Reduction in endothelial cell density following cataract extraction and intraocular lens implantation

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SUMMARY Comparison of endothelial cell density by specular photomicroscopy of the right and left eyes after single eye surgery shows a similar reduction in endothelial cell density to that recorded between pre- and postoperative photographs in the operated eye. A review of 43 single-eye cataract extractions, with and without placement of a prepupillary intraocular lens, confirms that the major cause of endothelial cell loss is operative trauma to the endothelium. In our experience a cataract extraction with lens implantation but without endothelial contact produces no greater reduction in cell density than the cataract extraction alone.

Since the modification of specular microscopy for clinical use by Laing et al. and Bourne et al. many reports have been published on the reduction in endothelial cell (EC) density following surgery involving the anterior chamber. This research has mainly been carried out by comparing the EC density pre- and postoperatively in the operated eye. Sugar et al. reported on 83 patients who showed a reduction in EC density in the operated eye as compared with the unoperated fellow eye, but question the accuracy of this technique. We have compared the results from a group of patients studied by both methods.

Secondly, we report on a small group of patients studied by the retrospective method of comparing operated with unoperated eyes following intraocular cataract extraction with and without the incorporation of an intraocular lens.

Patients and methods

Fifteen patients had pre- and postoperative specular photomicroscopy of both eyes, and again at an interval of greater than 3 months (average 9.3 months) following single-eye surgery. Forty-three patients were studied who had undergone single-eye cataract surgery, 33 with and 10 without the incorporation of an intraocular lens. We calculated the difference in EC density between the operated and unoperated fellow eyes at an average of 16.7 months after surgery.

Three photographs were taken of each eye with the Heyer-Schulte corneal endothelial camera (Model HS CEM3), and the EC density was averaged for each eye from black-and-white enlargements.

The plan of surgery was identical in every case and performed by one surgeon (M.J.R.H). All patients were given general anaesthesia. A 2-plane 170° corneal incision was used. Two peripheral iridotomies were made, and all cases received alpha-chymotrypsin prior to intracapsular cryoextraction of the lens. Acetylcholine (Miochol) and air were used to reform the anterior chamber during closure.

In those cases with intraocular lens this was a wet-pack Binkhorst 4-loop lens (Rayner), placed obliquely, with a single iris stitch around the upper anterior loop. The wound was closed with a single preplaced 8/0 (0.4 metric) virgin silk and a continuous 10/0 (0.2 metric) polyamide suture. During closure air was used to maintain the anterior chamber. The air was then removed and replaced with balanced salt or acetylcysteine solution. Watertight closure was confirmed.

During the procedure any endothelial contact with the intraocular lens was recorded and coded as nil, brief contact with no rubbing, or prolonged contact, with or without a rubbing force being applied.

Results

The 15 patients who were photographed pre- and post-operatively showed a mean reduction of EC density of 16.9% (SD 4.6). The comparison between
the right and left eyes of this group of patients showed a reduction of 16.5% (SD 4.5). There is no significant difference between these results.

The 43 patients who were studied retrospectively were divided into the 4 groups and showed the reduction in EC density in the operated eye as set out in Table 1. This gives an overall reduction in EC density of 23.2% in the 33 patients with intraocular lenses.

Table 1  Results of operation

<table>
<thead>
<tr>
<th>Endothelial trauma</th>
<th>Number of patients</th>
<th>Mean EC density decrease</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract extraction</td>
<td>0</td>
<td>13.1</td>
<td>6.2</td>
</tr>
<tr>
<td>Cataract extraction with IOL</td>
<td>0</td>
<td>11.7</td>
<td>12</td>
</tr>
<tr>
<td>Brief</td>
<td>11</td>
<td>26.1</td>
<td>11.7</td>
</tr>
<tr>
<td>Prolonged</td>
<td>4</td>
<td>52.3</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Discussion

The similarity between results when comparing pre- and post-operative EC densities shows that the retrospective study of single-eye surgery and its effects on the endothelium is feasible. Retrospective studies should not be used in preference to prospective work, but this technique is the only method possible in the study of cases where pre-operative EC density measurements are not possible, for example, in the study of the effects of accidental corneal trauma.4-5

Our series of patients who underwent cataract extraction with intraocular lens gives a very similar result (23.2% drop in EC density overall) to the prospective studies as reviewed by Bourne et al.,6 which gave an overall reduction of EC density of 23.8% in 542 cases. The reduction of EC density related to endothelial trauma is comparable with the retrospective results of Sugar et al.3

Those cases in which there was no evidence at operation of endothelial damage during the intraocular lens insertion show a similar reduction of EC density to the cases where cataract extraction was performed without the intraocular lens. In the presence of endothelial contact with the implant for a short period, and where no rubbing force was applied, the reduction of EC density is greater, but still remains within levels compatible with long-term retention of endothelial function. It is with prolonged endothelial contact, and particularly where the lens is rubbed against the endothelium, that an unacceptably large reduction of EC density occurs.

It is apparent that the final decision as to the placement of the intraocular lens must be taken at surgery. If the anterior chamber will not deepen sufficiently for the surgeon to insert the lens without prolonged endothelial contact or rub, then the high levels of reduction of EC density, which can be expected, indicate that lens insertion should not proceed. This decision is especially difficult to make in a situation where an intraocular lens is most desirable, for example, in the presence of a high preoperative hypermetropic refractive error, or if the fellow eye is already functioning satisfactorily with an intraocular lens in situ. Protective agents such as sodium hyaluronate show promise in preventing endothelial cell loss in this situation.7

References