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Short Communication

# Evaluating refractive outcomes after pars plana vitrectomy and scleral fixated intraocular lens with Gore-Tex suture

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It has been nearly 20 years since Girard first described the technique of placing a lens in the absence of capsular support [1]. Since that first report, numerous procedures have been described [2-9]. While the techniques have continued to evolve, little has been reported on refractive outcomes. Without evidence-based literature to support best practices, surgeons are forced to rely on anecdotal evidence to make lens selections in an attempt replicate the refractive outcomes patients have come to expect in modern day cataract surgery.

Lenses fixated in the absence of capsular support create a unique challenge for predicting lens power. While axial length and corneal power remain important factors in calculating the lens power, the effective lens position may be impacted by unique variables. When placing a lens in the bag, the effective lens position is somewhat predictable [10-13]. The procedure of fixating a lens to the sclera introduces a number of additional variables. First, there are numerous procedures that have been described. Each procedure has unique steps that may impact the final position of the lens. In addition, many of these procedures involve particular lenses with their own unique properties. Even within one particular technique, there are variables that have been shown to impact the predictive error of lens formulas. Su et al. showed that in their application of scleral fixated lenses movement of the fixation sites from 2 mm posterior to the limbus to 3 mmm posterior impacted refractive outcomes [14]. In addition, the size and location of the corneal incision may impact surgically induced astigmatism [15-17]. If care is not taken to ensure appropriate placement of the lens fixation sites, there can be lens tilt that will also contribute to post-operative astigmatism [18]. In sutured lenses the tension of sutures may also influence the final lens position with tight sutures resulting in anterior displacement and lax sutures impacting the stability of the lens. In cases where lens haptics are directly fixated to the sclera, there are additional considerations. Just as in a suture fixated lens, the position of the fixation site of the lens haptic as it relates to the limbus is important. However, some of these techniques require a portion of the externalized haptic to be buried or tunneled. The length of this buried haptic can affect the position of the lens. As the amount of the haptic externalized increases, the lens will be anteriorly displaced. Uneven haptic tension can also result in lens tilt [19].

Fortunately, scleral fixated lenses are only necessary in a relatively small population of patients as it relates to the total number of cataract surgery cases performed. However, this compounds the challenges of optimizing lens formula performance by reducing the number of reported outcomes as they relate to each of these procedures. However, there have been recent reports attempting to deliver refractive outcomes as they apply to some of these procedures. The following studies have been highlighted and summarized with attention to the refractive outcomes reported. These articles evaluate procedures that are generally similar in approach with all patients undergoing a pars plana vitrectomy in addition to a scleral sutured intraocular lens utilizing Gore-Tex suture.

Su et al. [14] reported results from 55 eyes of 53 patients who underwent pars plana vitrectomy with a Gore-Tex (W.L. Gore & Associates, Newark, DE) sutured IOL. The overall predictive error reported was -0.64 ±1.00 Diopters. It is important to note that this cohort included some disparate groups. In 14 of the eyes included in this study, the sclerotomy sites used for fixation were placed 2 mm posterior to the limbus and in the remaining 41 eyes the fixation sites were 3 mm posterior to the limbus. Breaking this down further, in the group with fixation 2 mm from the limbus the predictive error was -1.53 ± 1.35 Diopters. In the group with fixation 3 mm from the limbus, the predictive error was -0.43 ± 0.71. This is consistent with how one would expect the site of fixation to impact the effective lens position with a more anterior fixation site resulting in a more myopic result as the lens moves anteriorly. In addition, it highlights the importance of fixation site location as it relates to the predictive error. There is additional variability in the 3 mm group in that two different lenses were used. 34 eyes had an Akreos A060 lens (Bausch & Lomb, Rochester, NY) placed with a predictive error of -0.43 ± 0.71 Diopters. Eight eyes had an enVista MX60 lens (Bausch and Lomb, Rochester, NY) placed with a predictive error of -0.36 ± 1.02 Diopters. While there does not appear to be much impact on predictive error as it relates to these two lenses, as the number of eyes in each of these subgroups get smaller, the integrity of the data becomes less reliable. Finally, it is also important to highlight the fact that 3 different formulas are used. For axial lengths of less than 22 mm, the HofferQ formula was used. The Holladay formula was used for axial lengths between 22 and 26 mm, and the Sanders-Retzlaff-Kraff (STK/T) trial formula was used for axial lengths of more than 26 mm.

Botsford et al. reported results on 31 patients [20]. In this series a pars plana vitrectomy is performed and a lens is fixated 3 mm posterior to the corneoscleral limbus. Two different lenses are used in this report including the CZ70BD (Alcon, Fort Worth, TX) and the Akreos A060. The sclerotomies are spaced 2 mm apart for the CZ70BD and 4 mm apart for the Akreos A060 lens. The predictive error was found to be -0.19 ± 0.72 Diopters. In addition, 68% of patients were within 0.5 Diopters of the intended target refraction, 81% were within 1.0 Diopter of target, and 100% were within 2.0 Diopters of target.

The authors note that biometry data were imported to calculate lens power with the Haigis, SRK/T, Hoffer Q, Holladay 2 with Wang-Koch adjustments for high axial length, and Barrett II formulas. The breakdown of how these formulas were applied to the 31 patients to achieve this predicted error is not reported. However, the authors give a nice breakdown of the prediction error for each of the formulas applied to all of the eyes and their application to long eyes (axial length greater than 25 mm). In this breakdown, the Haigis formula generally underperformed relative to the other formulas. No formula was statistically superior for eyes with high axial length, although SRK/T trended toward more accurate outcomes. It is also interesting to note that in comparing the two different lenses used, the predictive error for the Akreos A060 lens trended toward more myopic outcomes while the CZ70BD lens demonstrated more hyperopic outcomes.

In the author's own paper, Ohr et al. [21], the results of 20 eyes from 20 patients were reported. A pars plana vitrectomy was performed with a Gore-Tex sutured IOL. The sclerotomy fixation sites were 3 mm posterior to the corneoscleral limbus and 4 mm apart. All surgery was performed by a single surgeon, and the Akreos A060 lens was used for all patients. Interestingly, the predictive error was noted to be 0.16 ± 0.69 Diopters which is in contrast to the slightly myopic error reported in previous studies. It is also important to note that the only formula evaluated in this study was the Sanders-Retzlaff-Kraff (SRK/T) formula. In addition, the mean axial length of the eyes included ranged was 24.67 mm with a range of 21.92 mm to 29.30 mm. In this population 45% were within 0.5 Diopter of the target, 80% were within 1.0 Diopters of target, and 100% were within 1.5 Diopters of the targeted refraction.

All of these studies have limitations including the small number of patients included and the retrospective nature of the reports. However, taken together, these studies are the first to report refractive outcomes for patients undergoing scleral fixated sutured lens procedures when applying formulas that were designed for in-the-bag placement of the lens. In general, the application of these formulas fared well (Table 1), with predictive error falling within an acceptable margin for all of these studies. As more data is reported, surgeons will continue to refine the application of these formulas to maximize refractive outcomes.

| Study | Prediction Error |
|---|---|
| Botsford et al. [20] | -0.19 ± 0.72 |
| Ohr et al. [21] | +0.16 ± 0.69 |
| Su et al. [14] | -0.64 ± 1.00 |

**Table 1:** Prediction Error Reported by Each Study.

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