EGYPTIAN DENTAL JOURNAL
www.eda-egypt.org
VOL. 69, 1859:1866, JULY, 2023
PRINT ISSN 0070-9484 • ONLINE ISSN 2090-2360
ORAL SURGERY
Submit Date : 02-05-2023 • Accept Date : 17-06-2023 • Available online: 25-6-2023 • DOI : 10.21608/EDJ.2023.212313.2562

VESTIBULAR VERSUS TRANS-CONJUNCTIVAL APPROACHES IN OPEN REDUCTION AND INTERNAL FIXATION OF INFRAORBITAL RIM FRACTURE: A RANDOMIZED CLINICAL TRIAL

Mohammed Omara [*], Haytham Rizk [**], Usama Taema [*] *and* Sherif Ali [***]

ABSTRACT

Objective: This study aimed to compare the vestibular approach versus trans-conjunctival approach in the open reduction and internal fixation of infraorbital rim fracture.

Patients and Methods: This randomized controlled trial was conducted on twenty-two patients with infraorbital rim fracture associated with or without other facial fractures excluding orbital floor that require open reduction and internal fixation. Patients were randomly divided into two equal groups; trans-conjunctival group and intraoral vestibular group. The intraoperative fracture exposure time was recorded in both groups and conducted for statistical analysis. The patients were recalled for clinical assessment of post operative pain, edema, infraorbital nerve (ION) function and eye lid integrity.

Results: The outcome of the studied patients showed that the intraoral vestibular group has significantly shorter exposure time but higher post operative edema that totally resolved by the second week post operatively and transient ION affection in 18.1 % of post trauma free cases while the postoperative orbital movement and eye lid integrity in the intraoral vestibular group was superior than the trans-conjunctival group.

Conclusion: Intraoral vestibular approach shortens the intraoperative time and provide ideal protection of eye ball function and eyelid integrity more than the trans-conjunctival group, but it required proper relaxing dissection of the ION and careful adequate retraction for better accessibility.

KEYWORDS: Zygomatico-maxillary complex fracture; Infraorbital rim fracture; Intraoral vestibular approach; trans-conjunctival approach.

* Lecturer at Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Cairo University, Cairo, Egypt.
** Assistant lecturer of Clinical Neurology, Faculty of Medicine, Cairo University, Cairo, Egypt.
*** Associate Professor at Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Cairo University, Cairo, Egypt.

INTRODUCTION

The key to skeletal surgery is having adequate bony exposure. Theoretically, the most direct approach through the soft tissues to the bone is usually performed. Even though during exposure of the facial skeleton, an alternative important concern is taken after to preserve the facial esthetics. Incisions are usually made in inconspicuous or hidden areas even this may compromise the bony exposure especially for the infraorbital rim region[1]. Thus, incision placement and design are guided by 2 goals: good intraoperative accessibility and minimal postoperative scar formation[2].

Esthetic results represent a priority in the treatment of orbito-zygomatic fractures because of the fundamental role of the cheeks, eyes and eye lids areas in the facial esthetics. Different approaches had been introduced in the literature to access the infraorbital rim. The most easy and accessible approach is the infraorbital skin incision placed directly at the inferior orbital rim; However, this is infrequently performed as the scar is readily seen. Instead, incisions are made just below the eyelashes (as sub-tarsal and sub-ciliary approaches) or behind the eyelid (as transconjunctival approach) to hide the scars.

Sub-ciliary, sub-tarsal, and transconjunctival periorbital approaches are rival alternatives for surgical treatment of infraorbital rim fractures[3-5]. However, these approaches involve some complications such as hypertrophic scar formation, scleral show, mild lid edema, keratoconjunctivitis, epiphora, ectropion, entropion, lagophthalmos, and injury of the nasolacrimal apparatus. Recent competent alternative to these eye lid approaches is the intraoral approach which eliminate the post-surgical functional and esthetic complications to the eyes and eye lids area[6,7].

The intraoral approach using the maxillary vestibule was introduced by Keen in 1909. It has been used to reduce the zygomaticomaxillary complex and zygomatic arch fractures. Recently, this approach was presented as alternative for the extraoral approaches for infraorbital rim fixation by limited studies[5,8-9]. Furthermore, limited studies have been conducted to compare it to different extraoral approach[10]. Thus, the aim of this study was to compare the vestibular intraoral approach to transconjunctival approach for open reduction and internal fixation of infraorbital rim fracture.

PATIENTS AND METHODS

This study was a randomized controlled clinical trial conducted on twenty-two patients. The patients were recruited consecutively at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Cairo University. Patients were selected according to the following clinical criteria: Adult patients complaining of infraorbital rim fracture associated with or without other facial fractures excluding orbital floor that require open reduction and internal fixation. Patients were allocated randomly into two equal groups. Open reduction and internal fixation of the infraorbital rim using 1.6 C-shaped orbital plate and screws was performed for all patients in both groups. The infraorbital rim fracture was exposed through intraoral vestibular approach for the intervention group; and through trans-conjunctival approach for the control group. The study followed the Declaration of Helsinki on medical research.

Preoperative preparation:

A thorough clinical examination was performed; preoperative CT scan was performed utilizing a multi-slice helical CT machine (I-CAT®PreciseTMfrom I-CAT®Technology, Hatfield, PA). Dental arch bar was installed for accurate occlusal reduction in cases associated with mandibular or maxillary dento-alveolar fractures.

Intervention group:

Under general anaesthesia using naso-tracheal intubation, an intraoral maxillary vestibular

incision was performed unilaterally to expose the facial skeleton of the affected side. Infraorbital nerve dissection with two medial and lateral vertical scoring incisions were performed within the periosteal lining of the flap to passively expose the infraorbital rim. Under adequate retraction using two Langenpick retractors at medial and lateral corners of the flap and malleable retractor for eye globe superior retraction, the fracture edges were reduced and fixed using 1.6 C-shaped orbital plate and screws (figure 1). Other fractures like zygomatico-maxillary fracture were reduced and fixed through the same approach. Zygomatic-frontal fracture if present required additional lateral eye braw approach, while zygomatic arch fracture was either reduced without fixation through keen approach or reduced with fixation through hemi coronal approach. Finally, the intra-oral incision line was sutured using continuous with lock suturing technique with 3–0 resorbable suture (Polyglycolic acid coated braided suture, CFIRM esnet Kratznedel fabrik, Germany). Also, other incisions if present were sutured.

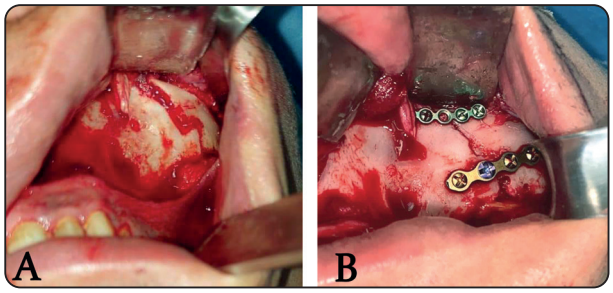

Fig. (1): Clinical photographs showing open reduction and internal fixation of infra-orbital rim fracture through Intraoral vestibular approach (intervention group). A; Infra-orbital nerve dissection and exposure of fracture line. B; Reduction and fixation of fracture line using plates osteosynthesis.

Control group:

Under general anesthesia using naso-tracheal intubation a trans conjunctival pre-septal approach was performed to expose the affected infraorbital rim[11]. Under adequate flap retraction using Desmarres retractors at both medial and lateral corners of the conjunctival flap and malleable retractor for eye globe superior retraction, the fracture edges were reduced and fixed using 1.6 C-shaped orbital plate and screws (figure 2). Other fractures like zygomatico-maxillary fracture were reduced through additional intraoral vestibular approach. Zygomatic-frontal fracture if present required additional lateral eye braw approach, while zygomatic arch fracture was either reduced without fixation through keen approach or reduced with fixation through hemi coronal approach. Finally, the trans conjunctival incision line was sutured with 5–0 resorbable suture using inverted suturing technique (Polyglycolic acid coated braided suture, CFIRM esnet Kratznedel fabrik, Germany). Also, other incisions if present were closed.

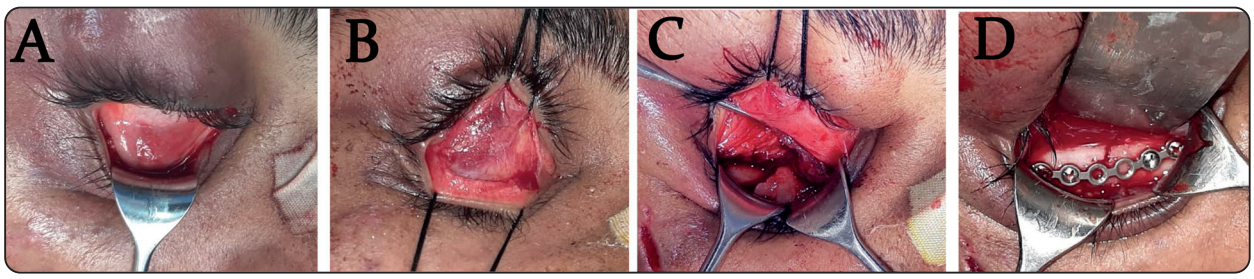

Fig. (2): Clinical photographs showing open reduction and internal fixation of infra-orbital rim fracture through pre-septal trans-conjunctival approach (control group). A; Trans-conjunctival incision. B; Orbital septal plane dissection. C; Exposure of fracture line. D; Reduction and fixation of fracture line using plates osteosynthesis.

Postoperative follow up and outcomes:

Elastoplast bandage was placed over the cheek region for 48h postoperatively. The patients were ordered to place ice-packs over the cheek region for twenty minutes every hour for 12 hours postoperatively in both groups. Additionally, Patients were instructed to perform warm saline mouth wash starting on the 2nd day after operation for 7 days postoperatively in all patients of the intraoral vestibular group and some patients of the trans-conjunctival group if intraoral incision was applied while all patients of the trans-conjunctival group were instructed to apply eye patch for 48 h postoperatively. Postoperative antimicrobial, pain-relieving, and anti-inflammatory drugs were prescribed for 5–7 days in both groups. Antibiotic eye drops were extra prescribed for patients of the trans-conjunctival group. CT scan was acquired within one week postoperatively for all patients to assess the alignment of fracture lines.

The intraoperative fracture exposure time was recorded in both groups. The patients were recalled at the 7th day post-operatively then weekly in the 1st month and monthly till the next 2nd month after surgery for clinical assessment regarding; post operative pain, edema, ocular mobility, eye lid integrity and infraorbital nerve (ION) function.

Pain was assessed at the 7th day postoperatively according to the following scale; 0: No Pain, 1: Tolerable (and doesn't prevent any activities), 2: Tolerable (but does prevent some activities), 3: Intolerable (but can use telephone, watch TV, or read), 4: Intolerable (but can't use telephone, watch TV, or read), 5: Intolerable (and unable to verbally communicate because of pain)[12]. Postoperative edema was categorized subjectively into mild (just noticeable), mild to moderate (more obvious edema without occlusion of palpebral fissure), moderate to severe (edema partially occluding palpebral fissure), and severe (edema totally occluding palpebral fissure). Degree of edema was observed weekly till edema subside. Neurosensory test procedure of the ION function was examined one week, two weeks, three weeks, 4 weeks and 8 weeks postoperatively. Light brush technique, two-point discrimination, and pin-prick test was used for upper lip, nasal side and lower eye lid based on the operated side. The test result was finally recorded for each patient as normal or affected (either hypoesthesia, hyperesthesia, dysesthesia, or paresthesia).

Statistical analysis

Statistical analysis was performed using SPSS (Statistical package for the social sciences- IBM® SPSS® Statistics Version 20 for Windows, IBM Corp., Armonk, NY, USA). Quantitative data were represented as mean ± standard deviation. Qualitative data were represented percentage and frequency. Quantitative data were explored for normality using Kolmogorov- Smirnov and Shapiro-Wilk tests. For parametric data; Student's t-test was used to compare variables between the two groups. For non-parametric data; Mann–Whitney U test was used. The results were considered statistically significant if the p value was less than 0.05.

RESULTS

This was a randomized controlled trial conducted on 22 patients (15 males and 7 females) with infra orbital rim fracture associated with or without other facial fractures excluding orbital floor that require open reduction and internal fixation. The main cause of fracture was road traffic accident in 54.5%, followed by interpersonal violence 27.3%. The right side was affected in 54.5%, while the left side was affected in 45.5%. The patients' mean age was 28.7±8.8 years for the intraoral vestibular group, and 31.8±9.2 years for the trans-conjunctival group.

The infra orbital rim fracture exposure time was shorter for the intraoral vestibular group (9.7±2.6 minutes) compared to the trans-conjunctival group (16.6±3.2 minutes), and there was statistical

significance difference between the two groups (P value < 0.001) (figure 3). Postoperative pain was scale 2 (tolerable but does prevent some activities) in 91% of the patients and scale 3 (intolerable but can use telephone, watch TV, or read) in 9% of the patients in the intraoral vestibular group, while for the trans-conjunctival group, pain was scale 2 in 63.6% of the patients and scale 3 for 36.4% of the patients (figure 4). The mean pain scale was 2.1± 0.3 for the intraoral vestibular group, and 2.4±0.5 for the trans-conjunctival group, and there was no statistical significance difference between the two groups (P value 0.14).

For the intraoral vestibular group, the edema was mild in 36.4% of the patients, mild to moderate in 45.4%, moderate to severe in 18.2 %. While for the trans-conjunctival group, the edema was mild in 45.4 % of the patients, mild to moderate in 36.4%, moderate to severe in 18.2%. In all patients for both groups the edema resolved within the first two weeks postoperatively (figure 5). Restricted downward orbital movement occurred in 9.09 % of the patients in the intraoral vestibular group. While for the trans-conjunctival group, downward orbital movement restriction occurred in 18.2 %. Orbital movement restrictions were resolved by the end of the first two weeks for all patients.

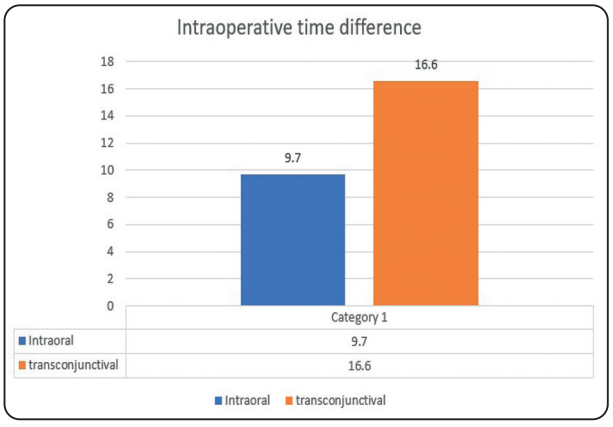

Fig. (3): Bar chart showing the intraoperative time difference between the two groups.

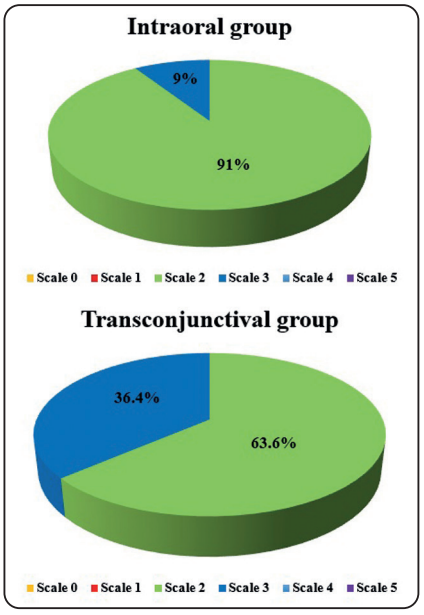

Fig. (4): Pie chart showing the percentage of patients with different pain scale in intraoral vestibular group (upper chart) versus transconjunctival group (lower chart).

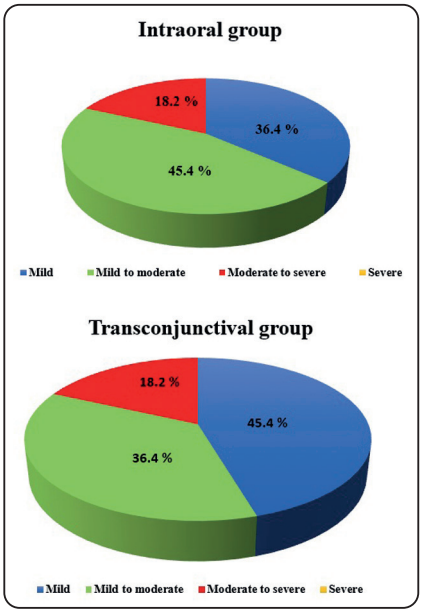

Fig. (5): Pie chart showing the percentage of patients with different post-operative edema response in intraoral vestibular group (upper chart) versus transconjunctival group (lower chart).

Infraorbital nerve affection (hypo or hyperaesthesia) was present preoperatively in 45.5% of the patients for intraoral vestibular group, and increased to 63.6%, 1 week postoperatively, then decreased to 27.3 % by the 4th weeks, and after 8 weeks all

patients returned to normal sensation. While for trans-conjunctival group, infraorbital nerve affection was present in 54.5% of the patients, remains 54.5% 1 week postoperatively, then decreased to 36.4% and 27.3% by the 2nd and 3rd weeks, after 4 weeks all patients returned to normal sensation (Figure 6). Entropion was recorded in 2 cases of the trans-conjunctival group and eyelid notching was reported in one case in the trans-conjunctival group. Entropion was totally corrected after using eyelid adhesive tapes for two months postoperatively. While eyelid notching was persistent but unnoticeable after total healing within the first postoperative month. Post operative CT showed accurate fracture alignment in all cases of both groups.

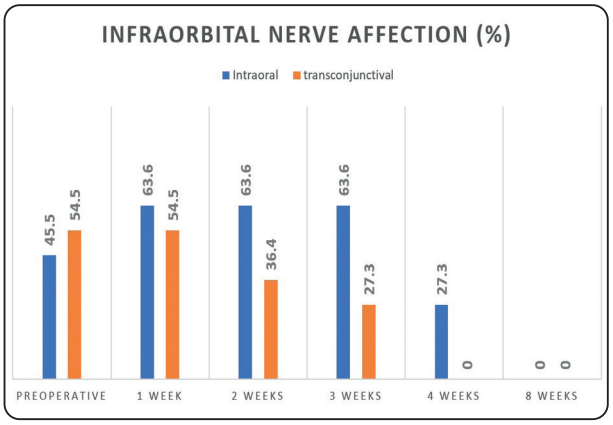

Fig. (6): Bar chart showing the percentage of patients with infra-orbital nerve affection within the follow-up time intervals.

DISCUSSION

Orbital fracture represents 40% of all maxillofacial fractures [6]. Facial impact can result in the fracture of orbital roof, floor or walls separately or all together which leads to facial disfigurement and can compromise the acuity of vision. The commonly affected wall is the inferior wall owing to the presence of infraorbital fissure groove and canal that weaken this area [3]. Eyes, housing bony orbits and the surrounding soft tissues are important for facial esthetics, so the maxillofacial surgeon must compromise between the needed approach for sufficient bony exposure and the esthetic concern of the patient [4,9]. The intraoral vestibular approach for reduction of zygomatic arch fracture was initially introduced by Keen in 1909, using the maxillary vestibular approach [13]. Balasubramaniam (1966) utilized the intraoral approach for the reduction of zygomatic body fractures [14]. De Souza Carvalho et al. (2012), Hammuda, A.A. (2018) and Thumu S K et al. (2021) used the intraoral vestibular approach for fixation of inferior orbital rim fractures. The utilized approach was resembling the approach utilized by keen. However, the infraorbital nerve was dissected to reach the part of the orbital rim above the infraorbital foramen [5,8-9]. The successful application of the intraoral vestibular approach in open reduction and internal fixation of infra-orbital rim fracture pushed the authors to modify this approach with two vertical periosteal scoring incisions within the flap periosteum medial and lateral to the infra-orbital nerve to increase the accessibility to the infra-orbital margin and compare it with the pre-septal trans-conjunctival approach in open reduction and internal fixation of infraorbital rim fracture.

Holtmann B et.al. [15] concluded that the subtarsal and infraorbital incisions provided access to the infra orbital rim in 8 and 15 min, respectively, whereas trans-conjunctival and sub-ciliary incisions provided access to the infra orbital rim in 20 and 15 min, respectively. These concluded data were similar to the statistical assumption of the infra orbital rim exposure time of the current study which was 9.7±2.6 min in the intraoral vestibular group compared to 16.6±3.2 in the trans-conjunctival group. This proved that the time taken from incision to complete exposure of the area of interest in the intraoral vestibular group is nearly equal to the time taken in the direct infraorbital skin incision which was extremely shorter than the time taken in the trans-conjunctival approach [16,17].

Postoperative pain was less in intra oral vestibular group which was 2.1±0.3 and for trans-conjunctival group was 2.4±0.5 this result was in accordance with

Thumu SK et al who finds that post operative pain was less after intra oral vestibular access to infra orbital rim fracture due to lesser time[9]. While the Postoperative edema was less in trans-conjunctival group than intraoral vestibular group but all resolved within a week this finding was likely as with ridgeway et al. Based in our findings the higher incidence of lid edema in the intra oral vestibular approach (8.9 percent) compared with the trans-conjunctival approach (1.4 percent) was owing to the further dissection and retraction performed to reach the area of interest [7].

Orbital movement was more restricted in trans-conjunctival group but reach the normal movement by the end of the second week also eyelid entropion and notching was only recorded in the trans-conjunctival group this was in accordance with ridge way et al which relate these results to several factors including the trauma of the surgical dissection which may leads to blunt injury of the conjunctiva or orbital septal disruption, both of which results in scarring, vertical shortening of the posterior lamella, and entropion. Canthal tendon injury and dehiscence can also leads to entropion. Placement of the trans-conjunctival incision (sub tarsal, forniceal, or midpoint), the cutting tool (cautery or knife), the followed approach (pre-septal or retro-septal), the addition of a lateral canthotomy, and the suturing technique are controlling factors that have been implicated in increasing or decreasing the risk of entropion[7].

The postoperative paresthesia was highly recorded in the intraoral vestibular group but all recorded cases turn normal within 4 weeks. This transient paresthesia was recorded owing to the performed tension on the infraorbital nerve to allow proper visualization of the infraorbital rim above the infra-orbital foramen. This problem was solved in the current study through the application of two vertical scoring incisions performed medial and lateral to the infra-orbital nerve within the periosteal lining of the elevated flap. These relaxing scoring incisions together with careful retraction of the nerve allow for direct and passive visualization of the infraorbital rim with subsequent proper reduction with direct and easy installation of the screws within the plate without harming the infra-orbital nerve [18,19]. However temporary paresthesia of the infra-orbital nerve due to its dissection and elevation, the intraoral vestibular technique presents much more advantages than the trans-conjunctival technique such as wider access, less morbidity, fewer complications, and simplicity [5,8-9].

CONCLUSION

The modified intraoral vestibular approach allowed exposure of the zygomatico-maxillary buttress and infra orbital rim with only 1 incision, optimized surgical time, decreased complication rate, and avoided periorbital deformity and scarring in the patient compared to the trans-conjunctival approach [3]. However, fragmentation of the infraorbital rim obligates the utilization of the trans-conjunctival approach for controllable mobilization and reduction of the fractured segments [20,21].

REFERENCES

1. Wang HD, Dillon J. Contemporary Management of Zygomaticomaxillary Complex Fractures. Semin Plast Surg. 2021 Oct 7;35(4):256-262. doi: 10.1055/s-0041-1735812.

2. Vaibhav N, Keerthi R, Nanjappa M, Ashwin DP, Reyazulla MA, Gopinath AL, Ghosh A. Comparison of 'sutureless' Transconjunctival and Subciliary Approach for Treatment of Infraorbital Rim Fractures: a Clinical Study. J Maxillofac Oral Surg. 2016 Sep;15(3):355-362. doi: 10.1007/s12663-015-0835-9. Epub 2015 Aug 26.

3. Baqain ZH, Malkawi Z, Hadidi A, Rajab LD. Subtarsal approach for orbital floor repair: a long-term follow-up of 12 cases in a Jordanian teaching hospital. J Oral Maxillofac Surg. 2008 Jan;66(1):45-50. doi: 10.1016/j.joms.2007.03.031.

4. Patel PC, Sobota BT, Patel NM, Greene JS, Millman B. Comparison of transconjunctival versus subciliary approaches for orbital fractures: a review of 60 cases. J Craniomaxillofac Trauma. 1998 Spring;4(1):17-21.

5. de Souza Carvalho AC, Pereira CC, Queiroz TP, Magro-Filho O. Intraoral approach to zygomatic fracture: modified technique for infraorbital rim fixation. J Craniofac Surg. 2012 Mar;23(2):537-8. doi: 10.1097/SCS.0b013e3182418ea6.

6. Metzger MC, Schön R, Schulze D, Carvalho C, Gutwald R, Schmelzeisen R. Individual preformed titanium meshes for orbital fractures. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006 Oct;102(4):442-7. doi: 10.1016/j.tripleo.2006.02.031. Epub 2006 Aug 2.

7. Ridgway EB, Chen C, Colakoglu S, Gautam S, Lee BT. The incidence of lower eyelid malposition after facial fracture repair: a retrospective study and meta-analysis comparing subtarsal, subciliary, and transconjunctival incisions. Plast Reconstr Surg. 2009 Nov;124(5):1578-1586. doi: 10.1097/PRS.0b013e3181babb3d.

8. Hammuda, A.A. Intraoral Approach for Reduction and Fixation of Infraorbital Rim Fracture. Egyptian Journal of Oral and Maxillofacial Surgery.2018 Oct; 9 (4): 179-184. DOI:10.21608/OMX.2019.6195.1021

9. Thumu SK, Vura N, Gaddipati R, Suvvada B. Management of Infraorbital Rim Fracture Through Intraoral Approach. J Maxillofac Oral Surg. 2022 Sep;21(3):911-915. doi: 10.1007/s12663-021-01566-5. Epub 2021 Apr 27.

10. Pawar S, and Bhola N. Comparison of the Efficacy of Transconjunctival Incision with Lateral Canthotomy and Intraoral Vestibular Incision for Management of Infraorbital Rim Fracture. Journal of Pharmaceutical Research International. 2021; 33(60B), pp. 3980–3985. doi: 10.9734/jpri/2021/v33i60B35102.

11. Bruneau S, Scolozzi P. Preseptal transconjunctival approach to the orbital floor fractures. Surgical technique. Rev Stomatol Chir Maxillofac Chir Orale. 2015 Dec;116(6):362-7. doi: 10.1016/j.revsto.2015.10.004.

12. Gloth FM 3rd, Scheve AA, Stober CV, Chow S, Prosser J. The Functional Pain Scale: reliability, validity, and responsiveness in an elderly population. J Am Med Dir Assoc. 2001 May-Jun;2(3):110-4.

13. Keen WW (1909) Surgery, its principles and practice. WB Saunders, Philadelphia, pp 1906–1921.

14. Balasubramaniam S. Intra-oral approach for reduction of malar fractures. Br J Oral Surg. 1967 Mar;4(3):189-91. doi: 10.1016/s0007-117x(66)80034-3.

15. Holtmann B, Wray RC, Little AG. A randomized comparison of four incisions for orbital fractures. Plast Reconstr Surg. 1981 Jun;67(6):731-7. doi: 10.1097/00006534-198106000-00003.

16. Raschke GF, Rieger UM, Bader RD, Schaefer O, Guentsch A, Schultze-Mosgau S. Transconjunctival versus subciliary approach for orbital fracture repair--an anthropometric evaluation of 221 cases. Clin Oral Investig. 2013 Apr;17(3):933-42. doi: 10.1007/s00784-012-0776-3.

17. Rowe NL, Williams JL (1994) Row and William's maxillofacial injuries, 2nd edn, vol 1. Churchil Livingstone, p 512.

18. Trivellato PF, Arnez MF, Sverzut CE, Trivellato AE. A retrospective study of zygomatico-orbital complex and/or zygomatic arch fractures over a 71-month period. Dent Traumatol. 2011 Apr;27(2):135-42. doi: 10.1111/j.1600-9657.2010.00971.x.

19. Yonehara Y, Hirabayashi S, Tachi M, Ishii H. Treatment of zygomatic fractures without inferior orbital rim fixation. J Craniofac Surg. 2005 May;16(3):481-5. doi: 10.1097/01.scs.0000157308.39420.74.

20. De Riu G, Meloni SM, Gobbi R, Soma D, Baj A, Tullio A. Subciliary versus swinging eyelid approach to the orbital floor. J Craniomaxillofac Surg. 2008 Dec;36(8):439-42. doi: 10.1016/j.jcms.2008.07.005.

21. Courtney DJ. Upper buccal sulcus approach to management of fractures of the zygomatic complex: a retrospective study of 50 cases. Br J Oral Maxillofac Surg. 1999 Dec;37(6):464-6. doi: 10.1054/bjom.1999.0010.