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**ORIGINAL ARTICLE**

# Comparative Evaluation of Infraorbital Nerve Recovery Following Open and Closed Reduction of Zygomatic Complex Fracture

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## ABSTRACT

**Objective:** To evaluate the recovery of infraorbital nerve injury following zygomatic complex fracture management with open reduction and close reduction.

**Material and Methods:** A sum of 128 subjects with zygomatic complex break and infraorbital nerve damage were incorporated in the research, and they were evenly divided into two collection: Close (Group A) and Open (Group B). A neurosensory assessment was carried out. The front cheek, lateral side of the nose, and upper lip were all inspected bilaterally. If two consecutive positive answers were obtained after 24 weeks, the result was referred to as recovery. The researchers used descriptive statistics.

**Results:** The mean fracture duration in group A was 20.31±9.45 hours, whereas it was 20.65±9.16 hours in group B. In comparison to Group A, Group B had superior results at the end of 24 weeks. Infraorbital nerve damage restoration was found to be 34.3 % in group A and 64.06 % in group B.

**Conclusion:** When contrasted to closed reduction, the probability of recoveries is higher with open reduction.

**Keywords:** Infraorbital Nerve Injury, Zygomatic Complex Fracture, Open Reduction, Close Reduction, Recovery

## INTRODUCTION

Face, head, and neck injuries are rather prevalent, although the pathogenesis of maxillofacial wounds has gotten comparatively little emphasis in the general trauma literature.[1] The predominance of the zygomaticomaxillary complex (ZMC) in the facial frame is one of the most prevalent causes of facial trauma, accounting for 45 percent of all midfacial and 25% of all facial fractures.[2,3]

The zygomatic bone figured the protrusion of the cheek, which increases the risk of fracture, and infraorbital nerve damage is frequently implicated in trauma to the zygomatic complex, leading in sensory dispersion of the region activated by it.[4] Because the fracture path travels across or near the infraorbital canal, fissure, and foramen, influencing the infraorbital nerve, the zygomatic complex fracture is commonly associated with sensory abnormalities of the infraorbital nerve and changes in infraorbital nerve complaints.[5,6]

Infraorbital nerve damage is common after ZMC fracturing, with rates ranging from 18 to 83 %. The infraorbital nerve is frequently implicated in ZMC fractures since the fracture line in 95 % of instances involves the infraorbital fissure, canal, or foramen. Hypoesthesia, dysesthesia, numbness or tingling, and anaesthesia of the upper lip, cheek, lower eyelid, epidermis of the nose, anterior mouth, and teeth of the afflicted side are all sensory changes caused by ZMC fractures.[7,8]

In the history, zygomatico-orbital complex fractures spanning the infraorbital foramen and causing chronic paresthesia have been widely documented.[9] The most prevalent known reason of such neurological impairment is nerve impingement caused by fracture components that have been improperly reduced or fixed.[10] The growth of fibrous or callus tissue surrounding the infraorbital nerve throughout the healing period, culminating in nerve compression, is the other most prevalent explanation cited.[11] As a result, nerve decompression, fracture reduction, and fixation are required. A superior outcome can be achieved with a milder nerve damage and early management.[12]

The ability of the infraorbital nerve to regenerate is influenced by a number of variables, notably the kind of nerve damage, the period between damage and surgical interventions, and the management approach. There are different method for the management of zygomatic complex fracture, these methods ranging from non to surgical intervention either with close reduction or with open reduction and internal fixation[2].

## METHODOLOGY

This Randomized Control Trial with Non-probability consecutive sampling was performed at Department of Oral & Maxillofacial Surgery, LUMHS Jamshoro/Hyderabad. By taking level of significance 5% power of test 90, proportion in 1st group is 55.56 and 33.33 in 2nd group so sample size of my study came as 64 patients in each group. So the total 128 patients were included.

**Sample size for each group is:**

Group A Close Reduction = 64 patients.
Group B Open Reduction = 64 patients.

**Inclusion Criteria:**

- Unilateral isolated zygomatic complex fracture having functional or esthetic problem with infraorbital nerve injury.
- Patients reported within 72 hours of injury
- Age ranged from 18-50 years old.
- Both genders.

**Exclusion Criteria:**

- Patient refuses to take part in the trial.
- Patients having any previous history of infraorbital nerve injury
- Patients with any other fracture of facial skeleton.

**Data Collection Procedure:** The study was carried out with the agreement of Liaquat University of Medical and Health Sciences' Research Ethics Committee. The research involved individuals who met the inclusion requirements and arrived at the Outpatient Service or the Emergency Department. Every patient or attendee of the patient signed a written permission form, and the surgical technique and its effects were thoroughly discussed. On a prescribed format, patients' personal information such as name, age, and gender were recorded. Clinical assessment and radiographic evaluation with at minimum two radiographs Occipitomental view 15 degree, Sub-Mentovertex view, or True Poterioranterior view were used to diagnose isolated Zygomatic Complex Injuries. Selection of each patient was done by randomized number trial into two groups. The fractures were treated by close reduction or open reduction method under general anesthesia

The neurosensory assessment incorporated light touch feeling with cotton wool, directional senses with a blunted probe, pain sensation with a 27 gauge needle, and thermal feeling with an ethyl chloride saturated dental swab test within the skin regions procured by the infraorbital nerve before surgery, 1 week, 6 weeks, and 12 weeks after surgery. The front cheek, lateral side of the nose, and upper lip were all examined bilaterally. Pre - operatively, postoperative, 1 week post - operatively, and 12 weeks post - operatively, sensory status was assessed. Ultimately, if two consecutive positive answers in these four tests were achieved after 12 weeks, the outcome was said to indicate recovery of infraorbital nerve function.

The statistical evaluation was carried out using the SPSS version 21.0 computer programme. The Mean+SD were calculated for age and duration of complain. Frequency and percentages were calculated for gender, site of fracture, and recovery.

## RESULTS

According to the findings, Group A included 80 male and 4 female cases, whereas Group B had 76 male and 8 female patients. The average age of the research participants in Group A was 31.34±8.61, whereas the average age of the study subjects in Group B was 33.25±7.55. The average fracture length in group A was 20.31±9.45 hours, whereas the average fracture duration in group B was 20.65±9.16 hours. Among both study groups left site of fracture was common side of fracture. Detailed frequency distribution and descriptive statistics are presented in Table-1.

Table 1: Frequency Distribution and Descriptive Statistics

| Study variable | Group a | Group b |
|---|---|---|
| Gender frequency<br>Male<br>Female | 58(90.6)<br>06(9.3) | 55(85.9)<br>9(14.06) |
| Age (mean ±sd) | 31.34±8.61 | 33.25±7.55 |
| Duration of fracture (hours) | 20.31±9.45 | 20.65±9.16 |
| Side of fracture<br>Right zmc<br>Left zmc | 28(43.7)<br>36(56.25) | 31(48.43)<br>33(51.5) |

Table 2: Frequency Distribution Preoperatively, at 1, 6 and 12 Weeks in Group A (Close Reduction Method)

| Test method | Status | Preoperative | After 1 week | After 6 week | After 12 week |
|---|---|---|---|---|---|
| Light Touch Sensation With Cotton Wool | Positive | 0(0) | 5(7.8%) | 11(17.1%) | 21(32.8%) |
| | Negative | 64(100%) | 59(92.1%) | 53(82.8%) | 43(67.1%) |
| Sensation With A Blunt Probe | Positive | 0(0) | 5(7.8%) | 11(17.1%) | 22(34.3%) |
| | Negative | 64(100%) | 59(92.1%) | 53(82.8%) | 42(65.6%) |
| Sensation With 27 Gauge Needle | Positive | 0(0) | 5(7.8%) | 12(18.75%) | 22(34.3%) |
| | Negative | 64(100%) | 59(92.1%) | 52(81.25%) | 42(65.6%) |
| Thermal Sensation With Ethyl Chloride Saturated Dental Swab | Positive | 0(0) | 5(7.8%) | 11(17.1%) | 22(34.3%) |
| | Negative | 64(100%) | 59(92.1%) | 53(82.8%) | 42(65.6%) |

Table 3: Frequency Distribution Preoperatively, at 1, 6 and 12 Weeks in Group B (Open Reduction Method)

| Test method | Status | Preoperative | After 1 week | After 6 week | After 12 week |
|---|---|---|---|---|---|
| Light Touch Sensation With Cotton Wool | Positive | 0(0) | 11(17.1%) | 26(40.6%) | 39(60.9%) |
| | Negative | 64(100%) | 53(82.8%) | 38(59.3%) | 25(39.06%) |
| Sensation With A Blunt Probe | Positive | 0(0) | 11(17.1%) | 26(40.6%) | 41(64.06%) |
| | Negative | 64(100%) | 53(82.8%) | 38(59.3%) | 23(35.9%) |
| Sensation With 27 Gauge Needle | Positive | 0(0) | 11(17.1%) | 29(45.3%) | 41(64.06%) |
| | Negative | 64(100%) | 53(82.8%) | 35(54.6%) | 23(35.9%) |
| Thermal Sensation With Ethyl Chloride Saturated Dental Swab | Positive | 0(0) | 11(17.1%) | 26(40.6%) | 41(64.06%) |
| | Negative | 64(100%) | 53(82.8%) | 38(59.3%) | 23(35.9%) |

Table 4: Frequency And Association Of Study Group According To Recovery (n=128)

| | STUDY GROUP | | TOTAL | P-Value |
|---|---|---|---|---|
| | Group A (n=64) | Group B (n=64) | | |
| Yes (n=63) | 22 | 41 | 63 | 0.023* |
| No (n=65) | 42 | 23 | 65 | |
| TOTAL | 64 | 64 | 128 | |

Table 2 shows the neurosensory responses to several diagnostic tests undertaken in both groups. Table 3 shows that there was a statistically significant relationship between study group and recovery (P=0.000).

## DISCUSSION

Since the infra-orbital fissure, canal, or foramen are present in 95 % of documented ZMC fractures, the infra-orbital

nerve is frequently affected. Infraorbital nerve damage is common after ZMC fractures, with rates ranging from 18 to 83 %.[13]

Impairment might occur as a direct result of the injury or as a result of the nerve being compressed when it exits its canal to feed the components of the midface.[7] After trigeminal nerve injury, infra-orbital nerve injury was the second most prevalent nerve injury in individuals with craniofacial trauma, according to an Iranian research.[14] Because all face fractures were examined in the prior study, it's possible that infra-orbital nerve injury was ranked second on the list. In a research from Israel, the incidence of infra-orbital nerve damage following ZMC fractures ranged from 18 to 83 percent, while in a study from India, it ranged from 58 to 94 %.[5]

ZMC fractures are the 2nd most frequent face fracture, following nasal bone or mandible fractures, according to several investigations. In our study males were affected predominantly affected with ZMC fractures as compared to female. There were 90.6% and 85.9% involvement of males in group A and B respectively. This data related to gender was well agreed by Bradley D[15], Where he found 89% subjects as males. Venugopal MG[16] and Forouzanfar T[17] have also found the male predominance in their respective studies on ZMC fractures.

This study reported mean age as 31.34±8.61 and 33.25±7.55 in group A and B respectively. Tripathi N[18] stated that in this study most of patients belonged to third (35%) and fourth (30%) decades of life. This shows that individuals in these decades of life are more active physically. A similar observation was found in the other studies Roy CS and Menon et al.[19-20]

Amongst the greatest common and recommended methods of fixation with good outcomes is open reduction and internal fixing. Reduction and fixation were essential variables in the rehabilitation of sensory abnormalities of the infraorbital nerve, according to De Man and Bax from the Netherlands.[21] Open reduction and internal fixation, according to Vriens and Moos, had an improved outcome for infraorbital nerve healing.[22]

In terms of functional restoration of the infra-orbital nerve, our research found that 64.06 % of participants made a full comeback after being treated with ORIF. Following open reduction and internal fixation, 77.3 % of the subjects claimed significant functioning improvement, according to Sakavicius D.[12]

Benoliel studied the neurosensory alterations in the infra-orbital nerve after different types of zygomatic injuries and concluded that plate fixing provides for much improved infra-orbital nerve functioning recovery.[13] Chronic nerve discomfort as a result of zygomatic fractures is uncommon. Kumar et al. found that the sooner the surgical action, the greater the healing of the nerve damage over the 1 and 6 month follow-up periods.[5]

## CONCLUSION

When contrasted to closed reduction, patients treated with open reduction and internal fixation has a higher rate of functional nerve reactivation. As a result, every subject with zygomatic complicated fractures involving the infraorbital nerve should be treated with open reduction fixation and sorted out for functional nerve recovery.

## REFERENCES


1. Ishaq Y, Noor M, Anwar MA. Comparison of infraorbital nerve recovery after open and closed reduction of zygomaticomaxillary complex fractures. Int J Otorhinolaryngol Head Neck Surg. 2018 May;4(3):613-617.
2. Yousaf H, Ali MH, Shah SFH, Hassan SG, Kumar L. Infraorbital nerve injury; assessment of recovery following open and close treatment methods in zygomatic complex fracture. Professional Med J 2018; 25(11):1754-1758.
3. Aguiar TL, Moraes BR, de Cerqueira Luz GJ. Symptomatology of fractures of the zygomatic complex. Analysis of a series of patients. Cir Traumatol Buco-Maxilo-fac Comarogibe. 2012;12(2):73-80.
4. Nofel R, Saeda IY, Mansour TW. Rehabilitation of Neurosensory changes in the Infraorbital nerve following zygomatic fractures. Curr Sci Intern. 2014;3(2):51-64.
5. Kumar P, Godhi S, Lall BA, Ram CS. Evaluation of Neurosensory changes in the infraorbital nerve following zygomatic fractures. J. Maxillofac. Oral Surg. Oct-Dec 2012;11(4):394-9.
6. Trindade PAK, Vieira EH, Gabrielli MAC, Gabrielli MFR, Filho VAP. Treatment and complications of orbito-zygomatico fractures. Int J Odontostomat 2012;6(3):255–262.
7. Pedemontet T, Basili E. Predictive factors in infraorbital nerve sensory disturbances following zygomaticomaxillary complex fractures. Int J Oral maxillofac Surg. 2005;34:503-6.
8. Nyachhyon P, Shah SAA. Management outcomes of Zygomatico-maxillary complex fractures. J Nepal Dent Association 2010;11:27-31.
9. Bailey K, Ng JD, Hwang PH, Saulny SM, Holck DE, Rubin PA. Infraorbital nerve surgical decompression for chronic infraorbital nerve hyperesthesia. Ophthal Plast Reconstr Surg 2007;23(1): 49–51.
10. Rao AYN, Jesudas J. An Alternative Route for Entrapped Inferior Orbital Nerve in Orbital Floor Fracture. Craniomaxillofac Trauma Reconstruction 2017;10:230–238.
11. Fogaça WC, Fereirra MC, Dellon AL. Infraorbital nerve injury associated with zygoma fractures: documentation with neurosensory testing. Plast Reconstr Surg 2004;113(3):834–838.
12. Sakavicius D, Juodzbalys G, Kubilius R, Sabalys GP. Investigation of infraorbital nerve injury following zygomaticomaxillary complex fractures. J Oral Rehabil 2008;35(12):903–916.
13. Benoliel R, Birenboim R, Regev E, Eliav E. Neurosensory changes in the infraorbital nerve following zygomatic fractures. Oral Surg Oral Med Oral Pathol Oral Radiol endod. 2005;99(6):657-65.
14. Poorian B, Bemanali M, Chavoshinejad M. Evaluation of sensorimotor nerve damage in patients with maxillofacial trauma; a single center experience. Bull Emerg Trauma. 2016;4(2):88-92.
15. Bradley D, Leung B, Saxena S, Dungarwalla M, Chapireau D, Fan K. Surgical management of zygomatic complex fractures in a major trauma centre. Plast Aesthet Res 2019;6:11.
16. Venugopal MG, Sinha R, Menon PS, Chattopadhyay PK, Roy Chowdhury SK. Fractures in the maxillofacial region: a four year retrospective study. Med J Armed Forces India 2010;66:14-7.
17. Forouzanfar T, Salentijn E, Peng G, van den Bergh B. A 10-year analysis of the "Amsterdam" protocol in the treatment of zygomatic complex fractures. J Craniomaxillofac Surg 2013;41:616-22.
18. Tripathi N, Goyal M, Mishra B, Dhasmana S. Zygomatic complex fracture: A comparative evaluation of stability using titanium and bio-resorbable plates as one point fixation. Natl J Maxillofac Surg 2013;4:181-7.
19. Roy CS, Menon S. Etiology and management of zygomaticomaxillary complex fractures in armed forces. MJAFI 2005;61:3.
20. Menon S, Chowdhary SK. Evaluation of bioresorbable vis-à-vis titanium plates and screws for craniofacial fractures and osteotomies. MJAFI 2007;6:331-3.
21. De Man K, Bax WA. The influence of the mode of treatment of zygomatic bone fractures on the healing process of the infraorbital nerve. Br J Oral Maxillofac Surg. 1988;26(5):419-25.
22. Vriens JP, Moos KF. Morbidity of the infraorbital nerve following orbitozygomatic complex fractures. J Craniomaxillofac Surg. 1995;23(6):363-8.