

Transconjunctival sutureless intrascleral intraocular lens fixation using intrascleral tunnels guided with catheter and 30-gauge needles

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ABSTRACT

We invented a new method for fixing an intraocular lens (IOL) in the scleral tunnel without using a wide conjunctival incision. Modified bent catheter needles were used to penetrate the IOL haptics through the sclerotomy sites. The IOL haptics were inserted into 30-gauge (G) scleral tunnels guided by double 30-G needles piercing the sclera. All procedures were performed through the conjunctiva without wide incision. The procedure does not require special forceps, trocars or fibrin glue, only catheter and 30-G needles. The aid of an assistant was not required to support the IOL haptic. The procedures were easily learnt based on our previous method. As with other transconjunctival sutureless surgeries, patients feel less discomfort and the conjunctiva can be conserved for future glaucoma surgery. Complications included two cases of vitreous haemorrhage (16.7%), and one case each of postoperative hypotony, and iris capture (8.3%). Astigmatism induced by intraocular aberration was the same as we reported previously. Our method for fixing the IOL into the scleral tunnel is innovative, less expensive, less invasive and quick. This modified method is a good alternative for fixing IOL haptics into the sclera.

INTRODUCTION

Among several techniques for intrascleral fixation of intraocular lens (IOL),^{1–12} a few recent reports^{10–12} challenge transconjunctival approach. A minimal conjunctival incision reduces patient discomfort after surgery and conserves space for future glaucoma surgery. Here, we report the lock and lead method,^{8, 9} a unique method using two catheter needles and two 30-gauge (G) needles and can be easily applied transconjunctivally.

MATERIALS AND METHODS

The procedures were performed according to the Declaration of Helsinki and were approved by the hospital ethics committee.

Participants

Twelve eyes of nine patients, which consist four aphakic eyes and eight IOL displaced eyes, were treated from December 2013 to August 2014 using transconjunctival sutureless intrascleral fixation.

Catheter needle preparation

Two 24-G catheter needles (Jerco 4053, Smiths Medical) were modified; a small hole was created in the external tubes of the catheters using a slit knife. These holes were to be used later to secure the IOL haptic during fixation and the needles were bent at appropriate angles. For the leading haptic guide, a

small hole was made approximately 3.0 mm from the tip and the needle was bent at the centre to create an inward bevel of approximately 45°. For the trailing haptic guide, a small hole was made 1.5 mm from the tip and the needle was bent at the centre to create an inward bevel of approximately 15°.

Intraocular lens

We used a three-piece acrylic IOL (NX-70, Santen Pharmaceutical Co, Ltd) with an XJ-70 injection system. The IOL was 13.2 mm long and had a 7 mm diameter optic. The haptics were composed of flexible polyvinylidene fluoride (PVDF).

Surgical procedure

The surgical procedure was slightly modified from our original technique (see online supplementary video 1).^{8, 9} Under perfusion, a 3.0 mm corneoscleral incision was made at the 11–12 o'clock position using a 3.0 mm slit knife. A transconjunctival scleral incision was made 1.5 mm from the limbus at the 4 o'clock position using a 22-G needle. A 24-G catheter needle prepared for the leading haptic was inserted in the scleral incision and was advanced through the 3.0-mm surgical corneoscleral incision guided by the 22-G needle or suturing forceps (figure 1A).

After losing the internal needle, the leading IOL haptic was inserted from the tip of the external tube of the catheter needle until the haptic exited through the small hole; the internal needle was then advanced until the leading haptic was locked between the external tube and internal needle of the catheter (figure 1B). The catheter with the leading haptic was pulled into the posterior chamber and the IOL was inserted (figure 1C).

Another catheter was inserted from the corneal port at 4 o'clock and penetrated through the corneoscleral incision as the first catheter was guided. The trailing haptic was inserted into the external tube from the small hole and secured between the external tube and internal needle of the catheter (figure 1D).

Another sclerotomy incision was made 1.5 mm from the limbus at 10 o'clock using a 22-G needle. The 22-G needle was used to guide the catheter with the trailing haptic (figure 1E). The trailing haptic was released from the catheter and the catheter needle was removed. The leading haptic was penetrated through the sclerotomy at 4 o'clock by pulling out the catheter and then released from the catheter (figure 1F).

Two ultra-thin 30-G needles (TSK, Tochigi, Japan) were bent 4 mm from the tips. A 30-G



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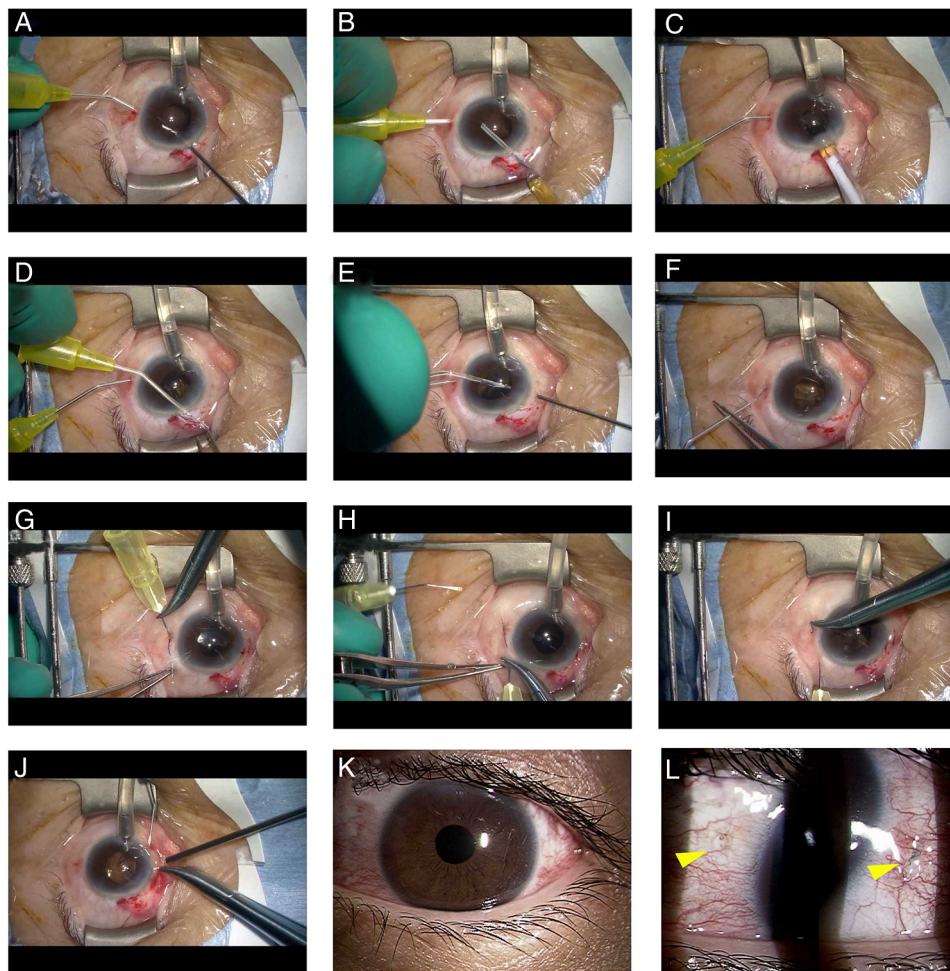


Figure 1 (A) A modified catheter needle was inserted from the sclerotomy site and penetrated through corneoscleral incision guided by a 22-G needle. (B) The leading haptic was secured using a catheter needle. (C) After the 24-G catheter was pulled, the intraocular lens was inserted into the eye. (D) The trailing haptic was secured using a second 24-G catheter. (E) A 22-G needle was inserted and used as a guide to introduce the second 24-G catheter. (F) The catheters were released from the haptics. (G) The first 30-G needle was inserted into the sclera from the sclerotomy site to form a scleral tunnel. (H) The first needle was then pushed out using the second needle. (I) The leading haptic was introduced into the 30-G guide needle. (J) The trailing haptic was introduced into the 30-G guide needle. (K) Slit-lamp photo of day 1 postoperation at lower magnification. (L) Slit-lamp photos of day 1 postoperation at higher magnification. Arrowheads show the sclerotomy points.

needle was used to pierce the sclera in a counter clockwise direction at the scleral port to make a scleral tunnel to secure the haptic (figure 1G). The tip of the needle was exposed from the sclera and conjunctiva. The tip of another 30-G needle was placed at the tip of the first 30-G needle and inserted until the first 30-G needle was pushed out transconjunctivally (figure 1H). The tip of the second 30-G needle was exposed at the scleral port and was used to guide the IOL haptic into the scleral tunnel. The haptic was inserted into the lumen of the needle using a needle holder (figure 1I). The haptics have to be bent sharply and the flexibility of the PVDF haptics facilitates this process.

This procedure is performed for both the leading and trailing haptics (figure 1J).

Astigmatism induced by intraocular aberration

Vector subtraction was performed to assess intraocular aberration with refractometer and keratometer measurements.^{7 9}

RESULTS

Twelve eyes of nine patients were treated. A representative image of the anterior segment of the eye at 1-day postoperation

is shown in figure 1K, L. The astigmatism induced by intraocular aberration was 0.63 ± 0.30 D. The mean (SD) preoperative and postoperative corneal endothelial cell densities were 1867 (624) cells/mm² and 1628 (502) cells/mm², respectively. The mean corneal endothelial cell density loss was 9.78% 3 months postoperatively. Complications included two cases of vitreous haemorrhage (16.7%), and one case each of postoperative hypotony, and iris capture (8.3%).

DISCUSSION

There are a few reports of IOL transconjunctival intrascleral fixation.^{10–12} In these reports, trocars were used to guide the haptics and forceps or needles were still used to penetrate the haptics. These methods may have the advantage that penetrating and inserting the haptics into the scleral tunnel can be done simultaneously. However, because the trocar is not designed for this procedure, the tunnel length may be shorter than that in other methods, which can be a potential risk for haptic displacement after surgery.

Although our method involves two steps, the procedure can be performed in the same manner as our original technique

using a conjunctival incision. Thus, surgeons can learn the procedure using a conjunctival incision and then adapt the procedure without a conjunctival incision. Patient discomfort can be reduced, and the conjunctival space can be conserved for future glaucoma surgery such as pseudoexfoliation.

Astigmatism induced by intraocular aberration was similar to our previous study.⁹ There were no complications caused by the transconjunctival procedure. This minimally invasive IOL fixation technique is a good alternative for intrascleral intraocular IOL fixation.

Contributors KT: Analysis, interpretation of data and drafting the article; MA: conception, design, performed the operations and revising the article; HT, SN and KH: interpretation of data and revising it critically for important intellectual content. All authors approved the final version to be published.

Competing interests MA is a consultant to KOWA Co, Naoya, Japan.

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