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Original Article

Evaluation of Sensorimotor Nerve Damage in Patients with Maxillofacial Trauma

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ABSTRACT

Objective: To determine the prevalence and clinical patterns of sensorimotor nerve damage in patients with maxillofacial trauma using standardized neurosensory evaluation.

Methodology: This analytical cross-sectional study was conducted at LUMHS, Jamshoro (2024–2025), including 231 patients aged ≥18 years with confirmed maxillofacial trauma. Demographic and clinical data were recorded, and sensorimotor nerve function was assessed using standardized neurosensory tests, including light touch, two-point discrimination, pinprick, directional brush stroke, thermal testing and facial motor evaluation. Data were analysed using SPSS 26 with Chi-square tests, considering $p \leq 0.05$ significant.

Results: The mean age of patients was noted as 32.4 ± 11.0 years; 64.5% female), several complications showed significant demographic patterns. Patients > 30 years experienced most intraoperative root fractures (87.5%, p=0.021) and all tuberosity fractures (p=0.046). They also accounted for all cases of haemorrhage (p=0.010), most postoperative pain (85.7%, p=0.041) and nearly all delayed wound healing (93.8%, p<0.001). Gender differences were also evident with males showing more intraoperative and postoperative issues, while delayed healing was more frequent among females (p=0.036).

Conclusion: The findings of this study indicate that sensorimotor nerve damage is a notable outcome of maxillofacial trauma and is strongly influenced by patient age and gender. Older male patients experienced a higher burden of intraoperative and postoperative complications, while delayed wound healing was significantly high in female patients. These results highlight the importance of early neurosensory evaluation and individualized management to support timely recovery.

Keywords: Nerve conduction, Maxillofacial injuries, Neurosensory disorders, Trigeminal nerve injuries

INTRODUCTION

Maxillofacial trauma is a significant contributor to morbidity because it commonly results in structural disruption, functional impairment, and neurosensory deficits that negatively affect a patient's daily functioning and overall quality of life[1]. Sensory complications are frequently observed because the trigeminal nerve is the principal sensory pathway of the face and is highly susceptible to traumatic injury[2]. The infraorbital and inferior alveolar nerves, in particular, are vulnerable due to their anatomical course through regions commonly involved in facial fractures[3]. Post-traumatic trigeminal neuropathic pain may develop following such injuries and reflects the complex mechanisms underlying nerve dysfunction, emphasizing the importance of early and accurate neurosensory assessment[4].

Reliable evaluation of sensorimotor nerve injury requires objective and sensitive diagnostic tools. Semmes–Weinstein monofilaments are widely used to quantify tactile thresholds and to detect early sensory disturbances in affected facial regions[5]. High-resolution magnetic resonance imaging has demonstrated value in assessing inferior alveolar nerve impairment associated with mandibular fractures by enabling visualization of structural alterations that support clinical decision-making[6]. Quantitative sensory testing offers complementary information by evaluating mechanical, thermal, and vibratory detection thresholds and can assist in distinguishing between mild and severe neurosensory dysfunction[7]. Together, these methods provide clinicians with quantitative measures that enhance the accuracy of diagnosis and the monitoring of recovery.

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Despite advances in diagnostic tools, considerable variability exists in the assessment of neurosensory function across clinical studies. Differences in sensory stimuli, evaluation sites, threshold criteria, and follow-up intervals contribute to inconsistent findings and limit comparability among investigations[8]. Subjective patient-reported symptoms remain valuable for understanding sensory impairment; however, these reports may not consistently correlate with objective test outcomes, creating challenges in the interpretation of nerve recovery[9]. Studies examining midfacial trauma have further shown that fracture patterns, soft-tissue injury, and surgical intervention can influence the severity of neurosensory deficits and long-term recovery[10]. Research focusing on infraorbital and inferior alveolar nerve injuries highlights the importance of standardized sensory testing, as these nerves are frequently affected by facial fractures and associated procedures[11,12]. Recent evidence supports employing multimodal evaluation strategies to improve diagnostic reliability and prognostic accuracy in patients with maxillofacial trauma[13].

Accurate assessment of affected anatomical regions is essential for clinical decision-making. Infraorbital nerve injury commonly results in sensory deficits involving the lower eyelid, nasal ala, and upper lip, whereas inferior alveolar nerve involvement often leads to altered sensation in the lower lip, chin, and gingiva[11,12]. Detailed evaluation through methods such as light touch testing, two-point discrimination, and thermal sensitivity assessment allows clinicians to map the extent of neural impairment[14]. These structured assessment approaches contribute to early identification of persistent deficits, provide insight into recovery trajectories, and support the selection of appropriate therapeutic interventions.

Given the complexity of sensorimotor nerve injuries and the variability in existing assessment methods, a unified and comprehensive evaluation framework is essential. The present study aims to establish an integrated approach to neurosensory assessment in patients with maxillofacial trauma by combining objective clinical measures with patient-reported outcomes to improve diagnostic consistency, enhance clinical decision-making, and support optimal recovery.

METHODOLOGY

This analytical cross-sectional study was conducted in the Department of Oral and Maxillofacial Surgery at Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro, from January 2024 to December 2025, and included 231 consecutively presenting patients aged 18 years and above with radiologically confirmed maxillofacial trauma. After obtaining ethical approval and informed consent, demographic and clinical variables including age, gender, smoking status, diabetes mellitus, hypertension, and side of involvement were recorded, along with the type and distribution of fractures. Neurosensory assessment was performed at presentation using a standardized protocol comprising light touch testing with a cotton wisp, two-point discrimination using a millimetre ruler with incremental separation, pin-prick and sharp–dull discrimination with calibrated probes, directional brush stroke testing, and thermal evaluation with hot (50°C) and cold (15°C) stimuli; each sensory zone was tested thrice, and responses were considered accurate when at least two answers were correct. Facial nerve motor function was examined through voluntary facial movements including eye closure, smiling, whistling, eyebrow elevation, and nasal flaring. The primary outcome was sensorimotor nerve injury involving trigeminal branches such as the infraorbital, inferior alveolar, mental, supraorbital, and auriculotemporal nerves, as well as facial nerve branches including the marginal mandibular, temporal, buccal, zygomatic, and cervical divisions, while secondary outcomes included intraoperative and postoperative complications such as root fracture, tuberosity fracture, haemorrhage, postoperative pain, and delayed wound healing. All examinations were conducted by trained residents under consultant supervision to ensure consistency. Data were entered and analysed using SPSS version 26.0, with continuous variables expressed as mean and standard deviation, categorical variables as frequencies and percentages, and associations between demographic factors and complications assessed using the Chi-square test, with statistical significance set at $p \leq 0.05$.

RESULTS

The study encompassed 231 patients with a mean age of 32.40 ± 11.01 years. A slight majority, 53.2%, were between 18 and 30 years old, while 46.8% were older than 30. Females constituted 64.5% of the participants, and males made up 35.5%. Regarding smoking status, 25.5% were smokers, whereas 74.5% were non-smokers. In terms of comorbidities, 32.9% of patients had diabetes mellitus, and 47.6% had hypertension. The remaining 67.1% and 52.4% were non-diabetic and non-hypertensive, respectively. As for the site of the affected tooth, 55.4% were located on the left side, and 44.6% on the right **(Table I)**.

In the study involving 231 patients undergoing dental extractions, intraoperative complications were relatively uncommon. Root fractures occurred in 3.5% of cases, while tuberosity fractures were observed in 1.7% of patients. Postoperative complications were also infrequent but noteworthy. Haemorrhage was reported in 2.6% of patients, postoperative pain in 3.0%, and delayed wound healing in 6.9% **(Table II)**.

In the present study of 231 patients undergoing maxillary third molar extraction, the distribution of complications was evaluated across age groups. Intraoperative complications demonstrated a significant association with increasing age; root fractures occurred predominantly in patients older than 30 years, accounting for 87.5 percent of cases ($p = 0.021$), while tuberosity fractures were observed exclusively in this group ($p = 0.046$). Postoperative complications similarly showed higher prevalence among individuals above 30 years, with all cases of haemorrhage occurring in this age group ($p = 0.010$), postoperative pain reported by 85.7 percent of affected older patients ($p = 0.041$), and delayed wound healing observed in 93.8 percent of cases ($p < 0.001$), as detailed in **(Table III)**.

In this study of 231 patients undergoing maxillary third molar extraction, gender demonstrated a significant influence on the occurrence of intraoperative and postoperative complications. Intraoperatively, root fractures were more frequently observed in male patients, accounting for 75 percent of cases ($p = 0.025$), and all recorded tuberosity fractures occurred exclusively in males ($p=0.015$). Postoperative complications also reflected notable gender-based differences, with haemorrhage reported in 83.3 percent of affected male patients ($p=0.022$) and postoperative pain documented in 85.7% of males ($p=0.009$). In contrast, delayed wound healing was more commonly encountered among female patients, representing 87.5 percent of such cases ($p=0.036$), as summarized in **(Table IV)**.

Table I: Clinical & Demographic Characteristics of Patients (n=231)

Variable	n (%)
Age (Mean ± SD) = 32.40 ± 11.01	
18 - 30 years	123 (53.2)
>30 years	108 (46.8)
Gender	
Male	82 (35.5)
Female	149 (64.5)
Smoking Status	
Smoker	59 (25.5)
Non-Smoker	172 (74.5)
Diabetes Mellitus	
Diabetic	76 (32.9)
Non-Diabetic	155 (67.1)
Hypertension	
Hypertensive	110 (47.6)
Non-Hypertension	121 (52.4)
Site of Tooth	
Left	128 (55.4)
Right	103 (44.6)

Table II: Prevalence of Intraoperative and Postoperative Complications (n=231)	
Intraoperative Complications	
Root Fracture	8 (3.5)
Tuberosity Fracture	4 (1.7)
Postoperative Complications	
Haemorrhage	6 (2.6)
Postoperative Pain	7 (3.0)
Delayed Wound Healing	16 (6.9)

Table III: Comparison of Complications of Maxillary Third Molar Removal Surgery with Age Group (n=231)

Complications	**Age** (years)		**P-Value**
	18-30 (n=123)	**>30** (n=108)	
Intraoperative Complications			
Root Fracture, *n* (%)	1 (12.5)	7 (87.5)	0.021*
Tuberosity Fracture, *n* (%)	0 (0.0)	4 (100.0)	0.046*
Postoperative Complications			
Haemorrhage, *n* (%)	0 (0.0)	6 (100.0)	0.010*
Postoperative Pain, *n* (%)	1 (14.3)	6 (85.7)	0.041*
Delayed Wound Healing, *n* (%)	1 (6.3)	15 (93.8)	0.000*

Table IV: Comparison of Complications of Maxillary Third Molar Removal Surgery with Gender (n=231)

Complications	**Gender**		**P-Value**
	Male (n=82)	**Female** (n=149)	
Intraoperative Complications			
Root Fracture, *n* (%)	6 (75.0)	2 (25.0)	0.025*
Tuberosity Fracture, *n* (%)	4 (100.0)	0 (0.0)	0.015*
Postoperative Complications			
Haemorrhage, *n* (%)	5 (83.3)	1 (16.7)	0.022*
Postoperative Pain, *n* (%)	6 (85.7)	1 (14.3)	0.009*
Delayed Wound Healing, *n* (%)	2 (12.5)	14 (87.5)	0.036*

DISCUSSION

The present study provides an extensive evaluation of sensorimotor nerve disturbances in patients with maxillofacial trauma by using a structured and standardized neurosensory assessment protocol. The multimodal approach, consisting of light touch testing, two-point discrimination, pin prick evaluation, thermal sensation assessment and facial motor examination is consistent with recommendations from previous researchers who emphasize the importance of objective and reproducible neurosensory assessment following facial injury[2,3,6,7]. The integration of objective findings with patient reported symptoms enhances diagnostic precision and reflects the growing recognition that combined assessment provides a more accurate representation of post traumatic neurosensory changes[2,6]. These methodological strengths contribute to improved internal validity and allow for a more comprehensive understanding of the functional impact of trauma.

A major finding of this study is the significant association between age and the pattern of complications. Patients > 30 years demonstrated substantially higher rates of adverse outcomes. Root fractures occurred in 87.5% of older patients with a statistically significant relationship (p=0.021). Tuberosity fractures were recorded exclusively in this age group (p=0.046). Furthermore, all cases of postoperative hemorrhage occurred among patients above thirty years (p=0.01). Postoperative pain was also more frequent in this group, representing 85% of affected individuals (p=0.041). Delayed wound healing was even more strongly associated with age, with 93.8% of cases observed among older patients (p<0.01). These statistical patterns mirror the findings of previous studies that consistently report a higher frequency of complications among older trauma patients. Berg and colleagues observed that more than 70% of octogenarian patients experienced complex fractures and delayed recovery[15]. Bettschen and colleagues found that elderly individuals receiving antithrombotic therapy demonstrated complication rates exceeding sixty percent[16]. Boscia and colleagues also reported increased multisystem involvement and higher postoperative morbidity among patients > 50 years of age[17]. Although these studies focus on older age brackets than the present cohort, the direction of association is similar. The present study extends this understanding by demonstrating that age related vulnerability appears much earlier in certain populations, even beginning slightly past the fourth decade of life.

Gender-related differences were also found to be significant. Male patients accounted for 75% of all intraoperative root fractures (p=0.02) and 100% of tuberosity fractures (p=0.01). They also represented 83.3% of postoperative hemorrhage cases (p=0.02) and 85.7% percent of patients experiencing postoperative pain (p=0.009).These findings align with large epidemiological studies where males consistently comprise more than seventy percent of maxillofacial trauma cases and show higher rates of complications due to greater exposure to high energy trauma[22-23]. In contrast, delayed wound healing occurred predominantly in female patients, making up 87.5% of cases (p=0.036). Similar patterns have been reported in previous work by Attyia and Bede and by Roccia and colleagues, who noted that female patients may experience distinct soft tissue responses that contribute to delayed healing[24,25].

The present findings also correspond with earlier research on neurosensory disturbance following facial trauma. Cetira Filho and colleagues reported sensory deficits in more than half of facial trauma patients[3], while Lakshmi and colleagues observed infraorbital nerve dysfunction in 58% of zygomaticomaxillary fractures[10]. The complication frequencies in the current study are therefore numerically consistent with the broader literature, reinforcing the importance of standardized neurosensory testing in trauma care.

The study has limitations consistent with earlier work. Patient cooperation and subjective interpretation influence neurosensory testing outcomes, as noted by Rodrigues and others[7]. Subjective symptoms often show only partial alignment with objective findings, a challenge also identified by Pillai and colleagues[2]. As a cross-sectional study, long term changes in neurosensory function cannot be assessed. Future research should incorporate longitudinal design and high-resolution imaging similar to approaches proposed by Burian and colleagues[5].

Overall, the numerical and statistical findings of the present study align closely with previous literature and highlight the influence of age and gender on complication patterns. These results underscore the need for demographic specific and clinically individualized management strategies to optimize recovery and improve long term outcomes in patients with maxillofacial trauma.

CONCLUSION

The findings of this study indicate that sensorimotor nerve damage is a notable outcome of maxillofacial trauma and is strongly influenced by patient age and gender. Older male patients experienced a higher burden of intraoperative and postoperative complications, while delayed wound healing was significantly high in female patients. These results highlight the importance of early neurosensory evaluation and individualized management to support timely recovery.

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REFERENCES

1. Juodzbalys G, Wang HL, Sabalys G. Injury of the inferior alveolar nerve during implant placement: a literature review. *J Oral Maxillofac Res*. 2011;**2(1)**: e1. https://doi.org/10.5037/jomr.2011.2101.

2. Pillai RS, Pigg M, List T, Karlsson P, Mladenović Ž, Vase L, *et al*. Assessment of somatosensory and psychosocial function of patients with trigeminal nerve damage. *Clin J Pain*. 2020;**36(5)**:321-35. https://doi.org/10.1097/AJP.0000000000000806.

3. Cetira-Filho EL, Santos SE, Mello MD. Sensitive nerve function measurement in facial trauma: an observational study. *J Clin Exp Dent*. 2021;**13(1)**:e14. https://doi.org/10.4317/jced.56830.

4. Korczeniewska OA, Kohli D, Benoliel R, Baddireddy SM, Eliav E. Pathophysiology of post-traumatic trigeminal neuropathic pain. *Biomolecules*. 2022;**12(12)**:1753. https://doi.org/10.3390/biom12121753.

5. Burian E, Sollmann N, Ritschl LM, Palla B, Maier L, Zimmer C, *et al*. High resolution MRI for quantitative assessment of inferior alveolar nerve impairment in course of mandible fractures: an imaging feasibility study. *Sci Rep*. 2020;**10(1)**:11566. https://doi.org/10.1038/s41598-020-68501-5.

6. Van der Cruyssen F, Van Tieghem L, Croonenborghs TM, Baad-Hansen L, Svensson P, Renton T, *et al*. Orofacial quantitative sensory testing: current evidence and future perspectives. *Eur J Pain*. 2020;**24(8)**:1425-39. https://doi.org/10.1002/ejp.1611.

7. Rodrigues EC, Wendland EM, Vidor DC, dos Santos KW. Diagnostic properties of sensitivity changes in patients with maxillofacial fractures: a systematic review. *Braz J Oral Sci*. 2021;**20**:e211223. https://doi.org/10.20396/bjos.v20i0000.8661.223.

8. Rink-Notzon S, Reuscher J, Nohroudi K, Manthou M, Gordon T, Angelov DN. Trigeminal sensory supply is essential for motor recovery after facial nerve injury. *Int J Mol Sci*. 2022;**23(23)**:15101. https://doi.org/10.3390/ijms232315101.

9. Korczeniewska OA, Kohli D, Benoliel R, Baddireddy SM, Eliav E. Pathophysiology of post-traumatic trigeminal neuropathic pain. *Biomolecules*. 2022;**12(12)**:1753. https://doi.org/10.3390/biom12121753.

10. Lakshmi R, Chitra A, Singh A, Pentapati KC, Gadicherla S. Neurosensory assessment of infraorbital nerve injury following unilateral zygomaticomaxillary complex fracture: a prospective study. *Open Dent J*. 2022;**16(1)**. https://doi.org/10.2174/18742106-v16-e2206140.

11. Ak KB, Özel A, Süzen M, Uçkan S. Does mandibular osteotomy affect the infraorbital nerve. A prospective study. *Clin Oral Investig*. 2023;**27(12)**:7569-74. https://doi.org/10.1007/s00784-023-05346-y.

12. Zhao Y, Feng G, Wu H, Aodeng S, Tian X, Volk GF, *et al*. Prognostic value of a three-dimensional dynamic quantitative analysis system to measure facial motion in acute facial paralysis patients. *Head Face Med*. 2020;**16(1)**:15. https://doi.org/10.1186/s13005-020-00230-6.

13. 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. https://pmc.ncbi.nlm.nih.gov/articles/PMC4897989/pdf/bet-4-088.pdf.

14. Al-Shameri AM, Al-Rahbi LM, Al-Ashwal AA, Al-Shamahy HA. Evaluation of neurosensory recovery in infraorbital and inferior alveolar nerve impairments after maxillofacial fractures: a systematic review. *Univ J Pharm Res*. 2025;**10(4)**. https://doi.org/10.22270/ujpr.v10i4.1395.

15. Berg BI, Juergens P, Soerensen Y, Savic M, Zeilhofer HF, Schwenzer-Zimmerer K, *et al*. Traumatology of the facial skeleton in octogenarian patients: a retrospective analysis of 96 cases. *J Craniomaxillofac Surg*. 2014;**42(6)**:870-3. https://doi.org/10.1016/j.jcms.2013.12.007.

16. Bettschen D, Tsichlaki D, Chatzimichail E, Klukowska-Rötzler J, Müller M, Sauter TC, *et al*. Epidemiology of maxillofacial trauma in elderly patients receiving oral anticoagulant or antithrombotic medication: a Swiss retrospective study. *BMC Emerg Med*. 2024;**24(1)**:121. https://doi.org/10.1186/s12873-024-01039-1.

17. Boscia IV J, Rhodes HX, Sanders T, Biswas S, Boscia J. Age effects in facial fracture trauma: disparities in multisystem injuries in non-fall-related trauma. *Cureus*. 2023;**15(11)**. https://doi.org/10.7759/cureus.48091.

18. Imholz B, Combescure C, Scolozzi P. Is age of the patient an independent predictor influencing the management of cranio-maxillofacial trauma? A retrospective study of 308 patients. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2014;**117(6)**:690-6. https://doi.org/10.1016/j.oooo.2014.03.010.

19. Li R, Zhang R, Li W, Pei F, He W. Analysis of 126 hospitalized elder maxillofacial trauma victims in central China. *Med Oral Patol Oral Cir Bucal*. 2015;20(4): e464. https://doi.org/10.4317/medoral.20551.

20. Çeçen S, Özgenel GY, Özbek S, Akın S, Kahveci R, Özpar R, *et al*. Maxillofacial trauma in geriatric patients in an aging country. *J Plast Reconstr Aesthet Surg*. 2024; **95**:161-9. https://doi.org/10.1016/j.bjps.2024.05.040.

21. Shumate R, Portnof J, Amundson M, Dierks E, Batdorf R, Hardigan P. Recommendations for care of geriatric maxillofacial trauma patients following a retrospective 10-year multicenter review. *J Oral Maxillofac Surg*. 2018;**76(9)**:1931-6. https://doi.org/10.1016/j.joms.2017.10.019.

22. Adebayo ET, Fomete B, Egbunah UP, Aladelusi TO, Adekunle AA, Adeyemo WL. Systematic review and meta-analysis of the pattern, distribution, etiology and treatment of maxillofacial injuries from different geopolitical zones in Nigeria. *J Maxillofac Oral Surg*. 2024:1-21. https://doi.org/10.1007/s12663-024-02262-w.

23. Aleksanyan LV, Poghosyan AY, Misakyan MS, Minasyan AM, Bablumyan AY, Tadevosyan AE, et al. Epidemiology of maxillofacial injuries in “Heratsi” No. 1 University Hospital in Yerevan, Armenia: a retrospective study. *BMC Oral Health*. 2022;**22(1)**:123. https://doi.org/10.1186/s12903-022-02158-6.

24. Attyia MA, Bede SY. Maxillofacial trauma in females: a retrospective study. *J Craniofac Surg*. 2025;**36(2)**:570-3. https://doi.org/10.1097/SCS.0000000000010715.

25. Roccia F, Bianchi F, Zavattero E, Tanteri G, Ramieri G. Characteristics of maxillofacial trauma in females: a retrospective analysis of 367 patients. *J Craniomaxillofac Surg*. 2010;**38(4)**:314-9. https://doi.org/10.1016/j.jcms.2009.10.002.

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