Clinical Results of a Scleral Fixation of the Posterior Chamber Intraocular Lens, through Sclerotomies, 1 mm Posterior to the Limbus

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The aim of this study was to evaluate the clinical outcomes of scleral fixation of a posterior chamber intraocular lens and an anterior vitrectomy through sclerotomies, 1 mm posterior to the limbus. The study comprised of seven eyes that required a scleral fixation. Sclerotomies, 1 mm posterior to the limbus, were performed using a 20G sclerotome at the 2 and 8 o’clock positions. Group 1 was defined as four eyes requiring scleral fixation of the secondary IOL (Intraocular lens), and group 2 as three eyes where dislocated IOLs were repositioned and fixed to the sclera via sclerotomy sites. In all the eyes, the knot of string (10-0 prolene®, W1713, Ethicon, USA) was buried. Postoperatively, the visual acuity was greatly improved, by more than 4 lines in the Snellen visual acuity chart, with the exception of one case of macular degeneration. The scleral fixation of the IOL through sclerotomies, 1 mm posterior to the limbus, had advantages in that the scleral fixation of the IOL could be achieved through sclerotomy sites, and the anterior vitrectomy parallel to the iris plane.

Key words: anterior vitrectomy, buried knots, IOL dislocation, sclerotomy, scleral fixation

INTRODUCTION

A scleral fixation of the IOL are required in cases of weak zonular or capsular support and of a IOL dislocation. The classical technique for a scleral fixation are usually performed 1 mm posterior to the limbus, and the IOL fixed to the sclera using needles, but with no scleral incision. When vitreous material prolapses, an anterior, or core, vitrectomy may be needed prior to the scleral fixation of the IOL. A classical pars plana three port vitrectomy should be performed in cases where the complete lens or IOL dislocation into vitreous cavity has occurred but in cases of a vitreous prolapse into the anterior chamber only, an anterior vitrectomy, through a limbal incision, could be carried out. However, the two techniques above are difficult in an anterior vitrectomy parallel to the iris plane. The authors performed an anterior vitrectomy, through sclerotomy sites, 1 mm posterior to the limbus, with the scleral fixation of the IOL through these sites, using instrumentation and sutures. The aim of this study was to confirm the usefulness of these surgical techniques.

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Table 1. Clinical presentations

<table>
<thead>
<tr>
<th>No</th>
<th>Age/Sex (years)</th>
<th>Cause of scleral fixation</th>
<th>Preop UCVA</th>
<th>Preop BCVA</th>
<th>Postop UCVA</th>
<th>Postop BCVA</th>
<th>Vitrectomy</th>
<th>Length of FU (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>77/F</td>
<td>ACL subluxation</td>
<td>0.15</td>
<td>0.15</td>
<td>0.4</td>
<td>0.6</td>
<td>Ant*</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>63/M</td>
<td>Aphakia due to ICCE 20 years ago</td>
<td>CF</td>
<td>0.9</td>
<td>0.7</td>
<td>1.0</td>
<td>Ant</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>69/M</td>
<td>Inadequate capsular support</td>
<td>0.01</td>
<td>0.01</td>
<td>0.2</td>
<td>0.2</td>
<td>Ant</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>92/M</td>
<td>Inadequate capsular support</td>
<td>HM</td>
<td>HM</td>
<td>0.2</td>
<td>0.7</td>
<td>PPV/Ant</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>84/F</td>
<td>IOL dislocation into vitreous cavity</td>
<td>0.02</td>
<td>0.02</td>
<td>0.7</td>
<td>0.9</td>
<td>PPV</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>79/M</td>
<td>IOL dislocation into vitreous cavity</td>
<td>HM</td>
<td>HM</td>
<td>0.1</td>
<td>0.7</td>
<td>PPV</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>46/M</td>
<td>IOL subluxation after Nd:YAG laser capsulotomy</td>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
<td>1.0</td>
<td>Ant</td>
<td>11</td>
</tr>
</tbody>
</table>

ACL: anterior chamber lens, CF: count fingers, FU: follow-up, HM: hand motions, ICCE: intracapsular cataract extraction, Preop UCVA: preoperative uncorrected visual acuity, Preop BCVA: preoperative best corrected visual acuity, Postop UCVA: postoperative uncorrected visual acuity, Postop BCVA: postoperative best corrected visual acuity, PPV: pars plana vitrectomy. *: anterior vitrectomy performed through the sclerotomies, 1mm posterior to the limbus.

MATERIALS AND METHODS

The study comprised of seven eyes that required a scleral fixation of the IOL, between November 2000 and January 2002. The male to female ratio was 5:2, and the ages of the subjects ranged from 46 to 92 years. According to the surgical technique, the patients were grouped into implantations of the secondary IOL, Group 1, and repositioning of a dislocated IOL, Group 2. The reasons for the scleral fixations were ACL subluxation and aphakia, due to ICCE and weak capsular support in group 1, and dislocation, or subluxation, of the IOL in group 2 (Table 1).

In group 1, an anterior vitrectomy was performed in all four eyes, through the sclerotomy sites, 1mm posterior to the limbus.

In group 2, a vitrectomy was performed in two eyes, were the IOL had become dislocated into the vitreous cavity following a cataract operation and pars plana three port vitrectomy. In one other eye, the IOL was subluxated after an Nd:YAG laser capsulotomy and an anterior vitrectomy through 2 limbal incisions. The visual acuity and biometry were checked two months postoperatively. The complications were reviewed, and the parameters compared with those obtained preoperatively.

Surgical techniques

The scleral fixations in group 1 were performed as follows. A limbal or clear corneal incision was made to a self-sealing wound at the 12 o’clock position, with a 3.0 mm keratome. The sclerotomy sites were made 1 mm posterior to the limbus, at the 2 and 8 o’clock positions, with a 20 gauge sclerotome (Fig. 1). In the cases requiring an anterior vitrectomy, a cutter was inserted through one of the sclerotomy site, with the infusion tip being inserted through another, the anterior vitreous material behind the iris was removed through these sclerotomy sites, maintaining a deep anterior chamber (Fig. 2). Through one of the sclerotomy site, a straight double-armed 10-0 polypropylene (prolene® W1713, Ethicon, U.S.A.) suture was passed behind the iris plane. Through the opposite sclerotomy site, a 27 gauge blunt needle was inserted, and where the two ends met, a 10-0 prolene® suture needle was
inserted, opposite the 27 gauge needle (Fig. 3). The Prolene® suture was passed out of the eyeball through the opposite sclerotomy site. McPherson forceps were inserted through the 12 o’clock limbal incision, and the prolene® suture pulled out of the anterior chamber, via the superior limbal incision, and the prolene® suture was then evenly cut. One haptic of the IOL was tied with a prolene® suture, and the IOL inserted through the superior limbal incision. The following haptic was located outside the superior limbal incision, tied with a prolene® suture on the opposite side and then inserted. The Prolene® suture needles coming out of the sclerotomy sites partially penetrated into one of the scleral edges, from inside to outside, with a vice versa penetration into the other scleral edge. The knots of string (Prolene®) were buried in the scleral groove, following the tying of the suture coming from the sclerotomy site (Fig. 4).

In group 2, the scleral fixation technique was as follows. A classical pars plana three port vitrectomy was performed. The sclerotomy sites were made 1mm posterior to the limbus, at the 2 and 8 o’clock positions, with a 20 gauge sclerotome. One haptic of the dislocated IOL was hooked with a prolene® loop through a 1mm sclerotomy site, and positioned into the ciliary sulcus (Fig. 5). This haptic of the IOL was fixed in the ciliary sulcus, and the sclerotomy
Fig. 5. Haptic was hooked with a Prolene® loop after a pars plana vitrectomy.

Fig. 6. Prolene® suture needle is inserted into the opposite 26 gauge needle, anteriorly to the haptic.

site closed with the same suture. The Prolene® sutures tied to the haptics of the IOL were fixed to the sclera, and then buried in the scleral groove, using the same technique as in group 1. The other haptic was fixed in the ciliary sulcus in the same way.

RESULTS

The preoperative uncorrected visual acuity ranged from hand motions to 0.6, which was increased greatly, ranging from 0.2 to 1.0, postoperatively. The visual acuity was greatly improved, by more than 4 lines in the Snellen visual acuity chart. In one eye, where the best postoperatively corrected visual acuity was 0.2, macular degeneration was thought to be the cause of the poor visual improvement (Table 1). During the follow-up period, the visual acuity was stable and the IOL remained centered, without tilting. The estimated spherical equivalents, on average, were $-0.21 \pm 0.26$ and $-1.03 \pm 1.14$ diopters pre- and postoperatively, respectively (Table 2). The postoperative estimated spherical equivalent were $-2.00 \pm 1.00$ and $-0.31 \pm 0.55$ diopters, on average, in groups 2 and 1, respectively, with the former group being more myopic than the latter (Table 2). This may be reasonable as the IOL in group 2, which was originally calculated as “in-the-bag IOL power”, shifted anteriorly during the scleral fixation procedure. On average, the postoperative anterior chamber depth was $3.71 \pm 0.30$ mm. The IOL was fixed and stable, with no IOL tilting or intraocular hemorrhage. Complications, such as conjunctival erosion, intraocular hemorrhage and endophthalmitis, were not found.

DISCUSSION

The posterior chamber IOL was inserted into lens capsule, but when difficulties arise they can be inserted into the ciliary sulcus. A scleral fixation of an IOL is required for a weak zonular or capsular support and with IOL dislocations.1-3 The surgical technique for the scleral fixation was as follows. The haptics of the IOL were inserted into the ciliary sulcus, and fixed to the sclera with prolene® sutures. The classical scleral fixation was performed 1mm posterior to the limbus, but the needle was passed through this site instead of through the scleral incision.4 The conditions requiring scleral fixation of the IOL were mostly complicated, such as a vitreous prolapse and lens remnant in the anterior chamber, due to a tear of the posterior lens capsule or poor zonular support.1-3 Various complications developed under the condition of a vitreous prolapse into the anterior chamber, where the prolapsed vitreous material hindered the stable positioning of the implanted IOL.10 Therefore, the vitreous and remnant lens material in the anterior chamber should be completely removed. An anterior vitrectomy was performed via a binuasal limbal approach, or the superior corneoscleral tunnel incision. With a vitrec-
Table 2. Preoperative and postoperative spherical equivalents

<table>
<thead>
<tr>
<th>No</th>
<th>Estimated spherical equivalent</th>
<th>Postoperative spherical equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.04D</td>
<td>0.50D</td>
</tr>
<tr>
<td>2</td>
<td>-0.63D</td>
<td>-0.50D</td>
</tr>
<tr>
<td>3</td>
<td>-0.49D</td>
<td>-0.75D</td>
</tr>
<tr>
<td>4</td>
<td>-0.05D</td>
<td>-0.50D</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>-0.28 ± 0.33D</td>
<td>-0.31 ± 0.55D</td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-0.02D</td>
<td>-2.00D</td>
</tr>
<tr>
<td>6</td>
<td>-0.06D</td>
<td>-3.00D</td>
</tr>
<tr>
<td>7</td>
<td>-0.25D</td>
<td>-1.00D</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>-0.11 ± 0.12D</td>
<td>-2.00 ± 1.00D</td>
</tr>
<tr>
<td>Mean ± SD in total</td>
<td>-0.21 ± 0.26D</td>
<td>-1.03 ± 1.14D</td>
</tr>
</tbody>
</table>

D: diopters, SD: standard deviation

tomy through the limbus, or pars plana, approach, the vitreous behind the iris can not be removed with a cutter due to its acute angle to the vitreous behind the iris. The authors were able to perform an anterior vitrectomy through sclerotomies, 1 mm posterior to the limbus, into one of the sclerotomy site, were a cutter was inserted parallel to the iris plane, with an infusion line inserted into the other. The instrumentation and sutures for the repositioning of a dislocated IOL could be inserted, and the scleral fixation performed through these sclerotomy sites. The scleral fixation of an IOL and the closure of the sclerotomy sites were completed with anatraumatic needle connected to a suture tied to the haptics of the IOL.

For the scleral fixation, the sclera should be penetrated many times. In this procedure, the risk of an intraocular hemorrhage, and trauma to the ocular tissue, was seen to increase. With the technique of Koh et al four scleral penetrations are required. To reduce the complications, such as an intraocular hemorrhage, they used a different pathway for the second scleral penetration, with the fixation sutures passed above and below the haptic of the IOL. However, the risk of an intraocular hemorrhage was still high with multiple penetrations of the sclera. With our technique, the numbers of scleral incision were minimized up to two times (Fig. 6), and the intraocular pressure was elevated when performing the sclerotomy, in order to prevent an intraocular hemorrhage. Here, any blood would be pushed to the outside of the eyeball, even if intraocular bleeding develops. When a scleral fixation was performed, with sutures tied to the haptics of the IOL, it was possible to decrease the risk of a postoperative intraocular hemorrhage by compressing the uveal tissues between the haptics and sclera.

Many complications associated with sutures in a scleral fixation have been reported, but complications, such as endophthalmitis, are rarely reported. Anand et al made a partial scleral flap covering the knots of the fixation suture in order to reduce conjunctival erosion. However, endophthalmitis has also been reported in cases of scleral flaps, where late conjunctival erosion in the knots can develop. Procedures where performed where the scleral fixation was achieved at the sclerotomy sites, with the fixation suture knots buried in the scleral groove. The advantage of this was that by using the sclerotomy sites as the vitrectomy port, the other scleral incision sites for the vitrectomy were not needed, and the knots were concealed by the scleral flaps.

The most serious complications with the scleral fixation were IOL tilting and intraocular hemorrhages. With these complications, the intraocular bleeding was prevented by the methods described above, and to insert the IOL without tilting, the haptics should be inserted with precision and placed accurately into the ciliary sulcus. For a sclerotomy to pass precisely into the ciliary sulcus, there have been cases reported where an endoscope was used. However, this procedure required more time and
expense. The authors could not confirm that the sclerotome exactly pierced the ciliary sulcus, but instead made the sclerotome sites 1 mm posterior to the limbus, in the traditional way. An anterior vitrectomy was completed to prevent tilting of the IOL by minimizing the other variations, with the exception of the location of the scleral penetration. It was also thought that a sclerotome, 1 mm posterior to the limbus, performed parallel to the iris plane, would greatly reduce the tilting of the IOL by increasing the contact surface between the haptic of the IOL and the ciliary sulcus.

In conclusion, by using sclerotome sites 1 mm posterior to the limbus, the anterior vitrectomy could be effectively performed, and the IOL constantly fixed to the sclera, without tilting, and reduced the intraoperative complications and operative time.

REFERENCES