainable but were the best that the patients could accomplish for everyday use without undue discomfort. Forty-one patients preferred a corneal contact lens (Fig. 2). The types of lenses prescribed are shown in Table I.

The visual acuities attained by the various aids are shown in Table II.

FIG. 1 Visual acuities attained in 100 eyes after keratoplasty

FIG. 2 Visual aid preferred by the patient in 100 cases after keratoplasty

Discussion

Since most corneal grafts result in some corneal irregular astigmatism contact lenses are often required for satisfactory vision. They are also useful in the early postoperative period as a protective membrane, to compress or mould low rigidity grafts, or to realign grafts. Since the graft may take several months to become as rigid as the normal cornea splinting or moulding can start when the sutures are removed. Scleral shells are best for this purpose and they can be retained until the curvatures of the graft are consistent with good acuity. This technique is restricted to selected cases as neovascularization commonly results owing to the often poor ventilation. The scleral shells are prepared from an impression of the anterior segment of the eye obtained by injection technique. Refitting is necessary as the keratoplasty changes its contour or the operative oedema resolves. This method is particularly suitable for grafts that are proud of the host cornea or when tilting is excessive.

Soft contact lenses may be used for splinting, compression, or reducing ocular discomfort at an early stage, even before the sutures are removed. They can be worn constantly for several weeks without apparently affecting the nutrition or

respiration of the graft tissue. Several cases in this series were fitted with large, flat-fitting soft lenses (85 per cent water content) at the end of the graft operation. In a few cases soft lenses were fitted at a later stage to try to alleviate ocular discomfort and blepharospasm due to graft sutures.

The final astigmatism and visual acuity were not noticeably better in cases of splinting with soft lenses. In some cases the soft lenses had to be removed prematurely owing to undue discomfort, and they did not substantially relieve blepharospasm or ocular discomfort from sutures or epithelial oedema.

Contact lenses for optical reasons may be fitted at any time after the removal of sutures. Corneal lenses, in fact, may be satisfactorily fitted and be tolerated in the presence of continuous corneal suturing, although, of course, they should not be fitted until inflammation has resolved. Neovascularization in the host tissue is not a contraindication to fitting lenses. Corneal irregularity resulting from keratoplasty usually lessens during the few months after the removal of sutures. Therefore it is advantageous to await stable keratometry before fitting contact lenses. Corneal lenses should be tried first in all cases, but in general they are more satisfactory with large grafts or with smaller grafts when the alignment between graft and cornea is good. When alignment is poor or astigmatism is high a thin corneo-scleral lens may be necessary, but if there is gross irregularity of the cornea a scleral lens is probably required. A lens of fairly rigid soft material can be used when there is intolerance to hard material. Intolerance, however, is not usually a problem after keratoplasty as the eyes are less sensitive and also the patient is usually strongly motivated.

Owing to the variety of the problems encountered the procedure for fitting corneal lenses after keratoplasty must be flexible and imaginative (Ruben, 1975). The cases with a fair degree of astigmatism, and therefore the more difficult to fit, are usually those that require contact lenses. Other problems in addition to the astigmatism often make fitting difficult. These may include poor alignment of the graft, protrusion of the graft, roughness of the graft-host junction, neovascularization and patches of oedema, and dry spots. Fitting must be by trial and error, which, unfortunately, may prove tedious and many lenses with various base curves and diameters may need to be tried. Often the trial-set lens fits the irregular corneal contour so poorly that an initial lens with the required modifications of the peripheral curves has to be ordered as a further trial lens.

In this series spherical lenses were fitted when possible regardless of the prevailing amount of astigmatism. A reasonable lens to start with is

Table I *Types of corneal lens prescribed in 41 cases after keratoplasty*

Type of lens	No. of cases
C ₄ -toric periphery	2
C ₄	4
C ₃ -toric periphery	5
C ₃	15
C ₂ -toric periphery	4
C ₂	—
C ₁	1
Offset	8
C ₂ -bitoric	2
Total	41

Table II *Visual acuities attained with various aids in 100 eyes after keratoplasty*

Visual aid	No. of eyes with visual acuity of				
	6/18	6/12	6/9	6/6	6/5
Unaided	—	—	1	1	—
Glasses	—	4	13	9	5
Corneal lens	4	7	11	14	5
Scleral lens	2	6	9	5	2
Soft lens	—	—	2	—	—

one with a base curve the same as the mean keratometry reading and of 9 mm overall diameter. All the lenses in this series were larger than the grafts. Lenses smaller than the grafts can be fitted but, owing to their small size, they are usually unstable and uncomfortable. Small lenses may also damage the graft-host junction, which is usually slightly raised. A larger lens rides with its edge outside the graft. The major problems in fitting lenses after keratoplasty are: difficulty in achieving stabilization in an acceptable position; difficulty in preventing the lid from flicking the lens out, especially with protuberant grafts; and the need to avoid problem areas.

When fitting, the lens should stabilize between blinks to a position over the graft. The optimal position is where the lens edge is furthest from potential trouble spots, which include the graft-host junction and areas of neovascularization, marked irregularity, oedema and scars around suture tracts, and chronic punctate staining. Obviously, compromises must be made to achieve the best fit and at the same time to avoid the trouble spots. In trying to stabilize the lens the usual basic principles apply, such as that steepening the base curve or increasing the diameter will increase the attraction of the lens for the cornea. The irregular surface of the cornea in these cases reduces the lens-cornea attraction and a larger lens is required to compensate for the loss in stability. However, the corneal irregularities allow an improved tear exchange and so larger lenses can be accepted more easily. Lenses with toric back surfaces are often needed to obtain the desired positioning and stability. Care must be taken to ensure that the edge lift is not too great, especially with proud grafts, in order to prevent the lens from being flicked out with the lid.

These patients may wear corneal lenses for up to 15 hours daily, preferably with a mid-day break, but they should be fairly closely watched since the usual warning symptoms of an ill-fitting lens are not normally felt after a keratoplasty. The lenses often need to be modified or changed frequently to overcome various problems that arise, especially in association with trouble spots already listed. The keratometry is also likely to change over the year or so after grafting. The two main complications that arise are neovascularization and oedema at the graft-host junction.

A wide range of lens types are required to satisfy the various criteria for the different eyes. In this series the tricurve spherical lens was used

in 15 cases and the offset lens in eight (Table I). Toric peripheral curves were required in 13 lenses, two of these being bitoric. The toric peripheral curves were necessary to attain stabilization in the correct position by obtaining a better lens-cornea relationship than was possible with spherical curves. The overall diameter of nearly all the corneal lenses fitted in this series was between 9 and 9.5 mm and the centre thickness was 0.1 mm.

When irregularities of the cornea after keratoplasty are gross a corneal lens may be impossible to fit or the resulting visual acuity may be unsatisfactory. A fenestrated scleral lens is then indicated. Because of the toric cornea too large an air bubble often forms under these lenses and interferes with tear exchange or obscures vision. In these cases flush-fitting or channelled scleral lenses should be supplied.

Soft lenses may be used to improve the visual acuity after keratoplasty, and they are especially useful for patients who cannot tolerate hard lenses. The results are usually disappointing owing to the residual astigmatism, but this can be reduced by using the more rigid soft materials. Supplementary spectacles with the appropriate cylindrical lens can be used with the soft lenses to correct the residual astigmatism. In this series two patients settled for soft lens correction and both achieved 6/9 vision. One patient required supplementary spectacles and the other did not.

Summary

Even when a clear corneal graft results from keratoplasty spectacles or contact lenses may still be needed for reasonable vision. In a series of patients treated at the contact lens department, Moorfields Eye Hospital, a transparent graft and functional improvement resulted in about 90 per cent of cases. One hundred of these successful cases are reviewed and the problems of achieving a reasonable visual acuity for the patients discussed. Of those who needed a visual aid 41 preferred a corneal contact lens. The particular difficulties of fitting these are reviewed and the need for a flexible procedure to meet the varying circumstances emphasized. The methods adopted in the cases under review are described. In the 100 eyes visual acuities of 6/6 were attained in 29, 6/9 in 36, and 6/12 in 17.

I am grateful to Mr M. Ruben of Moorfields Eye Hospital for kindly allowing me to report on patients under his care.

References

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