

# Comparison of Trans Conjunctival Approach versus Infraorbital Approach for Infraorbital Rim and Orbital Floor Fractures – A Prospective Clinical Study

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## Abstract

The contemporary surgeon faces the challenge of dealing with orbital trauma, reconstruction and aesthetics. Transconjunctival, subciliary, subtarsal and infraorbital incisions are used to approach the infraorbital rim/floor. Infraorbital incision produces a noticeable cosmetically disfiguring scar. Transconjunctival incision, on the other hand, leaves an inconspicuous scar which heals rapidly and uneventfully, but demands surgical precision. The purpose of this study was to compare the infraorbital and the transconjunctival approach for treatment of infraorbital rim and/or orbital floor fractures with regard to accessibility and exposure of the fracture site, aesthetics and postoperative complications. 18 patients, diagnosed with orbital floor fractures and/or infraorbital rim fractures, with or without other facial skeleton fractures respectively were divided into two groups based on their preference for either the infraorbital or the transconjunctival incision. The control group comprised of 11 infraorbital incisions and the study group of 11 transconjunctival incisions. We found that the transconjunctival incision provides adequate exposure to the surgical field, allows rapid healing leaving an unnoticeable scar, and causes minimal postoperative complications as compared to the infraorbital incision.

**Keywords:** *Incisions, Infraorbital, Infraorbital Rim Fractures, Orbital Floor Fractures, Trans Conjunctival.*

## 1. INTRODUCTION

Orbital fractures which involve some or all of the zygomatic articulations (zygomatic-sphenoid, zygomatic-frontal, zygomatic-maxillary, and zygomatic-temporal suture lines) comprise one of the most common conditions encountered today by Oral and Maxillofacial surgeons.<sup>1</sup>

Operative exposure of zygomatic fractures is accomplished through a variety of approaches including the intraoral (Keen), temporal (Gillies), lateral brow incision, hemicoronal and bicoronal flap techniques.<sup>1</sup> In patients with zygomatic

complex fractures, the orbital floor and rim components are usually treated through cutaneous incisions such as subciliary, mid lower eyelid or subtarsal and infraorbital incisions and the zygomatic-frontal region is approached either through a superciliary incision or a lateral brow incision.<sup>2</sup> These approaches however leave behind a scar, which may be cosmetically disfiguring at times.

Infraorbital incision (IO), the old workhorse incision, has several advantages like a short and direct path, avoids the orbital septum and periorbital fat, and provides good access.

With increasing emphasis on aesthetics and minimal invasive surgeries being the dictum in recent years, there has been a renewed interest in transconjunctival incision (TC) in both cosmetic and trauma settings.

Transconjunctival incision, an alternative, has significant advantages over the scar produced by a cutaneous incision as it lays hidden, is rapid and neither skin nor muscle dissection is necessary, but demands surgical precision.<sup>3, 4</sup> Described for the first time by Bourget (1924) for surgical access in the aesthetic blepharoplasty to remove palpebral fat, the transconjunctival approach has been used in orbital traumatology since the 1970s. Tessier reported his experience with this incision when treating syndromic patients.<sup>3,4</sup> In 1973, Tessier and Converse et al introduced the use of the transconjunctival approach in combination with a lateral canthotomy for exposure of the orbital floor and maxilla. Converse et al reported treating patients with orbital floor and rim fractures using this incision and also described the preseptal and the retroseptal techniques and lateral canthotomy extension for better surgical exposure of infraorbital rim or floor and the lateral orbital wall. Manson et al and Waite & Carr proposed a transconjunctival approach using a single Incision for both.<sup>2</sup>

The purpose of this study was to compare accessibility, visibility, aesthetics and complications in patients being treated for infraorbital rim and orbital floor fractures by either transconjunctival or infraorbital approach.

## 2. MATERIALS AND METHODS

This comparative prospective study was conducted in the Department of Oral and Maxillofacial Surgery of our institution from December 2012 till September 2014. The protocol for the study was approved by the Ethical Committee of the Institution and informed consent was obtained from the participating patients.

### Inclusion Criteria

- Patients of either sex, in the age group ranging from 18-50 years, with clinical and radiographic evidence of orbital trauma i.e. isolated orbital floor fractures and/or infraorbital rim fractures or Zygomaticomaxillary Complex (ZMC) fractures or Le fort II fractures, with or without other facial skeleton fractures respectively, which required open reduction with internal fixation (ORIF) and/or orbital floor reconstruction
- Patients having enophthalmos and/or extraocular muscle entrapment
- Patients having persistent diplopia

### Exclusion Criteria

- Patients with Contused Lacerated Wound in the periorbital region
- Patients with open globe injury or hyphema, conjunctival pathology, ocular surface disease or glaucoma
- Diabetic and/or immunocompromised patients

After pre-operative (Pre-Op.) clinical, radiological [Paranasal Sinus (PNS) X-ray and/or CT Scan Brain plain with PNS cuts with or without 3-D reconstruction] and Pre-Op. ophthalmological evaluation, 18 patients who fulfilled the above mentioned criteria were divided into two groups based on their preference for either the infraorbital incision (control group) or the transconjunctival incision (study group) and were taken up for ORIF/orbital floor reconstruction under general anaesthesia.

All patients were started on Pre-Op. intravenous (IV) antibiotics and analgesics (Inj. Ceftriaxone 1 gm. IV B.I.D, Inj. Metronidazole 500 mg. per 100 ml. IV T.I.D and IV analgesic Inj. Dynapar AQ 75 mg. in 100 ml. NS T.I.D. for 1-2 days). All patients were also started on Pre-Op. IV steroids i.e. Inj. Dexona 8 mg. IV T.I.D for 1 day because most of the patients had periorbital oedema and were operated on the second or third day after admission which could have otherwise caused problems in placement of the incisions in the orbital region.

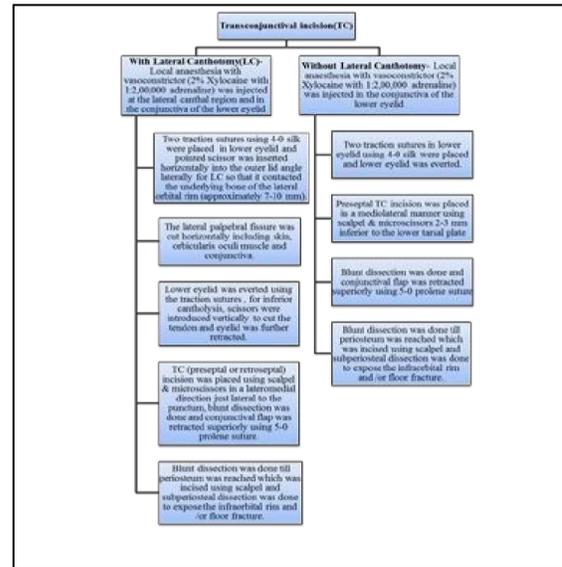
Out of the 18 patients, 11 infraorbital incisions were placed in 8 patients who served as the control group whereas 11 transconjunctival incisions were placed in the remaining 10 patients who comprised the study group. In the control group, 3 patients underwent bilateral infraorbital incisions and the remaining 5 underwent unilateral infraorbital incision. In the study group, 1 patient underwent bilateral transconjunctival incisions with lateral canthotomy, 2 patients underwent retroseptal transconjunctival incision with lateral canthotomy, 5 had preseptal transconjunctival incision with lateral canthotomy and 2 had preseptal transconjunctival incision without lateral canthotomy.

### Operative Technique

Infraorbital incision was marked at the level of the infraorbital rim margin in a minor skin crease at the transition of the thin eyelid and thick cheek skin, varying from 2.5 to 4 cms approximately. Local anaesthesia with vasoconstrictor (2% Xylocaine with 1:2, 00,000 adrenaline) was injected. Incision was then made through skin, subcutaneous tissue and then preorbital orbicularis oculi muscle. Blunt dissection was carried down to the preorbital periosteum. Periosteal incision was made 1 to 2 mm inferior to the infraorbital rim and subperiosteal dissection was done to expose the infraorbital rim and/or floor, maxilla and the zygoma. Infraorbital rim fracture and/or orbital floor fracture was exposed and visualized. Fixation was done using either 2 mm or 1.5 mm miniplates (varying from 2-9 holed) and screws (either 2x6 mm or 1.5x6 mm). Reconstruction of the orbital floor was done using prolene mesh in 2 patients with orbital floor fracture. Periosteal closure was done using interrupted sutures with 4-0 vicryl and skin closure was done using subcuticular suture with 5-0 prolene.

In the retroseptal transconjunctival technique, the exposure was achieved by dissecting posterior to the plane of the orbital septum, the lower eyelid retractors, or capsulopalpebral fascia, which contains the fascia extension of the inferior rectus. In the preseptal technique the periosteum was reached after the thin cranial part of the capsulopalpebral fascia was dissected above the lower lid retractor muscles and then dissection proceeded anteriorly and inferiorly between the

orbital septum and the orbicularis oculi muscle. The periosteum of the inferior orbital rim was incised and dissected to expose the orbital rim/floor. In the present study the following protocol was followed for the study group as depicted in fig. 1



**Fig.1 Protocol for TC incision in the Study Group**

In the study group, fixation was done using either 2 mm or 1.5 mm miniplates (varying from 2- 9 holed) and screws (either 2x6 mm or 1.5x6 mm). Periosteal closure was done using interrupted sutures with 4-0 vicryl and conjunctiva closure was done using continuous suture with 6-0 vicryl. If LC was done, closure was achieved using interrupted buried sutures with 6-0 prolene for canthopexy, canthal margin realignment and skin was closed using interrupted sutures with 6-0 vicryl.

All patients were continued on IV antibiotics and analgesics as mentioned earlier for the intraoperative period. IV antibiotics were given till Post-Op. day 3 (5 days) or Post-Op. day 5 (7 days) depending upon the severity of the sustained injuries. IV analgesics were usually given till Post-Op. day 3 and then changed to oral route. Neosporin skin ointment T.I.D was applied for a week in the Control Group (closed dressing till 2-3 days) and Neosporin eye ointment T.I.D was applied for 1 week in the Study group. Moxifloxacin eye drops (2 drops/eye) Q.I.D was

given for 1 week in both the groups. Subcuticular sutures were removed on the 7th day Post-Op. in Control group whereas the LC skin sutures were removed on the 15th day Post-Op. The patients were evaluated intraoperatively and postoperatively at the 7th day, 15th day, 1st month and 3rd month for the following parameters as shown in table 1. A modified version of The Patient and Observer Scar Assessment Scale was used to evaluate the postoperative scar in comparison to either the normal ipsilateral adjacent and/or contralateral periorbital tissue or conjunctiva, by a single observer and patient.<sup>5, 6, 7</sup> Post-operative periorbital oedema was recorded using an ordinal scale given by Gurlek A ETal.<sup>8</sup>

### 3. STATISTICAL ANALYSIS

Proportions were compared using Chi-square test and the Student's t test was used to determine whether there was a statistical difference between groups in the parameters measured if the data was normal. Data was analysed using SPSS (Statistical Package for Social Science, Ver.10.0.5) package. A p-value of less than 0.05 was accepted as indicating statistical significance.

### 4. RESULTS

The mean age of the patients in the control group was  $28.55 \pm 6.802$  years whereas it was  $30.36 \pm 11.218$  years in the study group. Among the 18 patients, 21 incisions (95.5%) were placed in 17 males and 1 incision (4.5%) was placed in 1 female. In the Control group 11 (100.0%) incisions were placed in 8 male patients whereas in the Study group, 10 incisions were placed (90.9%) in 9 male patients and 1 incision (9.1%) was placed in 1 female patient. No statistical significance was noted between the two groups. Intraoperative accessibility and visibility of infraorbital rim and/or orbital floor fracture was recorded using an ordinal scale whereas intraoperative complications were recorded using a nominal scale and these parameters were not

statistically significant. (Tables-2, 3; Figures 2, 3, 4)

For the independent factor of incisions given, the dependent variable of aesthetics for postoperative scar assessment by the observer included six parameters all of which were recorded using an ordinal scale on the 7th day, 15th day, 1 month and 3 months respectively. (Figures-5, 6 and 7)

Pliability for the post-operative scar assessment was evaluated by manual palpation. The difference in pliability was statistically significant at the 15th day ( $p < 0.001$ ) and 1 month ( $p = 0.001$ ) time interval post-operatively. Vascularity for the post-operative scar assessment was noted visually and the difference was found to be statistically significant at the 15th day ( $p = 0.004$ ) time interval post-operatively. Assessment of pigmentation (colour) for the postoperative scar was also done by means of visual examination and was found to be statistically significant at the 1 month ( $p = 0.008$ ) time interval post-operatively. Visual and manual evaluation was used for assessment of the scar thickness and relief. Both were statistically significant at the 1 month ( $p = 0.027$ ,  $p = 0.022$ ) time interval postoperatively. Surface area for the post-operative scar assessment was inspected by means of visual examination and did not show any statistical Significance. (Table-4)

For the independent factor of incisions given, the dependent variable of aesthetics for postoperative scar assessment was evaluated by the patient on the basis of a questionnaire along with manual or visual examination, which included six parameters. These were recorded using an ordinal scale on the 7th day, 15th day, 1 month and 3 months respectively.

Pain perception for the post-operative scar assessment was recorded on the basis of a questionnaire along with manual palpation. Pain subsided faster in the study group as compared to

the control group even though it was found to be statistically insignificant. The presence of itching was statistically significant at the 15th day ( $p=0.027$ ) time interval post-operatively. Colour for the post-operative scar assessment was recorded on the basis of a questionnaire along with visual examination. The difference in colour perception was statistically significant at 1 month ( $p=0.030$ ) time interval post-operatively. Stiffness, thickness and irregularity were recorded on the basis of a questionnaire along with manual palpation. Stiffness was found to be statistically significant at the 7th day ( $p=0.010$ ), 15th day ( $p=0.010$ ) and 1 month ( $p=0.001$ ) time interval post-operatively. Thickness was not statistically significant post-operatively. Scar irregularity was statistically significant at the 7th day ( $p=0.003$ ) and 15th day ( $p=0.034$ ) time interval post-operatively. (Table-5)

Postoperative periorbital oedema was recorded using an ordinal scale by means of visual inspection on the 7th day, 15th day, 1 month and 3 months respectively. The difference in degree of periorbital oedema was found to be statistically significant at the 7th day ( $p=0.032$ ) and 1 month ( $p=0.022$ ) time interval post-operatively. (Table-6)

Postoperative complications were recorded using

a nominal scale over a follow up period of 3 months. No post-operative complications were noted in the control group. However, in the study group, 1 transconjunctival incision (9.1%) in 1 patient developed a medial cicatricial entropion which resolved with conservative management over a period of 3 months. (Table-3)

## 5. DISCUSSION

Management of facial fractures necessitates a search for incisions which provide optimal exposure of fracture sites along with minimal cosmetic deformity.<sup>9</sup> The specialty, individual's expertise and experience with the eye as well as a thorough understanding of the periorbital anatomy and function partially dictates the choice of incision.<sup>10</sup>

The infraorbital incision has been used conventionally for the management of orbital rim/floor fractures. It is relatively easier to master and chances of postoperative lid dysfunction are less as compared to other cutaneous approaches.<sup>11</sup> When cautiously used, this incision heals adequately but has been known to cause prolonged lower eyelid pretarsal oedema.



**Fig. 2 Intra-operative Access with Infraorbital Incision**



**Fig. 3 Intra-operative Access with Transconjunctival Incision without Lateral Canthotomy**



**Fig. 4 Intra-operative Access with Transconjunctival Incision with Lateral Canthotomy**



**Fig. 5 A**

**Fig. 5 B**

**Fig. 5 C**

**Fig. 5 D**

**Fig. 5 Post-operative Scar of Infraorbital Incision: A) 7<sup>th</sup> Day B) 15<sup>th</sup> Day C) 1 Month D) 3 Months**



**Fig. 6 A**

**Fig. 6 B**

**Fig. 6 C**

**Fig. 6 D**

**Fig. 6 Post-operative Scar of Transconjunctival Incision with Lateral Canthotomy: A) 7<sup>th</sup> Day B) 15<sup>th</sup> Day C) 1 Month D) 3 Months**



**Fig. 7 A**

**Fig. 7 B**

**Fig. 7 C**

**Fig. 7 D**

**Fig. 7 Post-operative Scar of Transconjunctival Incision without Lateral Canthotomy: A) 7<sup>th</sup> Day B) 15<sup>th</sup> Day C) 1 Month D) 3 Months**

Table 1. Parameters assessed in the control group and the study group				
Intra-Operative Parameters	Post-Operative Parameters			
		Assessment of Scar on 7 <sup>th</sup> day, 15 <sup>th</sup> day, 1 <sup>st</sup> month and 3 <sup>rd</sup> month.(1-normal, 2-mild to moderate difference but acceptable, 3-marked difference & unacceptable): <b>Modified Patient and Observer Scar Assessment Scale</b>		Assessment of Periorbital Oedema on 7 <sup>th</sup> day, 15 <sup>th</sup> day, 1 <sup>st</sup> month and 3 <sup>rd</sup> month.
<i>Observer</i>		<i>Patient</i>	0-None 1-Minimal 2- Covering the iris 3- Extending to the pupil 4-Massive	Suture granuloma Ectropion Entropion Tissue dehiscence Scleral show
Accessibility and Exposure (1-Good, 2-Average, 3Poor)	Pliability	Painful		
Complications: (Present/Absent) Eyelid tear, Corneal injury, Buttonhole, Eyelid Notching	Vascularity	Itching		
	Pigmentation	Colour		
	Thickness	Stiffness		
	Relief	Thickness		
	Surface area	Irregularity		

Table 2. Comparison of intra-operative accessibility and visibility of fracture site between control group and study group						
	<i>Good</i>	<i>Average</i>	<i>Poor</i>	<b>Total</b>	<b>2 value</b>	<b>'p' value</b>
Control Group	11 (100.0%)	0 (.0%)	0 (.0%)	11 (100.0%)	1.048	0.306
Study Group	10 (90.9%)	1 (9.1%)	0 (.0%)	11 (100.0%)		
Total	21 (95.5%)	1 (4.5%)	0 (.0%)	22 (100.0%)		

	<i>Eyelid Tear</i>	<i>Corneal Injury</i>	<i>Buttonhole</i>	<i>Eyelid Notching</i>	<i>No Complication</i>	<b>Total</b>	$\chi^2$ value	'p' value
Control Group	0 (.0%)	0 (.0%)	0 (.0%)	0 (.0%)	11(100.0%)	11 (100.0%)	4.889	0.180
Study Group	1 (9.1%)	0 (.0%)	2 (18.2%)	1 (9.1%)	7 (63.6%)	11 (100.0%)		
Total	1 (4.5%)	0 (.0%)	2 (9.1%)	1 (4.5%)	18 (81.8%)	22 (100.0%)		

	<i>Suture Granuloma</i>	<i>Ectropion</i>	<i>Entropion</i>	<i>Tissue Dehiscence</i>	<i>Scleral Show</i>	<i>No Complication</i>	<b>Total</b>	$\chi^2$ value	'p' value
Control Group	0 (.0%)	0 (.0%)	0 (.0%)	0 (.0%)	0 (.0%)	11 (100.0%)	11 (100.0%)	1.048	0.306
Study Group	0 (.0%)	0 (.0%)	1 (9.1%)	0 (.0%)	0 (.0%)	10 (90.9%)	11 (100.0%)		
Total	0 (.0%)	0 (.0%)	1 (4.5%)	0 (.0%)	0 (.0%)	21 (95.5%)	22 (100.0%)		

		<b>7<sup>th</sup> Day</b>	<b>15<sup>th</sup> Day</b>	<b>1 Month</b>	<b>3 Months</b>
<b>PLIABILITY</b>					
Control Group	<i>Normal</i>	0 (0.00%)	0 (0.00%)	4 (36.40%)	11 (100.00%)
	<i>Slight Difference</i>	11 (100.00%)	11 (0.00%)	7 (63.60%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	2 (18.20%)	8 (72.70%)	11 (100.00%)	11 (100.00%)
	<i>Slight Difference</i>	9 (81.80%)	3 (27.30%)	0 (0.00%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		2.2	12.571	10.267	-
p - value		0.138	<b>&lt;0.001</b>	<b>0.001</b>	-
<b>VAS CULARITY</b>					
Control Group	<i>Normal</i>	0 (0.00%)	0 (0.00%)	11 (100.00%)	11 (100.00%)
	<i>Slight Difference</i>	11 (100.00%)	11 (100.00%)	0 (0.00%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	<i>Normal</i>	1 (9.10%)	6 (54.50%)	11 (100.00%)	11 (100.00%)

Study Group	<i>Slight Difference</i>	10 (90.90%)	5 (45.50%)	0 (0.00%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		1.048	8.25	-	-
p - value		0.306	<b>0.004</b>	-	-
<b>PIGMENTATION (Color)</b>					
Control Group	<i>Normal</i>	0 (0.00%)	0 (0.00%)	1 (9.10%)	8 (72.70%)
	<i>Slight Difference</i>	11 (100.00%)	11 (100.00%)	10 (90.90%)	3 (27.30%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	2 (18.20%)	3 (27.30%)	7 (63.60%)	11 (100.00%)
	<i>Slight Difference</i>	9 (81.80%)	8 (72.70%)	4 (36.40%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		2.2	3.474	7.071	3.474
p - value		0.138	0.062	<b>0.008</b>	0.062
<b>T HICKNESS</b>					
Control Group	<i>Normal</i>	0 (0.00%)	0 (0.00%)	4 (36.40%)	11 (100.00%)
	<i>Slight Difference</i>	11 (100.00%)	11 (100.00%)	7 (63.60%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	0 (0.00%)	4 (36.40%)	8 (72.70%)	11 (100.00%)
	<i>Slight Difference</i>	11 (100.00%)	7 (63.60%)	3 (27.30%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		-	-	4.889	2.933
p - value		-	-	<b>0.027</b>	0.087
<b>RELIEF</b>					
Control Group	<i>Normal</i>	0 (0.00%)	2 (18.20%)	5 (45.50%)	8 (72.70%)
	<i>Slight Difference</i>	11 (100.00%)	9 (81.80%)	6 (54.50%)	3 (27.30%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	3 (27.30%)	6 (54.50%)	10 (90.90%)	11 (100.00%)
	<i>Slight Difference</i>	8 (72.70%)	5 (45.50%)	1 (9.10%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		3.474	3.143	5.238	3.474
p - value		0.062	0.076	<b>0.022</b>	0.062
<b>SUR FACE AREA</b>					
Control Group	<i>Normal</i>	11 (100.00%)	11 (100.00%)	11 (100.00%)	11 (100.00%)
	<i>Slight Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

Study Group	<i>Normal</i>	11 (100.00%)	11 (100.00%)	11 (100.00%)	11 (100.00%)
	<i>Slight Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		-	-	-	-
p - value		-	-	-	-

**Table 5. Comparison of post-operative assessment of scar by patient between control group and study group**

		7 <sup>th</sup> Day	15 <sup>th</sup> Day	1 Month	3 Months
<b>PAIN</b>					
Control Group	<i>Normal</i>	2 (18.20%)	9 (81.80%)	10 (90.90%)	11 (100.00%)
	<i>Slight Difference</i>	9 (81.80%)	2 (18.20%)	1 (9.10%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	5 (45.50%)	10 (90.90%)	11 (100.00%)	11 (100.00%)
	<i>Slight Difference</i>	6 (54.50%)	1 (9.10%)	0 (0.00%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		1.886	0.386	1.048	-
p - value		0.17	0.534	0.306	-
<b>I TCHING</b>					
Control Group	<i>Normal</i>	2 (18.20%)	11 (100.00%)	10 (90.90%)	11 (100.00%)
	<i>Slight Difference</i>	8 (72.70%)	0 (0.00%)	1 (9.10%)	0 (0.00%)
	<i>Marked Difference</i>	1 (9.10%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	6 (54.50%)	7 (63.60%)	11 (100.00%)	11 (100.00%)
	<i>Slight Difference</i>	5 (45.50%)	4 (36.40%)	0 (0.00%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		3.692	<b>4.889</b>	1.048	-
p - value		0.158	<b>0.027</b>	0.306	-
<b>COLOUR</b>					
Control Group	<i>Normal</i>	0 (0.00%)	0 (0.00%)	4 (36.40%)	10 (90.90%)
	<i>Slight Difference</i>	7 (63.60%)	10 (90.90%)	7 (63.60%)	1 (9.10%)
	<i>Marked Difference</i>	4 (36.40%)	1 (9.10%)	0 (0.00%)	0 (0.00%)
	<i>Normal</i>	1 (9.10%)	3 (27.30%)	9 (81.80%)	11 (100.00%)

Study Group	<i>Slight Difference</i>	10 (90.90%)	8 (72.70%)	2 (18.20%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		5.529	4.222	4.701	1.048
p - value		0.063	0.121	<b>0.03</b>	0.306
<b>S TIFFNESS</b>					
Control Group	<i>Normal</i>	0 (0.00%)	0 (0.00%)	1 (9.10%)	11 (100.00%)
	<i>Slight Difference</i>	5 (45.50%)	9 (81.80%)	10 (90.90%)	0 (0.00%)
	<i>Marked Difference</i>	6 (54.50%)	2 (18.20%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	2 (18.20%)	6 (54.50%)	9 (81.80%)	11 (100.00%)
	<i>Slight Difference</i>	9 (81.80%)	5 (45.50%)	2 (18.20%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		9.143	9.143	11.733	-
Value		0.0 1	0.01	0.00 1	
<b>T HICKNESS</b>					
Control Group	<i>Normal</i>	0 (0.00%)	2 (18.20%)	6 (54.50%)	11 (100.00%)
	<i>Slight Difference</i>	9 (81.80%)	8 (72.70%)	5 (45.50%)	0 (0.00%)
	<i>Marked Difference</i>	2 (18.20%)	1 (9.10%)	0 (0.00%)	0 (0.00%)
Study Group	<i>Normal</i>	0 (0.00%)	7 (63.60%)	10 (90.90%)	11 (100.00%)
	<i>Slight Difference</i>	11 (100.00%)	4 (36.40%)	1 (9.10%)	0 (0.00%)
	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
2 value		2.2	5.111	3.66 7	-
p - value		0.138	0.078	0.05 6	-
<b>IRR EGULARITY</b>					
Control Group	<i>Normal</i>	0 (0.00%)	3 (27.30%)	7 (63.60%)	10 (90.90%)
	<i>Slight Difference</i>	8 (72.70%)	7 (63.60%)	3 (27.30%)	1 (9.10%)
	<i>Marked Difference</i>	3 (27.30%)	1 (9.10%)	1 (9.10%)	0 (0.00%)
Study	<i>Normal</i>	7 (63.60%)	9 (81.80%)	11 (100.00%)	11 (100.00%)
	<i>Slight Difference</i>	4 (36.40%)	2 (18.20%)	0 (0.00%)	0 (0.00%)

Group	<i>Marked Difference</i>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	2 value	11.333	6.778	4.889	1.048
	p - value	<b>0.003</b>	<b>0.034</b>	0.087	0.306

The ability to re-enter is compromised and chances of scarring and ectropion are increased.<sup>12</sup> the transconjunctival approach has become popular amongst surgeons as it allows adequate access along with a concealed scar.

Earlier studies have considered transconjunctival approach for children, older patients with eyelid laxity requiring canthal resuspension, patients prone to hypertrophic scarring, aesthetically conscious patients and patients undergoing reoperations.<sup>13</sup>

Relative indications for a cutaneous approach include hypertrophy of the orbicularis oris, the presence of malar festoons, planned skin resection owing to lid laxity and adjunct cosmetic procedures, persistent chemosis, unstable or high- risk corneal or globe injury such as traumatic hyphema, persistent periorbital oedema, acute or chronic conjunctival disease and presence of a lone functional eye.<sup>14</sup> However, when these conditions are not present, literature suggests the use of a transconjunctival approach.<sup>11</sup>

The infraorbital rim and orbital floor can be approached via two different techniques, retroseptal and preseptal, when using the transconjunctival incision. Several authors recommend the use of the retroseptal approach in blepharoplasty procedures and for management of orbital fractures, as it allows direct access to the orbital floor.<sup>2, 15</sup> Lower eyelid distortion seems to be preventable as the septal integrity is preserved with the retroseptal incision.<sup>2</sup> the direct exposure of the orbital fat is advantageous in a lower-lid blepharoplasty but could prove to be a disadvantage during fracture repositioning. The retroseptal approach can play a role in the development of an enophthalmos as well as influence the eye movements due to the formation of an additional scar in the anterior

intraorbital fat system and disruption of the intraorbital Connective framework.<sup>16</sup>

Advantages of the preseptal transconjunctival approach are minimal lateral scar, excellent patient acceptance, and decreased chances of eyelid retraction or ectropion. Disadvantages of this approach are that experience is necessary for the identification and dissection in the correct plane, is time consuming and reattachment of lateral canthus is mandatory if lateral canthotomy is used.<sup>13</sup>

In the present study, exposure of the surgical site obtained in 11 infraorbital incisions was found to be good for visualization and management of infraorbital rim and/or orbital floor fractures which was in accordance with many studies.<sup>9,11,14,17,18</sup> In our study the length of the IO incision varied from 2.5 cm to 4.0 cm depending upon the need for exposure.

In this study, out of 11 transconjunctival incisions 9 incisions (2-retroseptal and 7- preseptal) were supplemented with the lateral canthotomy to achieve good exposure of infraorbital rim and/or orbital floor fractures along with the frontozygomatic suture. Few studies have used a similar approach using lateral canthotomy.<sup>1,4,9,15,19,20,21,22,23</sup> The frontozygomatic suture was exposed bilaterally in one patient without any additional need of lateral eyebrow incisions. Transconjunctival incision with lateral canthotomy can be used for the treatment of ZMC fractures as it exposes both the infraorbital as well as the lateral orbital rim simultaneously, overcoming the need for an additional lateral brow incision.<sup>24,25</sup> Lateral canthotomy was not done in the remaining 2 TC incisions (2 patients) as the fracture was located at the centre of the infraorbital rim. Exposure was good in one and average in the other. Few studies advocate the use of transconjunctival incision without lateral canthotomy for treatment of orbital rim and/or

orbital floor fractures.<sup>3,16,26</sup>

In our study out of 11 transconjunctival incisions, 4 (36.4%) had intraoperative complications whereas all 11 infraorbital incisions were free of complications. Eyelid tear was seen with 1 TC incision (1 patient) probably because LC was not done and due to overzealous retraction by the assistant to visualize the fracture site.<sup>27,28</sup> The lower eyelid tear was managed intraoperatively by proper alignment of the grey line of the lower eyelid and suturing with 6-0 vicryl. Buttonholing was seen in 2 preseptal TC incisions (2 patients) probably due to the tendency to retract the lower eyelid in a caudate fashion causing folding of the eyelid over itself and increasing the risk of inadvertent penetration of the orbicularis muscle and the skin.<sup>13,29</sup> Additional causes could be excessive periorbital oedema thus causing difficulty in identifying the correct dissection plane.<sup>3,9</sup> The intraoperative complication of buttonholing was managed by primary closure with interrupted sutures using either 5-0 prolene or 6-0 vicryl. Eyelid notching seen in 1 TC incision (1 patient) was most likely due to incorporation of the orbital septum in the suture during closure.<sup>12,30</sup>

There were no intraoperative corneal abrasions noted with transconjunctival incisions even though we did not use a corneal shield. Instead, we retracted the conjunctival flap superiorly to protect the cornea. A similar technique was also used by Shumrick KA et al.<sup>29</sup> Some authors suggest the use of corneal eyeshield for corneal protection.<sup>9,14</sup>

In our study, even though pliability of the scar appeared to improve from being slightly stiff towards becoming supple over time for both the groups, the study group showed marked improvement as compared to the control group. This could possibly denote better reorganization of the transconjunctival incision.

Vascularity appeared to improve from being purplish in colour initially towards reddish pink before finally returning to pale pinkish over time for both the groups denoting adequate capillary refill. The study group showed marked improvement as compared to the control group. Pigmentation, which was used to assess the colour of the scar,

improved over time for both the groups and the study group showed marked improvement. We noticed two trends during this assessment. In dark complexioned patients the scar was initially hypopigmented, then exhibited areas of both hypopigmentation and hyperpigmentation after which it became hyperpigmented before becoming similar to the normal adjacent tissues. But in fair complexioned patients the scar was initially hyperpigmented, then appeared mixed, followed by a hypopigmented look and ultimately returned to normal colour. We also noticed that periorbital ecchymosis, which was present in almost all the cases, could be a confounding factor in the assessment of pigmentation. The periorbital ecchymosis usually resolved within 15 days to one month.

Thickness of the incision scar appeared to decrease over time for both the groups and the study group showed marked decrease. In this study we did not notice any hypertrophic scarring associated with either of the incisions.

With regards to relief (degree of irregularity), it appeared to decrease over time for both the groups and the study group showed marked improvement. The surgical expertise of the surgeon for placement of a linear clean cut incision either in the infraorbital region or in the conjunctiva can also influence the irregularity of the scar. Another contributing factor could be intraoperative iatrogenic laceration of the incision due to excessive retraction force, causing an additional scar which if not reapproximated primarily might further aggravate the irregularity during the healing phase.

Surface area was also assessed by the observer and neither of the incisions showed any change with respect to the initial length of the incisions. The patient was asked to assess pain based on the grading scale mentioned earlier and though it appeared to reduce over time in both the groups, the study group showed marked reduction.

Itching decreased over time for both the groups and the control group showed marked decrease. The presence of prolonged itching in the study group could be attributed to the presence of the 60 vicryl suture on the conjunctiva causing irritation. Itching may also be due to the trichiasis associated with cicatricial entropion which was seen in one patient with transconjunctival incision and resolved on

removal of the offending eyelash.<sup>31</sup> Colour appeared to revert back to normalcy over time in both the groups and the study group showed marked improvement. Stiffness, thickness and irregularity appeared to decrease over time in both the groups and the study group showed marked decrease as compared to the control group.

Thus in our study, it was deduced that the study group i.e. patients undergoing transconjunctival incision with or without LC showed a better clinical outcome in terms of all the parameters described above. It was noted that for a few parameters the observer differed from the patient such as stiffness, thickness and irregularity. For pliability/stiffness, the observer noted that all TC incisions became supple by 1 month whereas the patients assessed them to become supple by 3 months. On the other hand all the infraorbital incisions became supple by three months as assessed by both the observer and the patient.

On the 7th day few patients with infraorbital incision felt that there was a marked difference in thickness whereas the observer recorded only a slight difference. Both the observer and the patients noted a slight difference in thickness of the transconjunctival incision on the 7th day.

In terms of irregularity/relief on the 7th day, few patients with infraorbital incision felt a marked irregularity whereas the observer noted only a slight irregularity in all the 11 incisions. The patients felt that majority of the transconjunctival incisions were regular whereas the observer noted majority were slightly irregular.

According to the observer and the patient, the colour of both the incisions postoperatively appeared to improve within a span of 1-3 months. Hence, in the present study we can infer that the transconjunctival incision with or without lateral canthotomy appears to heal rapidly as compared to the infraorbital incision. Also the aesthetic appearance is superior especially by the 7th, 15th and 1 month time interval leaving the patients more satisfied. Superior aesthetics can be attributed to the fact that the transconjunctival incision lies well concealed in the conjunctiva hence making it much more aesthetically acceptable. Moreover it provides an adequate exposure of the surgical field. The amount of exposure mandates the need for a lateral canthotomy and in our study

we found that lateral canthotomy wherever performed left an inconspicuous lateral canthal scar<sup>24</sup> which goes against Holtmann et al's statement that lateral canthotomy offers adequate surgical exposure but, by encroaching on the skin, defeats the main purpose for which it was conceived, i.e. concealing the scar.<sup>17</sup> Even if a LC is combined with a TC we strongly feel that it is still more superior in terms of exposure, healing and aesthetics.

We have used both retroseptal and preseptal transconjunctival incisions and found that both provided adequate exposure but the retroseptal was more direct and the preseptal required a learning curve. Other studies also mentioned about the direct access to the orbital floor with the retroseptal technique.<sup>2,15,16,17</sup> In majority of the cases in our study, a preseptal transconjunctival approach was used. In literature several authors have recommended the use of a preseptal transconjunctival approach.<sup>4,9,11,13,21,25,32,33</sup>

We also felt that, the orbital fat which herniated into the exposure field could be easily retracted by a copper malleable retractor and no difficulty in infraorbital rim fixation and orbital floor exploration was encountered in this approach. Thus orbital floor fractures can be approached by retroseptal technique without the need for a lateral canthotomy.<sup>34</sup>

The degree and severity of periorbital oedema appeared to decrease over time for both the groups and the study group showed marked decrease. We noted that on the 7th day the control group showed a higher degree of periorbital oedema as compared to the study group. At 1 month, 10 TC incisions showed complete resolution of oedema but 1 incision still had minimal oedema. This was probably due to the incorporation of the orbital septum in the suture (6-0 vicryl) during closure causing disruption of the lymphatics which became patent once the suture resolved. Periorbital oedema subsided by the third month for both the groups. Usually the infraorbital incision is given in association with the lateral brow incision (to expose the lateral orbital rim) and/or another incision to expose the nasal region in facial trauma. But, it has been seen that these additional incisions do not bear any significant effect on the periorbital oedema caused by the infraorbital incision.

In our study we also noted that even without lateral extension of the infraorbital incision, there was prolonged periorbital oedema which is in agreement with other studies.<sup>12,35,36</sup>

We also agree that the infraorbital incision must be tapered laterally and failure to do so could lead to disruption of lymphatic drainage of the lower lid with concomitant, prolonged lid oedema and potential compromise of the final scar appearance.<sup>9,19</sup>

Considering the craniocaudal placement of the incisions, the aesthetic appearance of the scars deteriorates from the ciliary margin downwards. The skin of the eyelid seems to have a greater propensity to form aesthetically superior scars than the cheek or the brow skin, but as the level of IO incision corresponds with the transition from the eyelid to the cheek skin, it has a tendency to form conspicuous scars.<sup>35</sup>

In the present study, none of the incisions in the control group were associated with any suture granuloma, ectropion, entropion, tissue dehiscence or scleral show. However in the study group, 1 transconjunctival incision (9.1%) in 1 patient developed a medial cicatricial entropion which resolved with conservative management over a period of 3 months. The rest 10 TC (90.9%) incisions were free of post-op. complications. In the patient who developed a medial cicatricial entropion, an intraoperative complication of lid laceration on the medial and lateral aspect of the lower eyelid had occurred which was managed by primary closure. The contracture caused by the healed scar of the lower eyelid tear might be the cause of the entropion. Few other authors have also encountered entropion with transconjunctival incision in their studies.<sup>13,26,37,38,39,40</sup> We found no incidence of ectropion with either the infraorbital or transconjunctival incisions. This is in accordance with few other studies.<sup>15,35,38</sup>

In our study despite not using a frost stitch after closure of the transconjunctival incision, we did not encounter any lower eyelid retraction postoperatively, which is similar to Yamashita et al 28, and a closed dressing was advised for the involved eye. It is also believed that Frost or tarsorrhaphy suture techniques might help in the prevention of entropion by securing the lower lid in its proper position during the early healing phase.<sup>31,41,42,43</sup>

Infraorbital incision has been the standard approach for infraorbital rim/floor fractures and is preferred for the training of young surgeons

who are more inclined to use peripherally placed incisions. Severe periorbital oedema impedes identification or placement of higher lid incisions and thus mandates the use of the infraorbital approach.

## 6. CONCLUSION

By means of the present study, we conclude that the transconjunctival incision is superior to the infraorbital incision for reasons quoted below:

- Provides adequate exposure of the infraorbital rim/floor
- With a LC even the lateral wall can be exposed thus precluding the need for an additional cutaneous incision especially for a ZMC fracture
- Superior aesthetics as it is a concealed incision and even when combined with a LC the lateral canthal scar is inconspicuous
- Healing tends to be rapid and satisfactory
- Less incidence of post-operative complications
- Quicker resolution of post-operative periorbital oedema

Despite the above mentioned factors, the transconjunctival approach requires a learning curve, is technique sensitive and a sound knowledge of the periorbital and orbital anatomy is mandatory. As is true for facial fracture treatment, from facial skin incisions there has been a paradigm shift towards intraoral approaches, a similar pattern can be seen for management of orbital rim/ floor fractures wherein rather than placing cutaneous incisions around the eye, using a transconjunctival incision might be a preferred option. All these incisions have their own pros and cons but with a drastic increase in aesthetic demands in the present day scenario, the contemporary surgeon must be well versed and equipped so as to offer the best treatment possible.

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