Single-snip paralimbal incision: A quick approach to rectus muscles

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Abstract:
INTRODUCTION: Less invasive and quicker surgeries have become common. We compared two conjunctival incisional approaches in strabismus, namely Follow standard paralimbal approach for (SPLA) and single-snip paralimbal (SSPLA).

MATERIALS AND METHODS: Forty-four patients with horizontal strabismus qualifying for uniocular recession–resection surgeries were randomized to SPLA and SSPLA. SSPLA involved a single v-shaped incision, with the apex of the V near the limbus, and the limbs facing away: by pinching up the conjunctiva with a forceps and delivering the single snip with a spring scissors. We compared the postoperative grades of redness, congestion, chemosis, foreign body sensation, and drop intolerance at day 1, 2 weeks, and 6–8 weeks; scar visibility, as yes or no, at 6–8 weeks; success rates, considered to be within 10 prism diopters of orthophoria, at 6–8 weeks; and operation duration in minutes.

STATISTICAL ANALYSIS: Statistical analysis was done using Mann–Whitney U-test, for inflammatory grades, Chi‑square for proportions, and t-test for parametric measures. Statistical significance was set at \( P < 0.05 \).

RESULTS: On postoperative day 1, congestion \( (P = 0.02) \), foreign‑body sensation \( (P = 0.04) \), and total inflammatory score \( (P = 0.003) \) were statistically significantly favoring the SSPLA group. While at 2 weeks, only congestion \( (P = 0.02) \) was found to be significantly less in the SSPLA group. There were no significant differences in the proportions of scar visibility \( (5/22 \text{ in the SPLA vs. } 3/22 \text{ in the SSPLA}) \) and success rate: \( 20/22 \text{ vs. } 18/22 \). The SSPLA was quicker on an average by 6 min \( (P < 0.001, 95\% \text{ confidence interval: } 3.2–6.7) \).

CONCLUSION: Compared to the SPLA, the SSPLA is quicker and results in lesser inflammation in the immediate postoperative period.

Keywords:
Conjunctival incision, single‑snip paralimbal approach, standard paralimbal approach, strabismus

Introduction
Less invasive surgeries have gained popularity in different specialties with the advantages of causing lesser disruption of anatomy, often being quicker, healing rapidly, and providing better cosmesis and a more comfortable postoperative outcome.[1,2] Ophthalmology too has vastly evolved from the conventional surgeries to the small-sized phacoemulsification,[3] minimally invasive glaucoma surgeries,[4] and sutureless vitreo‑retinal surgeries. [5] Strabismus surgeries have also been involved in this transition, especially with regard to their conjunctival incisions. They are planned preoperatively based on the expected extent of exposure needed for the specific surgery to achieve optimal cosmetic and functional results.[6] The incisions have evolved from Harm’s limbal approach,[6‑8] Park’s fornical approach,[9] Velez’s radial incision,[10] Swan’s incison,[7,8,11] to the minimally invasive strabismus surgery (MISS) popularized by Mojon.[12‑15] Like other subspecialties of ophthalmology, strabismus surgery also strives to be less

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invasive and time efficient, permitting early ambulation, achieving better cosmesis and comfort postoperatively.

We planned our study to evaluate a rarely used single-snip conjunctival incision where the rectus muscle is approached by a single V-shaped incision, with the limbs away from limbus and the apex in the paralimbal area. We designed a randomized controlled trial (RCT) and compared the single snip paralimbal approach (SSPLA) to the standard paralimbal approach (SPLA), the usual technique in our set-up, in strabismus cases qualifying for horizontal rectus muscle surgery in terms of postoperative inflammation, success rate, scarring, and duration of surgery.

**Materials and Methods**

After clearance from the institutional review board and obtaining informed consent from patients or parents, and in the latter case with the assent of those between 10 and 18 years of age, we block randomized 44 patients of horizontal strabismus, qualifying for unioocular recession–resection surgery to SPLA or SSPLA. Allocation concealment was ensured by using opaque envelopes to seal the random allocation chits, by a person not involved in the study. Children <10 years of age and patients with previous ocular surgeries, inflammatory conditions, or inability to cooperate were excluded from the study.

**Steps of surgery**

In the SSPLA, the conjunctiva was pinched up with the Pierce–Hoskins conjunctival forceps about 1–2 mm from the limbus; with the Westcott scissors, a single snip was given on the conjunctiva, with the blades of the scissors pointing toward the muscle of interest, and the pivot abutting the lifted conjunctival flap [Figure 1]. This resulted in a V-shaped cut, which opened into a crescent-shaped conjunctival incision with the apex or convexity toward the limbus and the muscle insertion enclosed in the limbs of the V. The limbs were extended by 1–2 mm, if needed. Blunt dissection under the conjunctiva into the quadrant where there was no rectus muscle, exposed the insertion of rectus muscles. Subsequent rectus muscle surgery was done as planned. After muscle manipulation, the conjunctival flap was re-attached by a single 8-0 braided coated polyglactin 910-violet suture (Johnson & Jonson, Vicryl® 8-0, NW 2347) City: Waluj, Aurangabad State: Maharashtra Country: India at the apex of the V-shaped conjunctival flap.

We compared postoperative inflammatory scores (individual and total) on postoperative day 1, at 2 weeks, and 6–8 weeks. A standard set of photographs were used to grade the individual inflammatory scores which ranged from 0 to 3 (nil–mild–moderate and severe) and they were added to get the total inflammatory scores which thus ranged from 0 to 15. Scar visibility (from 1 m, classified as visible or not visible) and success rates (defined as alignment within 10 prism diopters of orthophoria) were compared at postoperative 6–8 weeks: both by the persons masked to the allocation. Time in minutes, taken for surgery, was also assessed and compared from conjunctival incision to suture closure of the conjunctiva.

**Statistical analyses**

We used statistical software: JASP Version 0.9.0.1, for statistical analysis (Eric-Jan, Wagenmakers, Department of Psychological Methods, University of Amsterdam, Amsterdam, The Netherlands) to perform statistical analysis. Data were summarized in terms of means (standard deviation), medians (range), and percentages, as required. Outcomes were compared between the groups using Student’s *t*-test (for continuous outcomes), Mann-Whitney *U*-test for graded outcomes, and Chi-square test (Fisher’s exact method) for proportions or counts. Confidence intervals (CIs) were quoted where possible. Statistical significance was set at *P* < 0.05.

**Results**

After randomization, we had 22 patients in each of the SPLA and SSPLA groups. Three eyes in each group were operated under general anesthesia. The baseline demographic, clinical, and presurgical characteristics of the patients are described in Table 1.
Table 1: Group-wise baseline clinical and demographic characteristics of the patients

| Features                        | Randomized groups |
|---------------------------------|-------------------|
|                                 | SPLA (n=22)       | SSPLA (n=22)     |
| Gender, n (%)                   |                   |                  |
| Female                          | 13 (59.1)         | 11 (50)          |
| Male                            | 9 (40.9)          | 11 (50)          |
| Age of patients in years, Mean (SD) | 20.36 (5.83)     | 20.82 (9.31)     |
| Age at onset of deviation in months, mean (SD) | 86.59 (115.6) | 58.91 (62.50)     |
| Esotropia, n (%)                | 7 (31.8)          | 5 (22.7)         |
| Exotropia, n (%)                | 15 (68.2)         | 17 (77.3)        |
| Congenital, n (%)               | 9 (40.9)          | 7 (31.8)         |
| Acquired, n (%)                 | 13 (59.1)         | 15 (68.2)        |
| Constant, n (%)                 | 20 (90.9)         | 17 (77.3)        |
| Intermittent, n (%)             | 2 (9.1)           | 5 (22.7)         |
| Eye involved, n (%)             |                   |                  |
| Right eye                       | 8 (36.4)          | 4 (18.2)         |
| Left eye                        | 11 (50)           | 11 (50)          |
| Alternate                       | 3 (13.6)          | 7 (31.8)         |
| BCVA (logMAR): mean (SD)        |                   |                  |
| Operated eye                    | 0.68 (0.72)       | 0.68 (0.81)      |
| Nonoperated eye                 | 0.07 (0.12)       | 0.04 (0.10)      |
| Anesthesia, n (%)               |                   |                  |
| Operated under general anesthesia | 3 (13.6)         | 3 (13.6)         |
| Operated under peri-bulbar block | 19 (86.4)        | 19 (86.4)        |
| Horizontal deviation in PD: mean (SD) | 49.32 (8.49) | 45.68 (13.21)   |
| (range: minimum to maximum)     | 35-65             | 20-70            |
| Surgical target in PD: mean (SD) | 51.14 (8.98)     | 46.36 (13.29)    |
| Amblyopia, n (%)                |                   |                  |
| No                              | 5 (22.7)          | 6 (27.3)         |
| Mild                            | 3 (13.6)          | 5 (22.7)         |
| Moderate                        | 7 (31.8)          | 5 (22.7)         |
| Severe                          | 7 (31.8)          | 6 (27.3)         |

SPLA: Standard paralimbal approach, SSPLA: Single-snip paralimbal approach, SD: Standard deviation, logMAR: Logarithm of the minimum angle of resolution, PD: Prism diopters, BCVA: Best-corrected visual acuity

On postoperative day 1, congestion ($P = 0.02$), foreign-body sensation ($P = 0.04$), and total inflammatory ($P = 0.003$) score were statistically significantly favoring the SSPLA group. On 2-week follow-up, only congestion ($P = 0.02$) was found to be significantly less in the SSPLA group [Tables 2 and 3].

On 6–8 weeks’ follow-up, similar distribution of inflammatory scores was found in both the groups [Table 3]. The visibility of scar showed no statistically significant difference ($P = 0.43$). Success rates at 6–8 weeks were compared and found to be similar ($P = 0.38$).

We found that on an average, the SSPLA took 26.3 (3.2) min compared to 32.2 (5.58) min for SPLA: the former being quicker by 6 min ($P < 0.001$; 95% CI: 3.2–8.7).

**Discussion**

In our RCT, we found that compared to Follow standard paralimbal approach for SPLA, the SSPLA was significantly quicker and less inflammatory in its postoperative course in the initial 2 weeks. It was similar in terms of scar visibility and success rate.

We found only one study similar to ours by Caputo *et al.* in 1991.[17] Similar to our study, they used a single-snip incision to cut the conjunctiva and tenons together rather than making three separate triradiate incisions, but differed from us in comparing with a standard limbal approach. Theirs was a noncomparison series of 140 patients, 92 of whom were congenital esotropes, 42 had exotropia, and 7 had dissociated vertical deviation (DVD), while 13 of them had re-surgeries and a total of 316 muscles were operated. They concluded that the technique was simpler and 4–5 times faster to perform as compared to the standard approach. They believed that it caused less bleeding and tissue damage and allowed good and direct exposure of the muscles, whether horizontal or vertical recti. This approach was considered
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useful even in scarred or shortened conjunctiva. Similar to us, after placing the traction sutures, the authors reported lifting the conjunctiva along with tenons, 4 mm from the globe using 0.3-mm toothed forceps. While they seem to have initiated the incision, 3 mm away from the limbus in the quadrant of interest, we did so at about 2 mm. A one-snip horseshoe-shaped conjunctiva and tenon incision was therefore made, and the conjunctiva was reflected back to expose the muscle: our procedure was similar. After surgery, they either repositioned the flap or recessed it, reattaching it with two 6-0 plain sutures. Contrary to them, we utilized one suture, and that too of 8-0 polyglactin to reposit the conjunctiva; moreover, we had no case where conjunctival recession was done. We believe that their study lacked in strength by not having a control group. By having a concurrent randomized controlled group, masking the allocation, and using blinded assessors, we substantially strengthened the design of our study.

Interestingly, we could not identify any other study which had evaluated the single-snip approach.

Our study evaluated an uncommonly used conjunctival incision to approach the horizontal rectus muscles, and compared it with the standard paralimbal triradiate approach, and found it significantly favorable even in a training environment because it lends itself to be easily comprehended by novice trainees, resembling in its location and approach the familiar SPLA. The SSPLA has demonstrated lesser inflammatory scores compared to the SPL, along with being better tolerated, at least in the initial 2 weeks. It is demonstrably quicker and leads to comparable success rate.

This study is limited to patients with a mean age of 20 years, ranging from 10 to 59 years old. However, it proves that it is feasible in patients across a wide age range, and we intend to perform it in children too. Subsequent studies may pit SSPLA against MISS, and the fornical approach. Finally, SSPLA was considered by far to be an easier, quicker, and better experience, and now forms the routine approach to horizontal strabismus surgeries in our setup. Moreover, novice surgeons are demonstrating it as a comfortable option to SPLA.

**Conclusion**

The results of our study suggest that the single-snip (SSPLA) is a quicker and less inflammatory approach than the standard paralimbal (SPLA) in terms of better and significant postoperative outcomes at least during the initial 2 weeks. The SSPLA group took significantly less time, while the success rates and scar visibility showed no significant difference between the two groups. We opine that SSPLA should be the preferred technique both by established and novice surgeons, due to it being quicker, easier, and familiar, with superior early postoperative course.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

| Table 2: Group-wise distribution of individual inflammatory scores at follow-up (P on Mann-Whitney U-test) |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Median inflammatory scores      | Redness         | Congestion       | Chemosis         | Foreign-body sensation | Drop intolerance |
| SPLA                           | SSPLA           | SPLA             | SSPLA            | SPLA             | SSPLA            | SPLA            | SSPLA           |
| Postoperative day 1             |                 |                  |                  |                  |                  |                  |                  |
| Median                         | 2               | 2                | 2                | 1                | 1               | 1               | 0               | 0               |
| P                              | 0.77            | 0.02             | 0.48             | 0.04             | 0.13            |
| Week 2                         | 1               | 1                | 2                | 1                | 0.5             | 0               | 0               | 0               |
| P                              | 0.60            | 0.02             | 1.00             | 0.06             | Not computable  |
| Week 6                         | 0               | 1                | 1                | 1                | 0               | 0               | 0               | 0               |
| P                              | 0.56            | 0.31             | 0.57             | Not computable  | Not computable  |                  |                  |                  |

SPLA: Standard paralimbal approach, SSPLA: Single-snip paralimbal approach

| Table 3: Group-wise comparison of total inflammatory score, scar visibility and success rate |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Outcome variables              | Randomized groups | P               |                  |                  |                  |
|                                | (n=22)           | (n=22)          |                  |                  |                  |
| TIS*: Median (range)           |                 | Mann-Whitney U-test |                  |                  |                  |
| Day 1                          | 6.5 (4-8)        | 5 (3-8)         | 0.003            |                  |                  |
| 2 weeks                        | 3 (1-6)          | 3 (1-6)         | 0.12             |                  |                  |
| 6-8 weeks                      | 1 (0-3)          | 1 (0-3)         | 0.75             |                  |                  |
| Scar visibility at*, n (%)     |                 | Fisher’s exact  |                  |                  |                  |
| 6-8 weeks                      | 5 (22.72)        | 3 (13.63)       | 0.43             |                  |                  |
| Success rate†, n (%)           |                 | Fisher’s exact  |                  |                  |                  |
| 6-8 weeks                      | 20 (91.0)        | 18 (81.8)       | 0.38             |                  |                  |

*T: Total inflammatory score ranges from 0 to a maximum of 15. †: Scar visibility as seen from 1 m and classified as visible or not visible. ‡: Success rate is defined as postoperative alignment within 10 PD of orthophoria. TIS: Total inflammatory score, SPLA: Standard paralimbal approach, SSPLA: Single-snip paralimbal approach, PD: Prism diopters
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