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Application of a four-flanged intrascleral fixation technique for toric and multifocal intraocular lenses

Woong-Joo Whang [a], Hyunggoo Kwon [b], Sohee Jeon [b,*]

[a] Department of Ophthalmology, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, South Korea
[b] Keye Eye Center, Seoul, Republic of Korea

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ABSTRACT

Purpose: To report clinical outcomes of a four-flanged intrascleral fixation technique using toric and multifocal intraocular lens.
Observations: We describe two cases of premium intraocular lens (IOL) implantation after which the patients fully recovered their visual function following a four-point sutureless scleral fixation technique via a 2.8-mm corneal incision. In the first case, a monofocal toric hydrophobic lens consisting of two haptic plates with four holes for suturing was fixated with 5–0 polypropylene monofilament. In the second case, a bifocal hydrophobic lens with the same haptic design was fixated. No conjunctival or scleral sutures, glue, or flap formation was required during the surgery. There were no complications related to the surgical process.
Conclusions and Importance: A four-flanged intrascleral fixation technique may benefit patients with poor zonular support who have high expectations for postoperative visual quality.

1. Introduction

Recent advances in premium intraocular lenses (IOLs) have benefited the postoperative lives of many patients by reducing astigmatism and providing multifocal vision. However, these advanced technologies have not been options for patients without sufficient zonular support. Because of the optic design, premium IOLs, including toric and multifocal IOLs, require precise centration and minimal residual astigmatism postoperatively. Conventional scleral fixation methods require relatively large corneal incisions and two-point fixation, which make postoperative outcomes unpredictable.[1–3] A large corneal incision changes the corneal shape significantly, and the two-point fixation raises the risk of IOL tilt. Although there have been several reports of scleral fixation of multifocal or toric IOLs,[4–9] the inherent limitations of conventional scleral fixation techniques have hindered the wide use of premium IOLs in patients without sufficient zonular support.

Now, Canabrava et al. have introduced a four-flanged intrascleral IOL fixation technique with 5–0 polypropylene that does not require flap creation, suture knots, or glue.[10] They created four fixation points by melting the tip of the suture, thereby creating flanges over the sclera. This innovative four-flange technique provides outstanding stability and centration of the fixated IOL without using suture knots. In addition, by using a foldable lens implant, the IOLs can be exchanged through small corneal incisions if the preexisting IOL is cut into two pieces and the new IOL is inserted in a folded shape.[11,12]

Combining two techniques, four IOL fixation points and a small corneal incision, would yield predictable and favorable outcomes even for premium IOLs. We report two cases of four-flanged intrascleral fixation with a small corneal incision using toric and multifocal IOLs.

2. Surgical technique

2.1. Four-flanged intrascleral fixation technique

A 27-gauge pars plana vitrectomy is done on the temporal side. The IOL is moved to the anterior chamber, cut into two pieces, and brought out through the 2.8-mm temporal clear corneal incision. A hydrophobic IOL equipped with two haptic plates forming four holes for suturing is fixated by the technique previously described by Canabrava et al.,[10] with some modification. A 26-gauge needle is inserted 2 mm posterior to the limbus and the 5–0 polypropylene monofilament (Ethicon Inc, Somerville, NJ) is inserted through the corneal incision and placed into the lumen of the 26-gauge needle. The same procedure is repeated at all four fixation sites. Then, the new IOL is folded with McPherson forceps

* Corresponding author. Keye Eye Center, Seoul, Korea. 326 Teheran-ro, Gangnam-gu, Seoul, South Korea.
E-mail address: soheeeee@gmail.com (S. Jeon).

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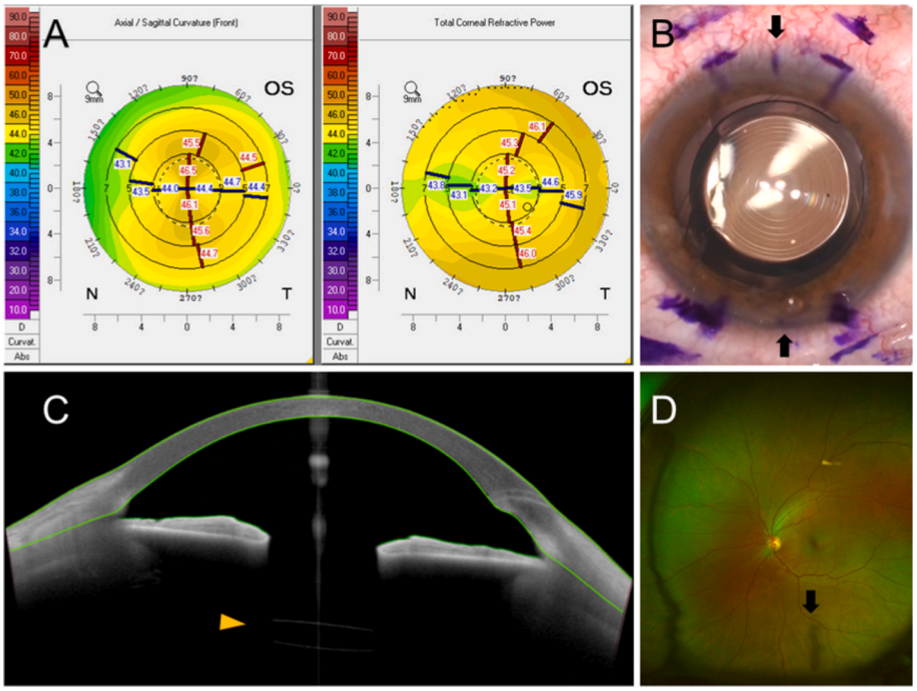

Fig. 1. Images from an eye with toric intraocular lens (IOL) fixation. (A) Scheimpflug tomography shows regular astigmatism. (B) Preoperative marking for fixation points according to the preoperative Scheimpflug tomography examination (arrows: steep axis). (C) Postoperative swept-source ocular coherence tomography (OCT) image shows well-maintained IOL position (arrow: IOL optic). (D) Postoperative wide-field fundus photography shows astigmatic axis of the IOL optic (arrows: steep axis).

(Sklar Instruments, West Chester, PA) and inserted through a 2.8-mm corneal incision. The tips of the two bottom sutures are heated by portable cautery to create flanges. Then the position of the IOL is adjusted by pulling the upper ends of the suture. When the IOL position is satisfactory, the tips of the two upper sutures are heated to create flanges. The alignment between the conjunctival marking for the steep axis and that of the IOL optic is checked. The corneal incision is hydrosealed and the trocars are removed without scleral suturing. The flanges are inserted into the subconjunctival space with forceps. (Video 1, Supplemental Digital Content).

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ajoc.2020.100933

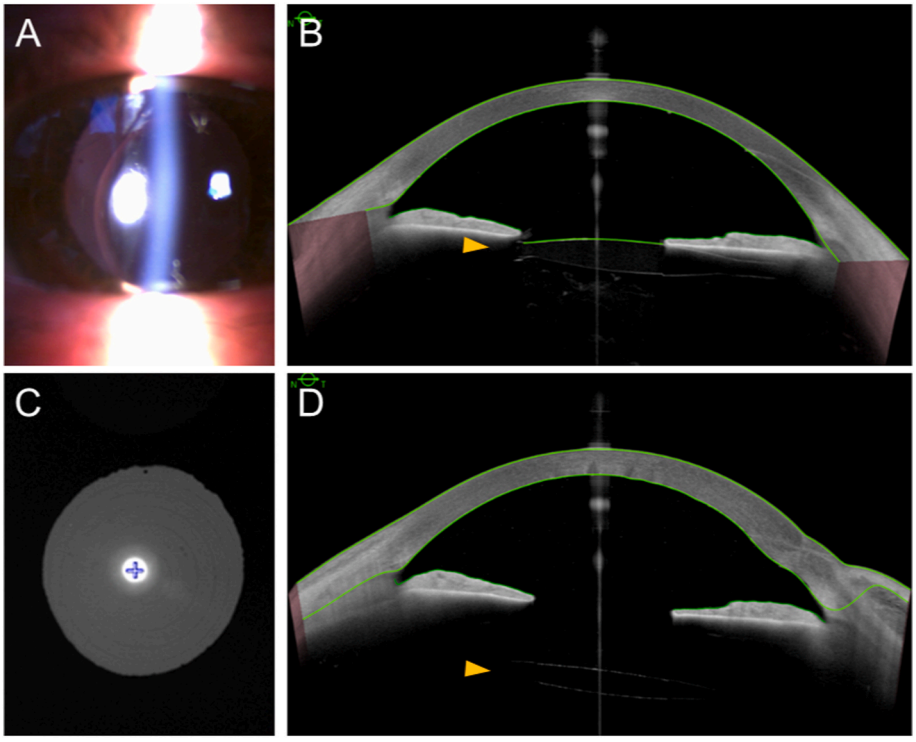

Fig. 2. Images from an eye with multifocal intraocular lens (IOL) fixation. (A) Slit-lamp examination shows the displaced plate-type IOL in the sulcus. (B) Preoperative swept-source OCT image shows the IOL touching the posterior surface of the iris (arrow: IOL optic). (C) Postoperative retroillumination image shows good centration of a fixated IOL. (D) Postoperative swept-source OCT image shows well-maintained IOL position (arrow: IOL optic).

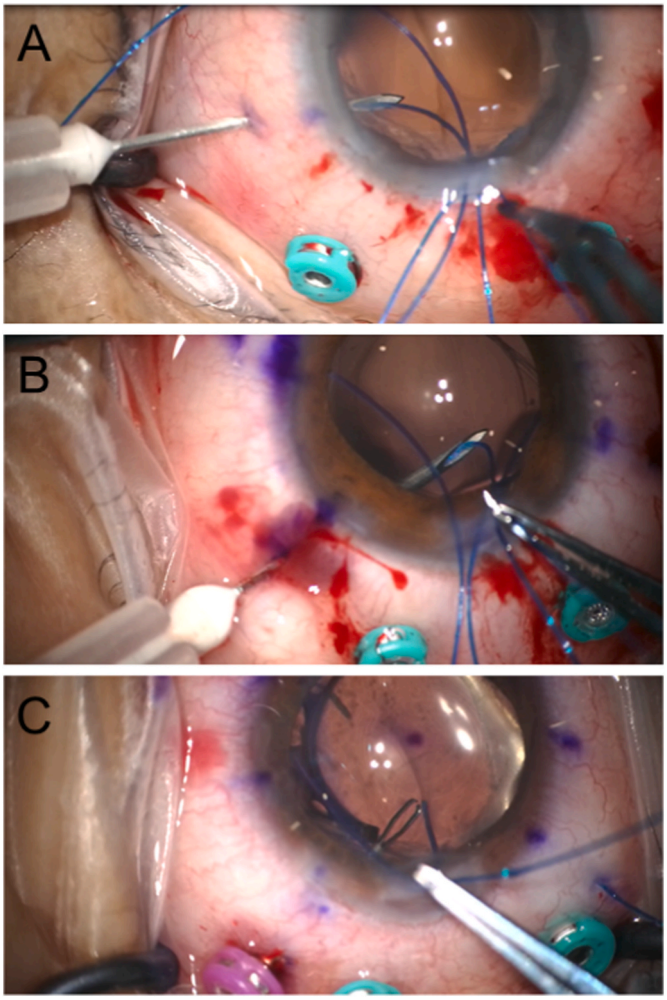

Fig. 3. Various methods for the placement of suture material with the needle tip. (A) A needle at 60° provides the proper angle for suture entry into the needle. (B) A needle at 50° provides a poor angle for suture entry into the needle. (C) In cases of difficult suture entry into the needle, 27-gauge intraocular forceps with a smooth tip can be helpful.

2.2. Case presentations

2.2.1. Case 1

A 40-year-old man was referred for IOL dislocation in his left eye. He had a history of phacoemulsification and implantation of an extended depth of focus toric IOL 1 year ago, and he first noted decreased vision a few days after yttrium-aluminum garnet (YAG) capsulotomy. He had no history of ocular diseases and showed no abnormal findings except for significant corneal astigmatism (Fig. 1A). On slit-lamp examination, the IOL was noted to be displaced through the large capsulotomy site. We decided to fixate a toric IOL to reduce residual postoperative astigmatism. The center of the visual axis, the steep axis, and four fixation points were marked at the beginning of the surgery (Fig. 1B). The four fixation points were designed symmetrically, with the astigmatic axis as a reference point. The preoperative corneal astigmatism measured by the IOLMaster 700 (Carl Zeiss Meditec AG, Jena, Germany) was 2.60 diopter; therefore, aided by the ARTIS PL E calculator[A] with surgically induced astigmatism (SIA) set to 0.1 diopter, we selected an Artis T3.00 monofocal toric hydrophobic IOL equipped with two haptic plates forming four holes for suturing (Artis toric; Cristalens Industrie, Lannion, France). At 1-week follow-up, the distant uncorrected visual acuity (UCVA) was 20/20 and the refractive error was +0.25–0.25 × 149. There was no postoperative complication. The centration of the IOL was maintained throughout the follow-up period (Fig. 1C and D).

2.2.2. Case 2

A 49-year-old man presented with decreased visual acuity in his left eye. He had a history of phacoemulsification and multifocal IOL implantation 1 month ago. On examination, a plate-type IOL was noted to be displaced in the sulcus and there was profound pigmentation in the anterior chamber (Fig. 2A and B). He had no history of ocular disease, and there was no abnormality on ocular examination except for an IOL-induced iritis. No significant astigmatism was noted, and we decided to fixate a bifocal hydrophobic IOL (ARTIS bifocal, Cristalens Industrie) after targeting emmetropia during the IOL diopter calculation. At the 1-month follow-up, distant UCVA was 20/20 and near UCVA was J1. The refractive error was +0.25–0.50 × 15. There was no postoperative complication. The centration of the IOL was maintained throughout the follow-up period (Fig. 2C and D).

3. Discussion

Postoperative astigmatism after IOL exchange with a large corneal incision and IOL tilt are the main limitations to wide application of scleral fixation for toric or multifocal IOLs. Minimal SIA from a small corneal incision on the temporal side and IOL stability from four fixation points can provide reliable postoperative outcomes in these cases. Supplemental Table 1 summarizes the clinical outcomes of eyes after a four-flanged intrascleral fixation technique using a 2.8-mm temporal clear corneal incision. The balance between two opposing sutures and the centration of the IOL are vital when multifocal and toric IOLs are fixated by this method. In cases of toric IOL fixation, the opposing fixation points should be symmetrical with respect to the steep axis. Therefore, preoperative markings for the visual axis and the steep axis of corneal astigmatism are critical for good postoperative outcomes. Also, the prediction of the effective lens position (ELP) is still challenging, which could result in hypermetric or myopic residual refractive errors. Further studies with more patients and longer follow-up are necessary to assess the exact outcomes.

We found that it is tricky to place a suture into a needle that is located near the incision site. The difficulty arises from the angle between the needle and the incision site, and it is recommended that the proximal needle be placed at 60° and 300° when the incision site is temporal (Fig. 3A). It is more difficult to place a suture closer than 60° and 300° to the incision site (Fig. 3B). In that case, a 27-gauge smooth tip intraocular forceps helps to catch the suture, and then the trocar can be removed without a scleral suture (Fig. 3C).

4. Conclusion

This novel method using four IOL fixation points and a small corneal incision yielded predictable and favorable outcomes even for premium IOLs. We believe this method can widen the scope of application of multifocal or toric IOLs to patients with poor zonular support and high expectations for postoperative visual quality.

Ethics and consent

This retrospective study (case series) adhered to the tenets of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of Yeouido St. Mary Hospital. This report does not contain any personal information that could lead to the identification of the patients.

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Authorship

All authors attest that they meet the current International Committee of Medical Journal Editors (ICMJE) criteria for authorship.

Declaration of competing interest

The authors have no financial disclosures.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2020.100933.

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