SCLERAL REINFORCEMENT IN THE TREATMENT OF PATHOLOGIC MYOPIA

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Abstract
Pathologic myopia is a relatively common blinding condition for which current treatment is limited and controversial. Macular changes and vision loss proceed from the development of a posterior staphyloma.
A scleral reinforcement technique has been used in seven eyes of six patients. The procedure is technically uncomplicated and safe.
Key words: Pathologic myopia, scleral reinforcement.

Pathologic myopia is associated with abnormal axial lengthening of the eye accompanied by staphyloma formation.1 Of the commonest primary staphylomata, types I and II (Curtin) involve the macula. Degenerative changes occur at the macula, and subretinal neovascularisation can occur — this was seen in 41% of highly myopic eyes in one series.2 Frequently this occurs bilaterally1 and the visual prognosis is poor. People with pathologic myopia account for 10% of blindness registrants in the United Kingdom3 and pathologic myopia is a major cause of world blindness.4

The surgical management of pathologic myopia remains controversial.5,6 Scleral reinforcement is a rational method for increasing scleral resistance in myopic eyes with a posterior staphyloma4 and if applied prior to the development of maculopathy, may exert a protective effect.7,8 The operation is designed to prevent the progression of the staphyloma and not to improve refractive error.

MATERIALS AND METHODS
The ‘simplified’ scleral reinforcement technique described7,8 and demonstrated by Thompson was used in all cases. With the initial demonstration of the technique by Thompson on a single case, and after a two-year period of observation a further six eyes in five patients were operated on between 1985 and April 1986.

This technique involves the use of a strip of corneo-sclera from whole eyes (to obtain sufficient length). The strips are approximately 4 mm wide anteriorly and 8 mm wide over the widest segment, posteriorly. The donor eye is sectioned...
through the cornea horizontally from limbus to limbus. A curved 4 mm strip of cornea and sclera is then cut from just lateral to mid cornea posteriorly gently curving with the concavity medial, around the back of the eye close to or including the stump of the optic nerve. The double cut is then continued in a curve around the underside of the donor eye finishing to match the start of the strip in the upper cornea.

The operation is performed under general anaesthesia. A strip is placed vertically over the posterior pole. It is placed under the superior rectus, under the lateral rectus, behind the insertion of the inferior oblique and the global side of the inferior rectus. The strip is anchored to sclera, just nasal and posterior to the insertion of the superior rectus. It is placed accurately over the posterior pole, between the optic nerve and inferior oblique insertion and is then sutured to sclera, infero-nasal to the insertion of the inferior rectus. The strip is pulled firm against the globe and held under tension while being fixed by the anterior sutures.

Two modifications to Thompson’s method were made. Orbital CT scans were performed on all patients (Figure 1). This appears to be the best method for demonstrating a posterior staphyloma in this location. As Thompson has found, the peripheral extent of a staphyloma often slopes steeply and a small movement may result in a large change in axial length measurement as the ultrasonic beam strikes a different spot on the slope of the staphyloma. Secondly, Argon laser photocoagulation was used to apply a lateral macular crescent (Figure 2) prior to

*Figure 1: Orbital axial computed tomographic view from a patient with pathologic myopia showing a posterior staphyloma involving the macular region (left panel), as compared to a similar view of a normal left eye (right panel).*

*Figure 2: Fundus photograph of an eye with pathologic myopia showing a lateral macular crescent applied by argon laser photocoagulation.*
### TABLE 1
Case summaries

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Side</th>
<th>Axial length</th>
<th>Acuity</th>
<th>Refraction</th>
<th>Status of macula</th>
<th>Follow-up</th>
<th>Complications</th>
<th>Current acuity</th>
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<tr>
<td>1</td>
<td>17</td>
<td>R*</td>
<td>35 mm</td>
<td>6/12</td>
<td>-20.75/-1.0°</td>
<td>(R) disciform</td>
<td>6/18</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>L</td>
<td>35 mm</td>
<td>6/60</td>
<td>-22.0</td>
<td>(L) disciform</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>R*</td>
<td>28 mm</td>
<td>6/60</td>
<td>-11.25</td>
<td>(R) subfoveal disciform</td>
<td>10 months</td>
<td></td>
<td>6/60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L</td>
<td>28.1 mm</td>
<td>6/24</td>
<td>-12.25</td>
<td>(L) juxtafoveal disciform</td>
<td></td>
<td></td>
<td>6/24</td>
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<td>3</td>
<td>62</td>
<td>R*</td>
<td>29.5 mm</td>
<td>1/60</td>
<td>-15.5/-1.50°</td>
<td>chorioretinal atrophy</td>
<td>8 months</td>
<td>limitations of I.O. action</td>
<td>1/60</td>
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<tr>
<td></td>
<td></td>
<td>L</td>
<td>28.5 mm</td>
<td>6/18</td>
<td>-16.25/-1.25°</td>
<td>(R) amblyopia</td>
<td>9 months</td>
<td></td>
<td>6/60</td>
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<td></td>
<td></td>
<td>26.8 mm</td>
<td>6/36</td>
<td>-12.5/-4^44°</td>
<td>(R) lacquer cracks</td>
<td></td>
<td></td>
<td>6/60</td>
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<td></td>
<td></td>
<td>Twins</td>
<td>L 28.2 mm</td>
<td>6/60</td>
<td>-9.0/-0.5°</td>
<td>(L) macular disciform</td>
<td>8 months</td>
<td></td>
<td>6/9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>27.0 mm</td>
<td>6/12</td>
<td>-10.0/-3.50°</td>
<td>(R) staphyloma greater</td>
<td></td>
<td></td>
<td>6/9</td>
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<tr>
<td>5</td>
<td>15</td>
<td>R*</td>
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<td>6/9</td>
<td>-11.0/-3.50°</td>
<td>chorioretinal atrophy</td>
<td>8 months</td>
<td></td>
<td>6/36</td>
</tr>
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<td></td>
<td></td>
<td>L</td>
<td>33.4 mm</td>
<td>6/24</td>
<td>-19.0°</td>
<td>diplopia in lateral gaze</td>
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<td>I.O. restriction</td>
<td>6/12</td>
</tr>
<tr>
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<td>47</td>
<td>R*</td>
<td>31.4 mm</td>
<td>6/18</td>
<td>-24.0°</td>
<td>chorioretinal atrophy</td>
<td></td>
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Surgery. This is done in the hope that chorioretinal stretching will occur in the area lasered rather than the macula.

**ASSESSMENT AND INDICATIONS**

Assessment and indications for surgery were otherwise as described by Thompson. In assessing these cases we think the important factors are to:

1. establish whether the axial length of the staphyloma is progressive. This can be done best, we think, by serial CT scanning and ultrasound measures;
2. assess the state of the central retina for lacquer cracks, Foster Fuchs spots, and atrophy;
3. locate, as precisely as possible, the staphyloma to ensure that the scleral strip is likely to support it.

Currently, our indication for surgery is the presence of a progressive posterior staphyloma that is, or is likely to be, associated with macular damage in a position between the optic nerve and the insertion of the inferior oblique muscle.

**RESULTS**

The six cases are summarised in Table 1. The follow-up period is inadequate to report on the effectiveness of this procedure. Visual acuity remained stable (within two Snellen lines) in all cases. In cases 2, 4 and 5, visual acuity improved. Complications were few and did not threaten vision. Limitation of elevation due to inferior oblique disturbance was seen in two cases. There was no evidence of ocular vascular disturbance or further macular deterioration.

**DISCUSSION**

Recently, the efficacy of scleral reinforcement surgery has been called into question. Curtin, whose short-term results were favourable, has reported that after a minimum follow-up of five years 43% of (40) eyes were stable, whilst 57% had an increase in myopia of at least -1.0 diopter. Eventually, 74% of these eyes had some increase in myopia. There were also significant complications.

Thompson however, with a larger, also uncontrolled series, reported that in 175 eyes followed for over 12 months, greater than 90% had stabilisation of visual acuity and appearance of the posterior pole. Complications were minimal.

A larger trial reporting the results of 756 scleral reinforcement procedures was also
favourable. In 244 eyes followed for a mean of 6.8 years, myopia was stabilised.

A debate has since ensued\textsuperscript{11,12} in which the argument has concentrated on differences in surgical technique. The problem remains that controlled studies have never been performed to determine whether cessation of myopic deterioration has occurred spontaneously or in response to a particular event, such as scleral reinforcement.\textsuperscript{13} In fact, Spaeth\textsuperscript{13} has pointed out that this condition lends itself well to controlled observations as it is a bilateral, common disability and unresponsive to other present modes of therapy.

We found scleral reinforcement using the Thompson method to be a safe operation. As in larger series this procedure did not appear to damage retina or choroid. Assessment of the site and size of posterior staphylomata may best be demonstrated using CT scans.\textsuperscript{14,15} We are working to develop more precise methods of locating and quantifying the staphyloma. So far we have been impressed with the variation from patient to patient of the location, shape and size of the staphyloma. We are also developing techniques to more certainly locate the scleral support sling. There is a need for a controlled trial of scleral reinforcement treatment in the management of pathologic myopia.

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References