A comparison of 141 polymacon (Iogel) and 140 poly(methyl methacrylate) intraocular lens implants

K J Lowe, D L Easty

Abstract
In a prospective controlled trial 290 consecutive patients were randomly allocated a polymacon or a poly(methyl methacrylate) (PMMA) intraocular lens. Early Treatment of Diabetic Retinopathy Study (ETDRS) acuity charts gave similar results with both lenses. However Pelli-Robson contrast sensitivity charts gave a better result with PMMA lenses. Polymacon lenses appeared to remain free of any adhesions after implantation raising the question of long term stability. Four patients experienced problems related to this, three involved total lens dislocation. Seven patients developed early 'fibrin' membranes coating the polymacon lens, of which three were florid.

Current intraocular lenses are relatively safe and provide good visual results. Modifications, new designs, and/or materials appear frequently. New is not necessarily better and apparently useful properties may also have disadvantages.

Polymacon (polyhema) is known to be less damaging to the corneal endothelium and less likely to cause inflammation in the eye due to its hydrophilic nature. It is a flexible material allowing the lens to be folded. All previous reports mentioned refer to the PC12 (12 mm long) polymacon lens. Initial reviews of this lens have been favourable. There have however been several reports noting poor centration and even dislocation. Some concern was also expressed about the positioning of the lens in the eye though it was felt that placement in the bag would overcome this. A trial of several types of soft lenses including polymacon concluded that caution was necessary in recommending soft lenses at present.

The 1988 American Society of Cataract and Refractive Surgery (ASCRS) survey showed that PMMA was used by 95% of its members, only 2% used polymacon. A survey by the European Intraocular Lens Implant Council (EICIC) covering 14 countries showed that on average 98.2% used PMMA lenses and only 1.2% used polymacon. The use of polymacon lenses varied from 0–6% by country. However due to the low response rate and the limitations of the sample population this survey may not be representative.

We compared a one piece polymacon lens (Alcon Iogel PC1103, 11·3 mm long) with a standard PMMA posterior chamber lens with poly(propylene) loops (Pharmacia 150A J-LP UV).

Materials and method
A total of 290 patients were randomly allocated a polymacon or PMMA intraocular lens before being seen in a preoperative assessment clinic.

The operation was a standard endcapsular cataract extraction with planned 'in the bag' placement of the lens. All operations were performed by the same surgeon using posterior peribulbar anaesthesia. The only difference in operative technique between the two groups was the routine use of a viscoelastic material (Healon) with PMMA lenses. Lens placement was not routinely verified postoperatively.

Patients were reviewed at 2, 8, and 16 weeks postoperatively. ETDRS charts were used to measure acuity since they are easier to analyse for statistical purposes due to their regular progression in letter size and simple logarithmic scoring system. Visual results relate to acuity with spectacle correction if prescribed. However 40 patients in the polymacon group and 32 patients in the PMMA group chose not to wear spectacles for distance. Their uncorrected distance acuity is included since we felt this was a more realistic assessment of their everyday visual performance. Contrast sensitivity was also measured using the Pelli-Robson chart at 3 metres which gave further information on the quality of vision.

Results
Operations were performed on 290 consecutive patients. Three died and six defaulted leaving 141 patients in the polymacon group and 140 in the PMMA group at 16 weeks.

The composition of both groups was similar by age and sex. The PMMA group had a mean age of 73–59 years (SD 8·03) and a male to female ratio of 52:88. The polymacon group had a mean age of 73–11 years (SD 8·28) and a male to female ratio of 55:86.

In terms of ETDRS acuity results were similar particularly when patients with pre-existing pathology such as age-related maculopathy, diabetic maculopathy, and pathological myopia were excluded (Table 1). The PMMA group had a mean acuity of 0·26 (SD 0·14) and the polymacon group a mean acuity of 0·28 (SD 0·15). A t test comparing polymacon and PMMA groups showed no significant difference (p=0·14).

Excluding pre-existing pathology as before the PMMA group had a mean contrast sensitivity for the frequency range 3–5 cycles/degree of 1·21 (SD 0·22) (Table 2). The polymacon group had a mean of 1·12 (SD 0·23). A t test showed the PMMA group to be significantly better (p<0·0001).

A list of problems associated with both lens types is given in Table 3. Moderate and severe examples of a 'fibrin' membrane are shown in Figs 1 and 2.

Of the 141 polymacon and 140 PMMA lenses 15 and 13 respectively caused some difficulty
Table 1 ETDRS acuity is as good or better than increment\*  

<table>
<thead>
<tr>
<th>ETDRS (log)</th>
<th>PMMA All</th>
<th>Corrected</th>
<th>Polymacon All</th>
<th>Corrected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0 (6/6)</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>0-1 (6/6)</td>
<td>17</td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>0-2 (6/6)</td>
<td>38</td>
<td>38</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>0-3 (6/12)</td>
<td>33</td>
<td>33</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>0-4 (6/18)</td>
<td>18</td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>0-5 (6/24)</td>
<td>12</td>
<td>10</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>0-6 (6/24)</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>0-7</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>0-8</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>0-9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-0 (6/60)</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-1</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CF</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>PL</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>124</td>
<td>141</td>
<td>123</td>
</tr>
</tbody>
</table>

CF = counting fingers; PL = perception of light.
* Measured on an open ended logarithmic scale. Approximate Snellen acuity is given in brackets for comparison. Patients with pre-existing pathology are excluded in the corrected group.

during implantation. Three operations in the polymacon group and five in the PMMA group were considered technically difficult. It was not necessary to change the type of lens implant at operation. No capsules were ruptured in the polymacon group and three were ruptured in the PMMA group, but posterior chamber lens implantation was still possible.

Discussion

We were surprised to find a significant difference in contrast sensitivity. The visible transmission for polymacon lenses is 95% (manufacturer's figures). Polymacon lenses do have a slightly milky appearance when viewed by slit-lamp, which may be relevant. Further investigation of the contrast sensitivity function in patients with this type of lens is required. Resolution alone is no longer sufficient when considering the properties of an intraocular lens. A graph of the modulation transfer function of the lens would provide important additional information.

The incidence of Nd:YAG laser capsulotomy varies widely.\(^\text{11}\) The higher levels in this study reflect an increased tendency to treat based on reduced contrast sensitivity rather than acuity or appearance. Cases of wrinkling of the posterior lens membrane (PLM) were also treated early since this caused a reduction in contrast sensitivity.

Implantation of both lenses was straightforward under normal conditions. However the flexibility of the polymacon lens proved a disadvantage in a shallow anterior chamber. Contact between the lens and any surgical instrument resulted in displacement due to the high coefficient of friction of the material compared with PMMA. Postoperatively its flexibility can allow the lens to bow forwards rather than backwards as the capsular bag contracts leading to iris damage and pigment liberation which can be seen on the lens. Previous studies have shown an increased tendency for pigment liberation associated with polymacon lenses.\(^\text{12}\)

Although the groups are not large enough for...
statistical analysis of the complications the complete dislocation of three polymacon lenses is worrying. One lens dislocated 5 days after a YAG laser capsulotomy through a 4.5 mm gap. Similar occurrences have been reported. The other two began to dislocate 6 months after an apparently routine operation and follow up. One appeared to be outside the bag inferiorly and eroding through the zonules, the other had already dislocated into the vitreous when seen. In both cases the posterior capsule itself appeared intact. This problem has not been reported previously. Dislocation due to capsule rupture and due to unspecified causes have been reported. It has already been established that the haptics of this type of polymacon lens can escape from the capsular bag postoperatively. In one series of polymacon lenses three were placed in the eye despite capsule rupture without any short or long term problems. In another series a lens placed in an eye with a ruptured posterior capsule subsequently dislocated. A lens dislocation following ‘spontaneous’ capsule rupture 4 months after operation has also been described. Damage to the posterior capsule would, in the authors’ opinion, preclude the use of a polymacon lens due to the risk of subsequent dislocation. Capsulotomies should also be kept as small as practicable. The manufacturers of this lens recommend a minimum period of 90 days after operation before performing a capsulotomy.

Another difference is in the number of ‘fibrin’ membranes associated with the polymacon lens. These occurred between 3 and 7 days after operation. The patient’s eye appeared quiet with virtually no cells in the anterior chamber while the lens was coated by the membrane and posterior synechiae were evident. Although the membrane absorbed over a period of weeks the synechiae persisted. Three patients were distressed by a sudden decrease in vision. The authors have never encountered such reactions with PMMA lenses. The membrane associated with one PMMA lens in the trial was difficult to see, and was associated with typical signs of a mild anterior uveitis which did not affect the patient’s acuity. Mild fibrin reactions with polymacon have been noted before. In cats a monolayer of fibroblasts has been shown to coat the polymacon lens. Dislocation, though rare, makes these lenses impractical in their present form. It is also possible that movement could lead to a variation in refractive error. A flexible material has obvious advantages for small incision surgery. The hydrophilic surface may be more biocompatible with advantages for the corneal endothelium, healing and, indeed, if removal of the lens is necessary. Polymacon is also more resistant to YAG laser damage, though we did not find any obvious advantages regarding posterior capsule opacification which had been suggested.

In summary we have reservations about the modulation transfer function of polymacon in vivo and its association with ‘fibrin’ membranes. It may yet prove to be a useful material for the optic of a lens. However a material which becomes fixed in the eye would be more appropriate for the haptic since long term stability is essential for any intraocular lens.

A comparison of 141 polymacon (logel) and 140 poly(methyl methacrylate) intraocular lens implants.

K J Lowe and D L Easty

doi: 10.1136/bjo.76.2.88