ON ADVISING A CORNEAL GRAFT*

BY

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The development of corneal transplantation both experimentally and clinically has advanced rapidly in the present century, and particularly in the last 30 years. It has now become established as a practical procedure which can be applied to many of those whose sight is defective owing to corneal opacities. It can also be useful in the treatment of certain eye diseases, especially those affecting the cornea. The demands for corneal donor material have made it necessary to establish eye banks, and by Act of Parliament the availability of donor eyes has been facilitated.

Corneal grafting has had a wide appeal and it quite often happens that a patient inquires whether his defective sight would be benefited by a corneal graft.

Some of the considerations to be kept in mind are here described, relating to the probable prognosis and the risks involved according to the favourability of the case.

Points in Examination

Examination of the eye may reveal densely white corneal opacities or considerable hazy opacity which might well account for very defective vision. One should, however, consider: (1) to what extent the corneal opacity could account for the defective sight; (2) what other conditions might be present to account for it; and (3) whether the eye is favourable or otherwise for a corneal graft.

Many conditions can contribute to defective sight even in the presence of corneal opacities. Chronic glaucoma is not infrequently found, and, in addition to estimating the tension of the eye, note should be made of the field of vision or the projection of light.

In some unfavourable cases with dense corneal opacities and adherent iris it may be difficult to estimate the field of vision, particularly if it is much restricted. Sometimes if one moves a light up and down in front of the eye the patient will say that the light is being switched on and off. This is a clear indication of extreme contraction of the field, and in such a case little benefit is possible from operation.

A patient, however, may desire to have a corneal graft while appreciating that his eye condition is unfavourable and that the prospect of improvement is very limited. Some, indeed, are grateful for very little improvement. On the other hand, some will expect too much from operation, and these should be guided by a reasonable estimation of the benefits that are likely to result and the risks that are involved. The general attitude of the patient is often one of optimism, but this is sometimes tempered with anxiety, and the disappointment of an unsuccessful operation may be keenly felt.

Quite frequently one has to advise a patient who has been blind or nearly blind from babyhood. In these cases there is, of course, a high degree of amblyopia. It is generally found that the patient has poor control over eye movements. There may be nystagmus, and inability to turn the eyes to look accurately in any given

direction. It is often also found that the patient moves his head so as to observe the shadows of objects moving across the eye.

This high degree of amblyopia is found in eyes that have suffered from perforating corneal ulcers in babyhood, and in many cases the iris is attached more or less extensively to the cornea. Clear grafts in such cases are difficult to obtain, and even with a clear graft the visual acuity would of necessity be poor, although it might be appreciated by the patient as giving him a new and interesting association with the world around him.

In one case of this kind, with a moderately clear graft, the patient, aged 33, became able to count fingers and to move about a room avoiding obstacles by seeing them. It is interesting, however, that when she was not being observed she reverted to her usual habit of feeling her way without visual aid.

In the case of an elderly patient there may be senile macular changes which would impair central vision and lead to disappointment if he expects to be able to read.

Many eyes with corneal opacities exhibit some other abnormality, and it is not infrequently found that a cataract is present which could not be seen through a densely opaque cornea. If such a condition is suspected the patient should be warned that it might be necessary to have a second operation some months after a successful corneal graft.

The chances of a successful result are influenced by many factors, and the favourability or otherwise of the eye itself, as well as that of the patient, must be considered.

Favourable Type of Patient

It is generally believed that a child under 14 years is an unfavourable patient, but many quite young children have proved to be very good patients, particularly when skilled and efficient nursing is brought to their aid.

It is nevertheless quite a problem to decide when to operate on a child with opaque corneae. If the operation is done in the first few years of life the risks are greater, but the longer the operation is delayed the greater the degree of amblyopia that will remain. If the corneal opacity affects only one eye and the other eye is normal, then amblyopia is in any case likely to result, and the question of operating can be deferred. If, however, vision is very defective in both eyes it is certainly desirable to operate as soon after 6 years of age as possible if there seems a reasonable chance of success. One patient of mine was only 2 years and 3 months when operated on. He was an extremely good patient and, although his eye condition was unfavourable, his own behaviour did not in any way prejudice the chances of success.

Unfavourable conditions of the patient include blepharospasm, photophobia, and lacrimation, although these symptoms can be lessened by medication or by injections of procaine-hydrochloride-alcohol into the orbicularis or into the orbit.

A highly nervous or extremely anxious patient is also an unfavourable type.

The totally deaf patient may be regarded as unfavourable, although my experience is that one can teach these patients to appreciate what is expected of them by simple signs communicated by touch, and a little time spent training them in this way before operating is well worth while. They usually co-operate intelligently and well when they know what is expected of them.

Eyes Suitable for Operation

Having considered the general favourability of the patient, we must consider the state of the eye itself, which is important in order to form an estimate of the possible result of operation.

*Read at the Section of Ophthalmology at the Joint Annual Meeting of the British Medical Association, Canadian Medical Association, and Ontario Medical Association, Toronto, 1955.

A favourable eye should have nothing much wrong with it except the corneal opacity. The extent of the opacity and its density, as well as the degree of vascularity, should be noted. The most favourable eyes have central opacities, or a more widespread opacity of mild or moderate degree, and there should be no more than slight vascularization. The tension of the eye should be normal, and there should be no adverse intraocular or extraocular condition. A conical cornea has proved to be a favourable type of eye to operate on, but the operation is usually reserved for severe cases in which other methods of treatment are not satisfactory.

Preliminary treatment by peritomy, keratectomy, or lamellar corneal grafting may be required for extensive and dense corneal opacities with epithelial degeneration, ulceration, or considerable vascularization.

Extraocular conditions which render an eye unfavourable include inefficient closure of the eyelids or undue exposure of the eye as in exophthalmos. There may be chronic conjunctivitis or scarring of the conjunctiva with irregularities of its surface. The conjunctiva may extend on to the cornea in the form of a false pterygium, or symblepharon, and such conditions are often found after burns or chemical injuries to the eye. Ectropion, entropion, and trichiasis are unfavourable conditions, and even one eyelash rubbing on the eye can do much harm to a corneal graft. Many of these conditions require preliminary operations, and much can be done to reduce the unfavourability of many of these eyes.

The eye may be unfavourable owing to intraocular conditions which may be difficult to diagnose with certainty in the presence of an opaque cornea. Sometimes oblique observation and illumination through a portion of clear cornea at the periphery may be possible, and through such an area a red reflex may be obtained which gives some information regarding the clarity of the media. In some cases of slight opacity of the cornea a careful trial with lenses may disclose a high degree of ametropia which when corrected may give the patient considerable improvement in vision. Much information about the state of the iris and pupil can be obtained by double transillumination in those eyes in which corneal opacity is dense.

Results are worse if the iris is adherent to the cornea, particularly if the adhesion is extensive, and it is better to deal with such anterior synechiae, if possible, by preliminary operation.

It is not always possible to tell whether a secondary cataract is present, although one can often determine whether the iris is bound down and fixed. It is reasonable to anticipate that a secondary cataract will be present in cases of severe injury, or where there has been much iritis or cyclitis, such as may happen in the case of a hypopyon ulcer of severe degree, and sometimes quite tough fibrous tissue is present between the cornea and the iris and lens. Unless it is certain that some such condition is present, it might be better to perform a corneal graft and note the condition of the lens, which may or may not require a future operation. If, however, it seems certain that the lens is opaque, one might decide to operate first of all for cataract, particularly if it is likely that the extraction will be difficult, and to postpone corneal grafting for some months, recognizing, however, that on the whole an operation on an aphakic eye is much less favourable than on an eye in which the lens is still present.

Any tendency to chronic glaucoma should be corrected, and one should note whether there is any tendency to attacks of cyclitis or iritis. In the presence of much corneal opacity it is often impossible to determine whether keratic precipitates are present, but if there is a history of recurrent pain and redness of the eye which cannot be accounted for by corneal ulceration or conjunctivitis it is very suggestive of the presence of an active iridocyclitis, and this tendency can react very unfavourably on a corneal graft.

Mild active foci of inflammation in a cornea have been found which are not evident on examination, and it has

been thought that these foci can account for opacity developing somewhat unexpectedly in a corneal graft. Their presence or absence cannot always be determined with certainty, but occasionally the history may show that the eye has been subject to mild attacks of inflammation, with some injection of the cornea, and possibly without active ulceration at the time. In such a case one would consider the possibility that this might be an unfavourable factor in relation to the clarity of a corneal graft.

Calcareous degeneration of the cornea has an adverse effect on the transparency of a graft, which may be apparent soon after operation, but in some cases produces its effect gradually over a period of months or years. In such a case it is well worth while removing any calcareous plaques and dealing as thoroughly as possible with the degenerate epithelium as a preliminary to corneal grafting.

Complications

Some risks have to be taken in most operations, and there are many possible complications that may occur after a corneal graft operation. Fortunately, our control of septic infection is now such that there is very little risk of complications due to infection.

Occasionally some unforeseen complication may occur during the operation, one of the worst being a prolapse of the lens through the wound in the cornea. This sometimes happens in eyes that are apparently quite favourable, and is associated with lack of rigidity in the sclera, so that the globe tends to collapse. Sometimes it may be found that the lens is absent, and vitreous may protrude through the corneal opening, an occurrence which is usually followed by the development of opacity on the posterior surface of the graft. Damage to the lens at operation may cause a cataract, but this does not often happen, and can in most cases be avoided by careful technique.

My own experience is that anterior synechia does not often occur in straightforward cases, although it is regarded as being a fairly common complication and tends to produce opacity in the graft, unless it is possible by operation or otherwise to free the iris.

In the weeks following operation such complications may occur as one of the sutures cutting out too early, leading to partial displacement of the graft, or the tension of the eye becoming increased, or a reaction taking place in the graft causing opacity and vascularization. In spite of these occurrences, it is often possible, with appropriate treatment, to prevent the graft becoming opaque.

A patient may well inquire about the permanency of the result if a clear graft is obtained. In uncomplicated cases he can be assured on this point, but it depends to some extent on the care with which the patient looks after his eyes. Protective glasses are an advantage, and so is an occasional inspection of the eyelids for the presence of any possible displaced lashes that may be rubbing on the eye. In many cases, however, the original condition of the eye has an influence not only on the immediate result but on the ultimate result of the graft. A very thick cornea may extend a film of connective tissue behind the graft in the weeks or months following operation. This tendency is commonly found in eyes that have suffered from hypopyon ulcer, where the cornea is often very thick. A rough cornea with calcareous degeneration of its epithelium tends to affect the graft in some cases, even after an initial success. An unfavourable condition also is a tendency to redness and conjunctivitis, which can easily produce superficial ulceration of a graft.

Possibilities of Other Operations

Before advising a corneal graft, one should consider whether an optical iridectomy may produce improvement in vision, and whether this relatively safe operation is preferable in certain circumstances. Furthermore, one should consider the possibility of utilizing a lamellar graft instead of a perforating graft.

Lamellar grafts offer a good prospect of success, and are applicable particularly to eyes in which the corneal opacity is fairly superficial. They should also be considered even in cases of more extensive and deeper opacity of the cornea, particularly if dealing with an only eye, or if there are unfavourable conditions such as aphakia, or if the patient himself is not a very favourable subject. Lamellar grafts can in suitable cases produce much improvement in vision, although one does not usually expect quite as perfect a result as one might get in a successful perforating graft.

It is usually considered that in corneal opacities caused by interstitial keratitis good results are obtained by corneal grafting, unless the opacity is extremely dense and vascular. Good results can also be obtained in circumscribed corneal opacities due to injury or ulceration, or following phlyctenular or rosacea keratitis.

However, one has to be more cautious in prognosis when dealing with opacities caused by thermal or chemical burns of the eye, or explosions, and this also applies to some cases of dense opacity following severe hypopyon ulcers, in which the cornea may be very thick, with the formation of a retrocorneal membrane. One would also be rather cautious in prognosis where the corneal opacity develops secondarily to cyclitis, because there are possible complications that will be encountered owing to the state of the iris and the lens, and possibly owing to the formation of a retrocorneal membrane.

There is a large group of cases classified as the hereditary dystrophies of the cornea, many of which do well by corneal grafting, the notable exception being Fuchs's dystrophy.

Prognosis

It is to be expected that a patient will want to have some idea of the prospects of operation in his case, and some generalizations have to be made, with modifications according to individual circumstances. The remarks that follow refer to circumscribed penetrating corneal grafts.

If the case is a favourable one it seems approximately correct to say that clear grafts should be obtained in about 60% to 70% of the cases, although in highly selected cases the percentage may be higher. In less favourable cases the percentage of clear grafts is about 50%. In the unfavourable group not more than about 10% may obtain clear grafts. This, however, does not mean that it is not worth operating in such cases, because a much higher percentage may derive considerable benefit and improved vision though the graft may be hazy or exhibit some scattered opacity.

The patient can be assured that in general there is little chance that he will lose his eye, although that may happen in some 2% of cases, particularly if one includes those who lose an eye some considerable time after operation, sometimes from causes not directly related to the grafting operation.

Figures relating to results in complete series of cases are not quite as helpful as those relating to groups of cases in various categories of favourability and unfavourability. Many surgeons have published their results relating to particular eye conditions—for example, conical cornea or corneal dystrophy—and they are a valuable guide in prognosis. For example, it appears from published reports that, in cases of conical cornea, clear grafts may be obtained in 70% to 90% of the cases, and in Groenouw's dystrophy clear grafts may be obtained in 60% to 80% of cases.

It is difficult to generalize on the probable results in burns and explosion injuries to the eye, because they vary so much individually, but it is evident that the results in these cases are nothing like as good, and the percentage of clear grafts would be low, although there may be many more cases in which vision is considerably improved thereby.

In a favourable case a clear graft may improve vision to 6/12 or better, but one cannot be certain of this beforehand, and it is well to consider whether the requirements of the patient would be met if this degree of perfection were not attained. Circumstances may make it advisable

to operate on a patient whose vision is 6/60, while in the case of another patient with similar vision it may be wiser to advise against operation.

One should consider the degree of handicap from which the patient suffers in the course of his ordinary life and in his employment. The possibility of becoming able to read may impel some patients to seek an operation even though there may be relatively little handicap in other ways. In other cases the desire to participate in sport or to be able to do clerical work for a living may be a strong incentive towards operation. One should be more cautious in advising operation if the patient has only one seeing eye, and particularly if that eye has some useful vision.

All such things have to be taken into account when advising a corneal graft, and the advantages and possible benefits have to be balanced against the risks and probabilities in individual cases, as well as the possibility of simpler measures that may be of assistance, such as an optical iridectomy or the wearing of a contact glass.

Much advance has been made in corneal grafting, safety measures have increased, and results are improving. Many cases, however, are still hopeless and much remains to be done. By preliminary treatment we can reduce vascularization and improve unfavourable conditions of the eye, and therapeutic agents such as cortisone assist in controlling undesirable inflammatory reaction. We can utilize a lamellar corneal graft, and, if need be, operate a second or a third time on the same eye.

A corneal graft can also be used as a method of treatment in some cases of chronic ulceration of the cornea. In obstinate chronic ulceration of a portion of the cornea it is often quite feasible to excise the ulcerated area and replace it by a lamellar corneal graft, thus relieving the patient of continuous distressing symptoms and perhaps also improving the visual acuity and usefulness of the eye.

Conclusion

Valuable work in transplantation of the cornea is being done over the world and a large volume of experience is accumulating in this relatively young but rapidly advancing field of ophthalmic surgery. In selected and favourable cases corneal grafting can be advised with a considerable degree of confidence, and even in the unfavourable cases there is often a reasonable probability of improvement to be expected, particularly in those cases where the patient has little useful vision and where even moderate success means that he is a little better off than before.

The American Heart Association has issued a warning statement on tobacco smoking in relation to heart disease. A committee appointed in 1954 reports: There is evidence that tobacco smoking is harmful in certain diseases of the peripheral blood vessels of the arms and legs. This harmful effect is demonstrated most clearly in thrombo-angiitis obliterans (Buerger's disease). It is known that this disease will usually continue to progress if the patient continues to smoke, and that it will usually become stationary or even improve if he stops smoking. If smoking is resumed the disease will usually become active again. A small percentage of persons with known disease of the coronary arteries will develop symptoms and will display signs detectable by laboratory tests when they smoke. Such people may be harmed by smoking. The committee believes that the available evidence is not sufficient to define the effect of tobacco smoking on the coronary arteries or on the heart itself, except in the small group mentioned who already have coronary artery disease. It is believed that if smoking plays any part in the causation of heart disease, it is only one of many factors. Much greater knowledge is needed before any conclusions can be drawn about relationships between smoking and increased death rates from coronary heart disease.