

Case Report

Case Report: Yamane Fixation of a Light Adjustable Lens in a Patient with Marfan Syndrome

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Abstract

This paper aims to discuss a case of a Light Adjustable Lens (LAL) implanted with the Yamane technique in a Marfan patient undergoing complex cataract surgery. A 60-year-old female with a history of Marfan syndrome presented in May 2020 with complaint of worsening vision due to bilateral subluxed cataracts. Bilateral LALs were planned to be implanted in the capsular bag with scleral fixated Ahmed segments using 5-0 prolene due to zonular instability. The procedure was complicated by an anterior capsular tear at 6 O'clock due to a very friable capsular bag. This tear extended posteriorly with no vitreous loss. Given inadequate capsular support, the decision was then made to scleral fixate the LAL using a Yamane technique. The first attempt at scleral fixation resulted in the LAL haptic breaking off into the 27G needle during the scleral pass. The LAL with remaining haptic was cut in half and explanted. A new LAL was successfully fixated with the Yamane technique. A scleral fixated Ahmed segments using 5-0 prolene was done successfully for the right eye. Final adjustment and locking occurred 10 weeks after right eye procedure. The final refraction of the right eye was measured to be plano, + 0.5 cyl, 85 axis with uncorrected distance visual acuity of 20/20 and corrected distance visual acuity of 20/20. The final refraction of the left eye was measured to be -2.75 D, 0 cyl, 0 axis with uncorrected distance visual acuity of 20/200, uncorrected near visual acuity of J1+ and corrected distance visual acuity of 20/20. When choosing a lens to Yamane, LALs are uniquely capable of correcting a residual refractive error without an additional surgery. LALs are an excellent option for patients that desire a refractive outcome with limited or no capsular support.

Keywords: Refraction; Intraocular Lens; needles; Extended Depth-of-Focus

Introduction

Sutureless intrascleral Intraocular Lens (IOL) fixation has become an increasingly popular technique in patients with compromised capsular or zonular support. These techniques offer an alternative to angle-supported or iris-fixated anterior chamber IOLs.

One sutureless technique commonly used is the double-needle flanged haptic technique also known as the Yamane technique. This technique involves inserting a pair of 30G needles through the sclera, 2 mm posterior to the limbus. The surgeon then feeds the haptics of the IOL, already *in-situ*, into the lumen of the needles. The needles containing the haptics are drawn out of the scleral tunnels, resulting in the fixation of the haptics within the tunnels. Finally, the protruding ends of each haptic are cauterized into flanges that prevent the haptic from slipping into the eye and dislocating the IOL [1].

Indications for scleral fixation via Yamane technique include subluxation of the lens and inadequate capsular support. The most common causes of zonular insufficiency are pseudoexfoliation syndrome, trauma, previous ocular surgery, hyper-mature

cataracts and increased axial length. Less common causes include Marfan's syndrome, homocystinuria, microspherophakia, retinitis pigmentosa and intraocular neoplasms [2].

The light adjustable lens (LAL, RxSight, Inc.) has gained popularity in recent years due to the ability to adjust the lens postoperatively. The LAL is a type of 3-piece foldable monofocal IOL composed of photosensitive silicone macromers in a matrix. Selective irradiation of 365 nm UV light is used to activate and polymerize the photoreactive silicone matrix to modify the shape and therefore refractive power, of the lens. This process can be repeated until the desired refraction is achieved, at which point the surgeon locks in the lens to the desired configuration [3].

This paper aims to discuss a case of an LAL implanted with the Yamane technique in a Marfan patient undergoing complex cataract surgery.

Case Report

A 60-year-old female with a history of Marfan syndrome, hypertension, hyperlipidemia and type II diabetes mellitus presented in May 2020 with a complaint of worsening vision in the left eye. Uncorrected Distance Visual Acuity (UDVA) was Counting Fingers (CF) at 2 ft in both eyes. Corrected Distance Visual Acuity (CDVA) was 20/80 in the right eye and CF 2 ft in the left eye. Slit lamp examination showed subluxation of the lens bilaterally.

The patient expressed interest in lenses that would provide her with maximal independence from spectacles. A long conversation was had with the patient explaining that her weakened zonules and subluxed lenses made her a poor candidate for multifocal or Extended Depth-Of-Focus (EDOF) lenses. She ultimately chose LALs which gave her the ability to adjust for monovision as tolerated. LALs were the ideal lens for monovision because her advanced bilateral cataracts had made testing for her dominant eye difficult and she had no prior history of monovision. This lens was also ideal for this patient given her high axial length and less predictable effective lens position.

She was educated on the risks of the procedure, including aphakia with scleral fixation of the lens if the capsular support was inadequate. The surgical plan was monovision with the left eye set for near and right eye set for distance before correcting the residual postoperative refractive error with the light delivery device.

Bilateral LALs were planned to be implanted in the capsular bag with scleral fixated Ahmed segments using 5-0 prolene due to zonular instability. The first procedure, involving the left eye, was done with a femtosecond-assisted capsulotomy. The procedure was complicated by an anterior capsular tear at 6 O'clock due to a very friable capsular bag. This tear extended posteriorly with no vitreous loss. Given inadequate capsular support, the decision was then made to scleral fixate the LAL using a Yamane technique. The first attempt at scleral fixation resulted in the LAL haptic breaking off into the 27G needle during the scleral pass. The LAL with remaining haptic was cut in half and explanted. A new LAL was successfully fixated with the Yamane technique.

The patient returned the following day with left eye Intraocular Pressure (IOP) of 0 with no obvious leak, no vitreous to the wound and a negative Seidel test. Additionally, there was no evidence of infection, choroidal effusion, retinal tear or retinal detachment. The IOL was well centered but slightly inferior in visual axis. The patient was treated with hourly prednisolone in addition to routine post-op drops. The patient was followed daily and showed no sign of complication from the hypotony. It was not until day 5 post-op that the pressure returned to 7 and stabilized at 11 by the 2-week follow up. When planning the right eye surgery, the decision was made not to use the femtosecond laser as it was felt that the laser capsulotomy in combination with the very friable anterior capsule likely contributed to the anterior capsular tear. The plan was again an LAL to be implanted in the capsular bag with scleral fixated Ahmed segments using 5-0 prolene and this was done successfully for the right eye. There were no complications. The patient was refracted and adjustments were performed once refraction was stable. Final adjustment and locking occurred 10 weeks after right eye procedure. The final refraction of the right eye was measured to be plano, +0.5 cyl, 85 axis with uncorrected distance visual acuity of 20/20 and corrected distance visual acuity of 20/20. The final refraction of the left eye was measured to be -2.75 D, 0 cyl, 0 axis with uncorrected distance visual acuity of 20/200, uncorrected near visual acuity of J1+ and corrected distance visual acuity of 20/20.

Discussion

This case represents the first reported incident of a complicated cataract surgery with an LAL fixated via Yamane technique. The Yamane technique was utilized for this procedure due to the formation of an anterior capsular tear that extended posteriorly. The surgeon believes that the combination of capsular tension hooks and femto-capsulotomy were the main factors contributing to the tear formation in the friable capsular bag. Manual capsulorhexis was utilized in the subsequent procedure of the right eye which was completed with no complications. It appears that manual capsulorhexis may be superior to femto-capsulotomy for scleral fixation of Ahmed segments in patients with a friable capsular bag.

For patients with insufficient capsular support the LAL is an excellent option for Yamane fixation because it allows for post-operative adjustment of astigmatism. Toric IOLs is commonly used to treat preexisting astigmatism in cataract patients.⁴ While foldable Toric lenses are typically not recommended for scleral fixation due to poor post-operative refractive outcomes, single piece Toric IOLs have been fixated to the sclera with success in patients with capsular instability [5,6]. However, Toric IOLs are designed to correct for a specific amount of astigmatism. Scleral fixated Toric IOLs is also subject to poor postoperative results which can cause defocusing, astigmatism and wavefront aberrations [7]. Additionally, lenses fixated to the sclera with sutures have been reported to cause Uveitis-Glaucoma-Hyphema (UGH) syndrome in up to 3% of cases [8]. Given the 3-piece design of the LAL, UGH syndrome is much less of a concern than when fixating single piece IOLs.

All other three-piece lenses approved for Yamane fixation are all spherical mono-focal lenses making LAL the only Yamane option that is able to correct for astigmatism and post-operative refractive error. A common issue with scleral fixated IOLs is difficulty hitting the refractive target due to effective lens position. IOLs implanted with the Yamane technique or other scleral fixation methods can have significant complications impacting refractive power secondary to lens tilt, IOL decentration, rotation, or luxation [9]. Studies by Chen, et al. and Ashena, et al., showed that a 0.2 to 0.3 mm decentration and up to 2 to 3 degrees tilt are common and are usually clinically unnoticed. More than 5 degrees of tilt or more than 1 mm of decentering was shown to induce a substantial vision-reducing astigmatism. Ashena, et al., also notes that tilt and rotation in Toric lenses have an even more profound negative impact on visual outcomes [7,10]. Studies have reported an average tilt ranging from 3.28 to 13.2 degrees resulting from Yamane procedures [11-13]. The LAL is unique in its ability to compensate for tilt and decentration-induced impact on lower order aberrations with postoperative UV treatments. The LAL allows for correction of up to 2 Diopters (D) of spherical error and 3 D of cylindrical error [14]. In this case, post-operative adjustment of the LALs achieved the desired outcome of monovision with an uncorrected visual acuity of 20/20 OD for distance and J1+ OS for near.

While the LAL is an excellent choice for Yamane fixation, there are some associated drawbacks. One potential patient complaint with LALs is the need for multiple follow up visits for adjustment and locking [15]. While follow up visits can be inconvenient for the patient; they enable non-invasive post-operative adjustments with very minimal risk. This contrasts with the inherent risks involved with other scleral-fixated monofocal lenses which require staged laser procedures to correct residual refractive error. Another drawback of LALs include the rigidity of the haptics when compared to other IOLs commonly used for Yamane. The CT Lucia 602 (Carl Zeiss Meditec) is a commonly used 3-piece lens for the Yamane technique because its polyvinylidene fluoride haptics resist kinking and breakage [16]. When compared to the CT Lucia, the blue poly (methyl methacrylate) modified-C haptics used for the LAL are more rigid, which likely contributed to the haptic breaking during the scleral pass in this case [15]. Despite Yamane's conceptual simplicity, it can be surgically challenging even for those experienced with scleral fixation. Therefore, Yamane fixation of a LAL may not be suitable for surgeons with limited experience.

Conclusion

This report represents the first reported case of scleral fixation of a LAL via the Yamane technique. When choosing a lens to Yamane, LALs are uniquely capable of correcting a residual refractive error without an additional surgery. LALs are an excellent option for patients that desire a refractive outcome with limited or no capsular support.

Conflict of Interest

The authors have no conflict of interest to declare.

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