

Comparative study of visual outcome of newly designed scleral tuck lens and suture-fixated lens for rehabilitation of aphakia in various aetiologies

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Purpose: Visual rehabilitation in aphakia can be performed using several modalities. However, these modalities could be either technically difficult or expensive. Herein, we developed a scleral tuck lens to provide a simple and cost-effective solution for aphakia and compared its outcome with standard methods. **Methods:** A specially designed posterior chamber self-sustaining lens was implanted in patients with aphakia without capsular support because of different primary etiologies. The visual outcomes, as well as intraoperative and postoperative complications, were examined. The data were retrieved from electronic medical records, and visual outcome and complication rates were compared. The outcomes were also compared according to the etiology and age groups (pediatric and adults). **Results:** We found significant improvement in preoperative and postoperative visual outcome. We did not find any significant difference in visual outcome amongst suture-supported scleral fixated lens with scleral tuck lens. **Conclusion:** Satisfactory visual outcomes were noted with minimal complications; and comparable with gold standard suture fixated lens, however long-term follow-up is required.

Key words: Aphakia, scleral tuck lens, secondary lens implant, self-retaining

Cataracts account for 47% of all cases of blindness worldwide. The epidemiological effect of cataracts is varied in different countries, which might be associated with the economic conditions.^[1] Posterior capsular rent is one of the most common complications preventing satisfactory visual outcomes.^[2]

The rehabilitation of the aphakia eye is a crucial challenge. Aphakia is one of the most common problems encountered in patients with trauma. On the one hand, it could result from complete loss of the lens and capsular support during the trauma itself, but on the other hand, it could also be caused by zonular dialysis or lens subluxation beyond a few clock hours, in which case capsular support or implantation of the posterior chamber lens would be inadequate. Occasionally, intracapsular cataract extraction or pars plan lensectomy is required for managing the cataract. In such cases, the only treatment option is the implantation of a secondary lens. Secondary lens implantation can be performed by implanting an intraocular lens (IOL) on the remnant of the capsule, an iris-supported lens, an angle-supported anterior chamber IOL or a scleral-fixated IOL either with sutures, glue, or any other technique.^[2]

In some cases, an angle-supported anterior chamber lens is not suitable when patients require a detailed posterior segment evaluation with fully dilated pupils, which is not possible with an angle-supported anterior chamber lens *in situ*. This is important because patients with ocular trauma are prone to retinal detachment and require a detailed fundus evaluation with indentation. In addition, the implantation of an angle-supported anterior chamber lens is avoided in patients who may have a normal posterior segment in the target eye, but

in patients with a history of retinal detachment in the other eye or the family; a routine examination is necessary. Furthermore, an angle-supported anterior chamber lens is contraindicated in patients with glaucoma and narrow angles and frequently require gonioscopy. This approach could be difficult to perform with the haptics of an angle-supported anterior chamber lens in the angle because an associated angle recession may be present in the traumatized eyes, and an angle-supported anterior chamber lens could further aggravate the damage. Moreover, an angle-supported anterior chamber lens is also not recommended in patients with corneas with low endothelial count because this lens could lead to corneal decompensation and bullous keratopathy.

The advantage of a scleral-fixated lens over an angle-supported anterior chamber lens is its placement in the anatomical location, proximal to the nodal point of the eye, resulting in favorable optical properties.

Previous studies have attempted implanting scleral fixated lenses with prolene sutures, iris-supported lenses and glued lenses; however, the implantation of all these lens types have a long learning curve and is not cost-effective.^[2,3]

In the current study, we designed a self-sustaining lens that does not require any suturing.

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Methods

The present study was approved by the Drashti Netralaya hospital ethics committee (approval no DN/2021/12). Study followed Helsinki ethical guidelines. In the current retrospective cohort study, we compared the newly designed scleral tuck lens with the standard scleral fixated lens using prolene sutures with four-point fixation.

Herein, we designed hydrophilic acrylic foldable lens, which can be suspended with the sclera without any suture or glue (Manufactured by Omni lenses Pvt Ltd Ahmedabad).

Fig. 1 The horizontal size of the current lens was 14 mm with an optical diameter of 6.5 mm, and acrylic tags connected with the main optics to the neck. The tag size is 20 G (0.89 mm) with a hole.

In aphakia eyes, following anterior vitrectomy, scleral flaps were created using a crescent blade after hemostasis. A 23G forceps was used to create an opening under both the flaps.

The foldable lens was inserted into the anterior chamber. Then, the acrylic tag was handed over using a 23G forceps, the tag was pulled out through the bevelled scleral opening 1 mm away from limbus on both sides 180° apart [Figs. 2 and 3], and the posterior chamber self-sustaining scleral fixated lens was implanted appropriately. The lens tag was covered by the scleral flap without sutures [Figs. 4 and 5].

Scleral supported suture fixated lens was PMMA lens with hole and sutured to sclera using 10/0 prolene suture using rail road technique.

We retrieved data from the electronic medical record and compared visual outcomes and complication rate. We also compared the outcome according to etiology and age groups (pediatric and adults).

We exported data from the electronic medical record to Microsoft Excel and analyzed using SPSS22; descriptive analyses and cross-tabulation were applied, and P value < 0.05 was considered statistically significant.

Next, we compared the outcomes of sutured-fixated sclera-supported lenses with scleral tuck based on etiology age group visual outcome and complications.

Results

Our cohort consisted of 197 eyes consisting of 124 (64%) males and 71 (36%) females (mean age 53 ± 19.05 years) [Table 1]. Among them, 21 (10.7%) were pediatric patients. In 30/197 (15.2%) patients, a scleral tuck lens was utilized.

The majority of the cases were iatrogenic and traumatic [Table 2]. A comparative study revealed a significant difference between pre- and postoperative vision ($P = 0.004$). Conversely, the visual outcomes of scleral tuck and suture-fixated lenses did not differ significantly ($P = 0.731$) [Tables 3 and 4].

The postoperative mean cylinder in all the cases was 0.81 dioptre (D) when compared among scleral tuck and suture-fixated lenses, albeit no significant difference was detected ($P = 0.315$).

Also, the comparative study of visual outcomes based on etiology did not detect any significant difference ($P = 0.159$),

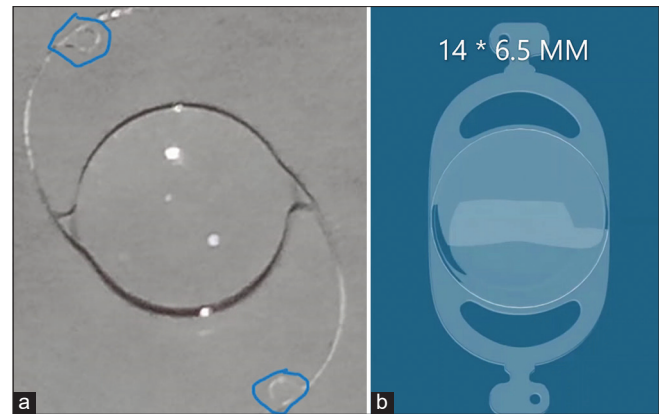


Figure 1: (a) scleral fixation lens with eyelet (b) Scleral tuck lens design

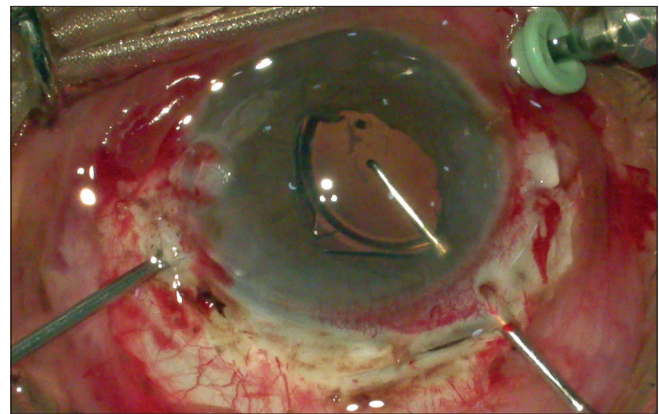


Figure 2: Retrieval of right tag

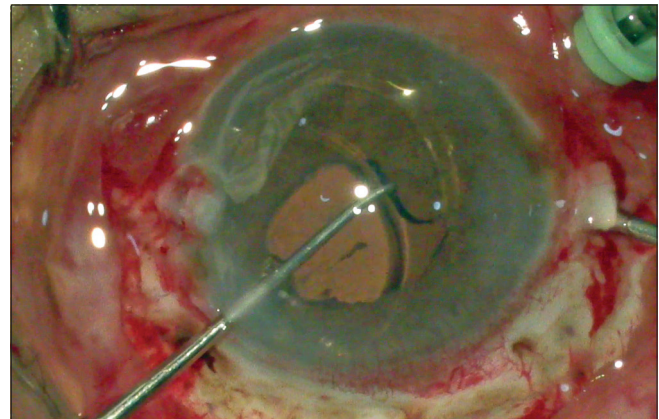


Figure 3: Retrieval of left tag

while a statistically significant difference was noted when comparing the visual outcome between pediatric and adult categories ($P = 0.001$).

Irregular astigmatism, posterior segment complications and corneal opacity are factors due to which postoperative vision might not improve [Table 5]. No significant difference was observed when we compared the causes of no improvement in vision ($P = 0.184$).

Table 1: Age and sex distribution

	Sex		Total
	F	M	
0-10	4	12	16
11-20	2	3	5
21-30	0	5	5
31-40	1	10	11
41-50	14	13	27
51-60	23	37	60
>70	27	46	73
Total	71	126	197

Table 2: Etiology of subluxated lenses

Categories	Frequency	Percent
Complication of cataract surgery	122	61.9
Congenital ectopia lentis	5	2.5
Trauma	70	35.5
Total	197	100.0

Table 3: Comparative study for scleral tuck and suture supported scleral fixated lens

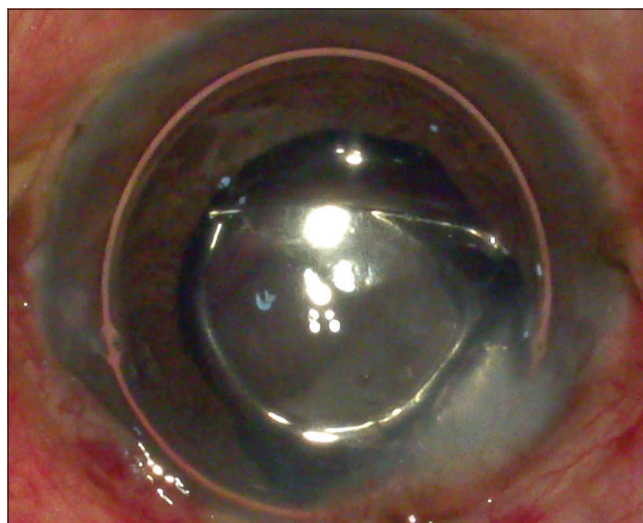
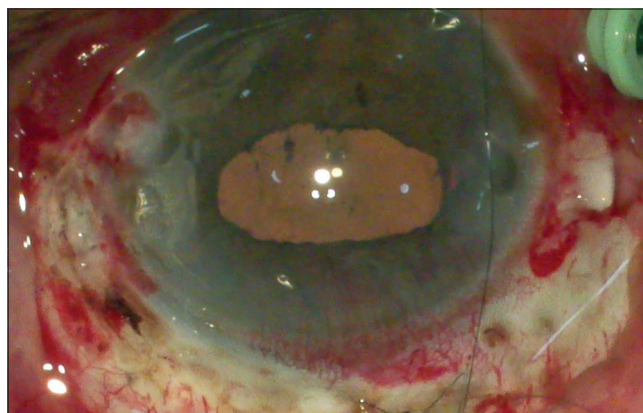
Final vision	Category		Total
	Other	Scleral tuck	
1/60	7	3	10
2/60	9	0	9
3/60	9	3	12
6/12	19	4	23
6/18	18	3	21
6/24	16	4	20
6/36	12	4	16
6/6	4	0	4
6/60	12	3	15
6/9	19	1	20
FCNF	9	2	11
HM	7	1	8
LF	18	2	20
NOPL	3	0	3
PL	5	0	5
Total	167	30	197

Table 4: Causes of nonimprovement of vision

Category	No	%
Irregular astigmatism	65	32.5
Corneal opacity	28	14.2
Pseudophakia bullous keratopathy	20	10.1
Posterior segment complications	24	12.1
Optic atrophy	6	3
Secondary glaucoma	3	1.5
Lens malposition	6	3
Other	5	3
Nil	18	8.2
Lost follow-up	20	10.2

Table 5: Comparative study of scleral tuck and suture fixated scleral supported lens

Variable	Scleral tuck		Suture fixated scleral supported		P
No	30		167		Na
Traumatic	15		55		Na
Non-traumatic	15		112		Na
Lens material	Foldable acrylic		Rigid PMMA		Na
Pre-post vision	0.011		0.021		0.731
Vision >6/24	76	45%	19	63%	Na

**Figure 4: Final status in non traumatic eye****Figure 5: Final status in traumatic case**

Discussion

The technique presented in this study is a novel lens design for the management of aphakia in the absence of a posterior capsule. Herein, we compared the previous results with the current lens design.

Thouvenin *et al.*^[3] reported that intracapsular lens implantation has more visual benefits and fewer complications than no implants. Wood *et al.*^[4] reported that secondary implants in aphakia cause minimal complications and favorable visual outcomes. Nihalani *et al.*^[5] and Ahmadiéh

et al.^[6] reported satisfactory outcomes in pediatric aphakia. Dick *et al.*^[7] and Augustin *et al.* proposed several options, such as angle-supported anterior chamber lens or scleral suture-supported posterior chamber IOL, for secondary implants in the absence of capsular support. Shah *et al.*^[2] also reported similar findings.^[7] Slade *et al.* reported satisfactory visual outcomes in cases of posterior capsular complication.^[2,8-11] Many studies have utilized iris-supported lenses to correct aphakia.^[12-15] Shah *et al.*^[2] did not find any significant difference if the secondary implant was placed either in the anterior chamber or sulcus following proper vitrectomy.

Recently, several studies have shown promising results with minimal complications while using scleral-fixated glued IOLs.^[16-20] Kumar *et al.*^[21] conducted a comparative study of various techniques of implanting scleral-fixated secondary lenses and found that it is most effective with minimal complications. Dadeya and Kamlesh^[22] compared the results of the angle-supported anterior chamber lens and suture-supported scleral fixated lens and found that the former provided better outcomes than the latter.^[15] Nonetheless, no study has yet compared the outcomes amongst the etiologies and pediatric and adult population. We did not find any significant difference between the traumatic and non-traumatic groups in the current study, probably due to comorbidities with both all etiologies.

To the best of our knowledge, no study has yet used the lens design described in this study. Also, the outcomes and complications between the two lenses have not yet been compared.

The self-retaining sclera-supported lens used in the present study has many benefits, such as a small learning curve, easy to perform and low cost owing to no requirement of glue. Moreover, the incidence of complications is minimal and similar to that of the suture-fixated lens.

Conclusion

This novel technique could be useful to manage aphakia in the absence of capsular support. The advantages of the method are cost-efficiency, a small learning curve and minimal intra- and postoperative complications; however, a prolonged follow-up is essential.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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