

Merits of conjunctival frill incision in reducing trabeculectomy-induced astigmatism and patient discomfort

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Purpose: To compare results of a novel “conjunctival frill/smile incision” on surgically induced astigmatism (SIA) and patient discomfort vs conventional trabeculectomy in the initial postoperative period. **Methods:** Sixty trabeculectomy cases were subjected to either conjunctival frill incision, performed 1.5–2.0 mm from the limbus (study group) or conventional fornix-based conjunctival flap (control group). Corneal astigmatism and suture-induced discomfort were assessed by keratometry and a self-devised patient questionnaire, respectively. **Results:** Both groups generated a “with the rule” SIA, which was 1.77 vs 2.42 at 1 week and reduced to 1.27 vs 1.8 in the study vs control group, after removal of sutures – both scleral flap releasable and conjunctival at 1 month. Patient *discomfort score* revealed enhanced comfort in 37% of patients (study group) vs 17% (control group) during the early postoperative period. After 1 month of surgery, good comfort was regained in all cases. **Conclusion:** This novel suturing technique results in reduced SIA, patient discomfort during the 1st month after trabeculectomy.

Key words: Astigmatism, conjunctival frill incision, discomfort score, trabeculectomy

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Trabeculectomy is the time tested glaucoma surgery which has witnessed several modifications starting from Cairns in 1968.^[1] Each modification aims to promote the survival or safety of the procedure. Conjunctival incision technique also has evolved with many modifications and currently, the two types of conjunctival flap techniques are fornix-based or limbal-based. Most comparative studies evaluating these report similar efficacy and bleb morphology.^[2-6]

The preferred conjunctival incision in our setting has been fornix-based due to optimal exposure of surgical limbus, reduced surgical time, and avoidance of “ring of steel” formation at incision site of limbal-based conjunctival flaps.^[7] The need to anchor the fornix-based conjunctival flap to the limbus with sutures, however, results in patient discomfort, tear film disruption, and corneal astigmatism. A modified conjunctival incision the “conjunctival frill (CF) incision” places the incision and sutures away from the limbus and seeks to redress these adverse issues of the limbal-based incision while preserving its benefits. The authors have devised this incision and designed this study to compare surgically induced astigmatism (SIA) and patient discomfort induced by this new conjunctival incision with conventional limbal-based conjunctival flap.

Methods

This prospective, double arm, pre-, and post-interventional study was carried out at a tertiary level teaching hospital. Consecutive 60 adult trabeculectomy surgeries were

randomized to **study group** with CF incision or **control group** with “limbal incision” using the envelope method. Eyes having undergone prior incisional surgery, dry eyes, and healed keratitis were excluded. The minimum follow-up was for 6 months.

The primary outcomes were SIA measured by keratometry (Potec, PRK-5000, Korea) and suture-induced discomfort evaluated by a self-devised patient questionnaire over the 1st month. Patient discomfort was graded by a Likert scale as mild/moderate/severe depending on symptoms of *watering, foreign body, and blurring of vision*. Secondary outcomes were *bleb morphology, intraocular pressure (IOP), and tear film disruption* over 6 months. Quantitative data (IOP/SIA) was analyzed by Mann-Whitney U Test/Student’s *t*-test/Wilcoxon Rank Sum test, while the categorical variables (Bleb morphology/patient comfort) were analyzed by Friedman test/Chi-square test. The follow-up protocol was 7 days, 14 days, 1 month, 3 months, and 6 months.

Surgical technique

Surgery was performed under peribulbar anesthesia without adrenaline. In the study group, a conjunctival incision was made 1.5–2.0 mm from limbus leaving a frill of conjunctiva attached. In the control group, a standard limbal conjunctival incision was made to generate a fornix-based flap. We used

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0.02% MMC for 2 min (in patients younger than 40 years) in addition to the seronegative commercially available amniotic membrane (AMT), as an antifibrotic agent, placed over the superficial scleral flap (before conjunctival suturing) for all patients (both study and control group).

Subsequent trabeculectomy procedure comprising of a trapezoid superficial scleral flap, 1.5–2 mm deep sclerotomy with two fixed and two releasable sutures were done in both groups. The conjunctival incision was sutured with 8–0 nylon, in a running, horizontal mattress type, with both ends being knotted away from the superior limbus [Fig. 1a]. In the control group, the conjunctiva was anchored at limbus with two wing sutures at two ends and two bleb forming sutures [Fig. 1b]. Bleb titration from preplaced side port at the end of surgery ensured watertight wound. Keratometry was performed at every follow-up visit until 1st month. The blebs were graded on slit-lamp using the *Indiana Bleb appearance grading system* (IBAGS) at all follow-up visits and IOP was monitored [Fig. 1c]. Tear film integrity was monitored by tear breakup time (TBUT) and discomfort level was analyzed by the questionnaire at 2-week follow-up. Releasable sutures were sequentially removed from day 7 to day 30 dictated by IOP control and bleb height. The conjunctival sutures were removed from 3 to 4 weeks depending on conjunctival healing [Fig. 1d].

Results

The mean age of subjects was 41 ± 13 years (range 18–65 years) in the study group and 49 ± 10 years (25–65 years) in the control group. Glaucoma subtypes were heterogeneous and equally distributed between angle-closure glaucoma (25) and open-angle glaucoma (24), followed by juvenile open-angle glaucoma (8), secondary glaucoma (2), and iridocorneal endothelial syndrome (1) cases.

Primary outcome

Surgically induced astigmatism (SIA)

SIA was “with the rule” of a magnitude 1.77 ± 0.8 vs 2.42 ± 0.83 at 1 week in study vs control group, the difference being highly significant ($P < 0.001$, using Mann-Whitney U test). Astigmatism declined to 1.27 ± 0.7 vs 1.8 ± 0.8, (study vs control) after removal of scleral releasable and conjunctival sutures by 1st month of follow-up, Table 1 and Fig. 2 depict the same.

Patient discomfort

CF incision resulted in reduced discomfort at all stages in the immediate postoperative period as evident from Fig. 3. Around 37% of patients were comfortable in the study group compared to only 17% in the control group, the difference being statistically significant ($P = 0.04$). By 1st month comfort was regained in almost all cases irrespective of the type of conjunctival incision.

Intraocular pressure (IOP)

A significant reduction of IOP was recorded in both groups (paired *t*-test). The intergroup difference between the study and control group as evaluated by the Mann-Whitney U test was statistically insignificant, although there was a greater reduction reported in a study group at week 1, 3 months, and 6 months. At 6-months follow-up 90% of patients had IOP <18 mmHg without the requirement of any antiglaucoma medication. Percentage fall in IOP at week 1 was more evident in the control group with a reduction of 61.4 ± 10% versus 57 ± 11% in the study group, however, at 6 months this reduction became greater in study group 60 ± 10% versus 57 ± 8% in control [Fig. 4].

Discussion

Postoperative astigmatism is one of the most important causes of diminution of vision after trabeculectomy. Hugkulstone et al. in 1991 investigated changes in corneal astigmatism after trabeculectomy and reported a reduction in vertical corneal radius, inducing SIA of “With the rule” (WTR) astigmatism over a 7-week follow-up.^[8] Kook et al. in 2001 studied SIA over a longer follow-up of 12 months period and reported WTR at 3 months, followed by an “against the rule” (ATR) shift at 1 year.^[9] Claridge et al. used computer-assisted corneal topography to document SIA after trabeculectomy and reported superior steepening of corneal curvature in the majority, which they attributed to tissue contraction around the trabeculectomy site secondary to extensive scleral cautery.^[10] This finding was echoed by Vernon et al.^[11] Dietze et al. mentioned the possibility of tight sutures and suggested a “posteriorly placed wound gape” from the internal sclerotomy as the cause.^[12] Cunliffe et al. besides suggested that the internal sclerotomy allowed the corneal edge of trabeculectomy to sink slightly thereby decreasing the vertical radius of the cornea.^[13]

Table 1: Surgically induced astigmatism (SIA) progression over the study period

Astigmatism	Study group		Control		Intergroup difference (Mann-Whitney U test)
	Mean ± SD	Change from preoperative level (Paired student’s <i>t</i> -test)	Mean ± SD	Change from preoperative level (Paired student <i>t</i> -test)	
Preoperative	0.93 ± 0.56	-	1.13 ± 0.78	-	$P = 0.41$
Week 1	1.77 ± 0.8	$P = 0.001^*$	2.42 ± 0.83	$P = 0.001$	$P = 0.001\#$
Week 2	1.55 ± 0.72	$P = 0.001^*$	2.53 ± 0.83	$P = 0.001$	$P = 0.001\#$
Post releasable suture removal					
1 month	1.27 ± 0.65	$P = 0.001^*$	1.78 ± 0.77	$P = 0.001$	$P = 0.007$
Post conjunctival suture removal					
3 months	1.09 ± 0.57	$P = 0.006$	1.47 ± 0.8	$P = 0.001$	$P = 0.065$
6 months	1.02 ± 0.75	$P = 0.081$	1.46 ± 0.74	$P = 0.001$	$P = 0.035$

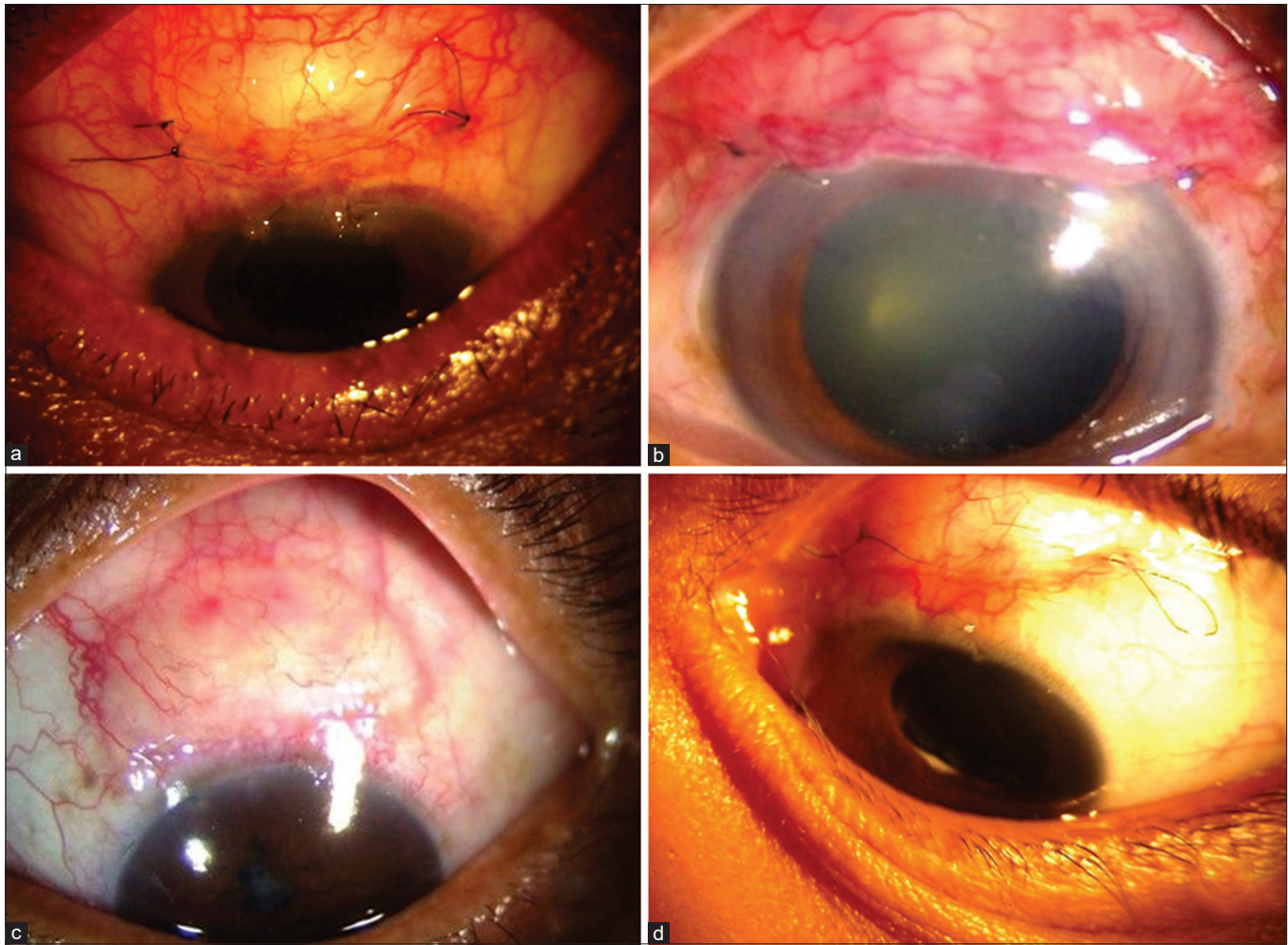


Figure 1: (a) *frill* incision bleb at the end of surgery. (b) Conventional/fornix-based bleb (control group). (c) Bleb appearance following conjunctival suture removal (d) Conjunctival frill bleb appearance at postoperative follow-up visit (2 weeks)

CF incision induced significantly less SIA compared to the control group at $P < 0.001$ at weeks 1 and 2, and $P < 0.007$ at 1st month (Mann-Whitney U test). On further evaluation of change in vertical and horizontal meridian over time, vertical steepening was noted evident of *WTR* most pronounced at week 2 and 1 month. The reduction in astigmatism was maximal up to 1st month and minimal thereafter. Delbeke *et al.* have also reported the stabilization of astigmatism over 3 months.^[14] This finding leads us to infer that refractive correction needs to be deferred for a minimal 1-month post trabeculectomy.

Patient comfort level was higher in CF group 37% versus 17% in the control group at 1st-week follow-up. After suture removal, in both groups, the comfort level improved to 50% in the study group and 23% in the control group. At 1-month follow-up, good comfort was regained in almost all patients irrespective of the type of suturing in 87–100% cases. To our knowledge, no prior study has evaluated suture induced discomfort post trabeculectomy.

By the end of the 6-months follow-up, 90% of patients had IOP < 18 mmHg without the requirement of any antiglaucoma medications, the documented IOP reduction although

greater in the study group as compared to the control, was not statistically significant. Most prior studies have also documented similar IOP control between the limbus-based and fornix-based conjunctival incisions.^[6,15-20]

Complications

A *wound leak* was seen in one patient in the study group and two patients in the control group. The study group case required resuturing, others were managed conservatively. *Hypotony* was seen in four patients of the study and six patients in the control group. Again it was self-resolving. *Subconjunctival fibrosis* requiring needling with 5 FU was required for 1 patient in each group, during the 6-month duration of study follow-up. No sight-threatening complications occurred in any patient.

Limitation

Long time survival of the bleb and sustained IOP control over years determines the success of a trabeculectomy, while SIA and patient comfort are important parameters in the early-intermediate postoperative period only. So a relatively shorter mean postoperative follow-up is the limitation of this study.

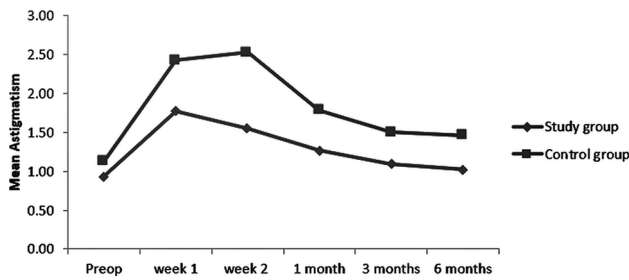


Figure 2: Surgically induced astigmatism (SIA) comparison between study vs control group

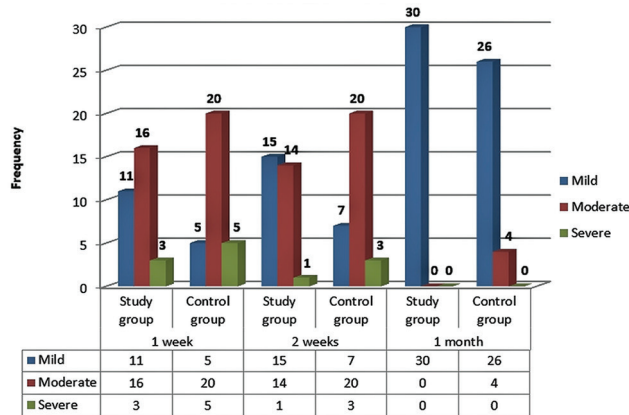


Figure 3: Patient discomfort score in study vs control group

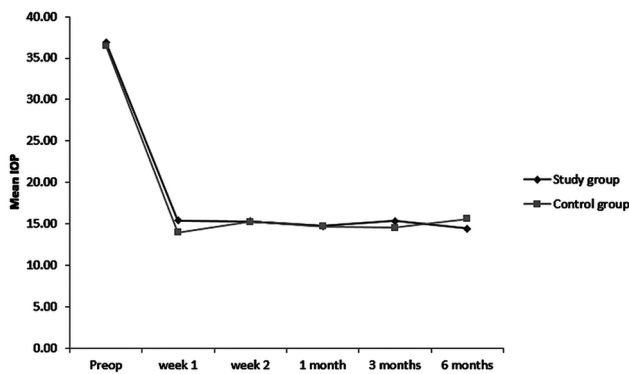


Figure 4: IOP variation over the study period

Conclusion

This new conjunctival incision technique resulted in reduced SIA and patient discomfort during 1st month after trabeculectomy with comparable intraocular pressure control till a 6-months follow-up.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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