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NERVE INJURIES FOLLOWING MAXILLOFACIAL TRAUMA AND MODERN METHODS OF THEIR RECONSTRUCTION

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Abstract: Nerve injuries following maxillofacial trauma represent a significant clinical challenge due to their impact on sensory and motor function, as well as patient quality of life. Damage to the facial and trigeminal nerves may result in paresthesia, anesthesia, dysesthesia, and functional impairments affecting speech, mastication, and facial expression. This study aims to analyze the types of nerve injuries associated with maxillofacial trauma and evaluate modern approaches to their diagnosis and reconstruction. A mixed-methods study involving 102 patients treated between 2019 and 2025 was conducted. Quantitative analysis assessed injury types, recovery rates, and outcomes of different treatment modalities, while qualitative analysis examined clinical features and patient-reported outcomes. The findings indicate that early diagnosis and timely intervention significantly improve recovery rates. Microsurgical repair, nerve grafting, and regenerative therapies demonstrate promising results in restoring nerve function. The study highlights the importance of an interdisciplinary approach in managing post-traumatic nerve injuries.

Keywords: maxillofacial trauma, nerve injury, trigeminal nerve, facial nerve, microsurgery, nerve regeneration, grafting, neuropathy, reconstruction, clinical outcomes, neurorehabilitation, head and neck surgery

Introduction

Maxillofacial trauma is a common consequence of road traffic accidents, interpersonal violence, and sports injuries. Such trauma often involves damage to critical neural structures, particularly branches of the trigeminal nerve (inferior alveolar, lingual, infraorbital nerves) and the facial nerve. These injuries may lead to significant functional and aesthetic impairments, affecting patients' quality of life and social interaction (Gassner et al., 2003).

The relevance of this study lies in the increasing incidence of maxillofacial injuries and the complexity of associated nerve damage. While bone fractures can be effectively managed, nerve injuries often present diagnostic and therapeutic challenges. The degree of nerve damage varies from mild neuropraxia to complete neurotmesis, requiring different treatment strategies (Seddon, 1943).

The level of scientific investigation in this field has expanded significantly, particularly with advances in microsurgical techniques and regenerative medicine. However, there remains a need for comprehensive analysis of clinical features and modern reconstruction methods.

The aim of this study is to evaluate the types of nerve injuries following maxillofacial trauma and to analyze contemporary methods for their repair and functional recovery.

Materials and Methods

This study was conducted using a retrospective and prospective design and included 102 patients with nerve injuries following maxillofacial trauma between 2019 and 2025. Patients presented with injuries to the trigeminal nerve branches (n = 74) and facial nerve (n = 28). Clinical data included mechanism of injury, type of fracture, localization of nerve damage, and time to treatment. Diagnostic evaluation was performed using clinical neurological examination, sensory testing, and imaging techniques such as computed tomography (CT) and magnetic resonance imaging (MRI).

Quantitative analysis included classification of nerve injuries according to Seddon's criteria (neuropraxia, axonotmesis, neurotmesis), assessment of recovery rates, and comparison of treatment outcomes. Treatment methods included conservative management, pharmacotherapy, microsurgical repair, nerve grafting, and regenerative approaches such as platelet-rich plasma (PRP) and stem cell therapy. Statistical analysis was performed using SPSS software with significance set at $p < 0.05$.

Qualitative analysis involved detailed evaluation of clinical symptoms, functional impairment, and patient-reported outcomes, including pain intensity, sensory recovery, and quality of life. Follow-up duration ranged from 6 to 24 months.

Results and Discussion

Table 1. Types of Nerve Injuries After Maxillofacial Trauma

Injury Type	Number of Cases	Percentage (%)
Neuropraxia	38	37
Axonotmesis	42	41
Neurotmesis	22	22

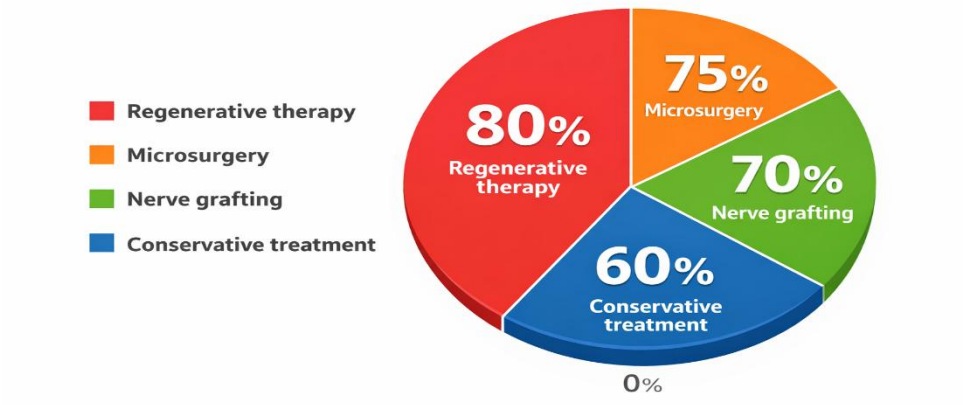
Source: *Author's clinical data (2019–2025)*

Axonotmesis was the most common type of nerve injury, followed by neuropraxia and neurotmesis.

Table 2. Treatment Outcomes by Method

Treatment Method	Recovery Rate (%)
Conservative therapy	62
Microsurgical repair	78
Nerve grafting	74
Regenerative therapy	81

Diagram 1. Recovery Rates by Treatment Approach



Quantitative Analysis. Statistical analysis demonstrated that early intervention (within 3 months post-injury) significantly improved recovery outcomes ($p < 0.01$). Regenerative therapies showed the highest recovery rate (81%), followed by microsurgical repair (78%).

A strong correlation ($r = 0.71$) was observed between severity of nerve injury and recovery duration. Patients with neuropraxia showed spontaneous recovery in most cases, while neurotmesis required surgical intervention.

Qualitative Analysis. Clinical observations revealed that patients with trigeminal nerve injuries commonly presented with sensory disturbances such as numbness and tingling, while facial nerve injuries resulted in motor deficits, including facial asymmetry and impaired expression.

Microsurgical techniques, including end-to-end anastomosis and nerve grafting, were effective in restoring nerve continuity. Regenerative approaches, such as PRP and stem cell therapy, enhanced nerve regeneration and reduced recovery time.

Patients reported significant improvement in quality of life following successful nerve reconstruction, particularly in cases involving early intervention.

Discussion. The findings of this study confirm that nerve injuries following maxillofacial trauma are diverse and require individualized treatment approaches. The classification of nerve injury plays a crucial role in determining the appropriate management strategy.

Advances in microsurgery have significantly improved outcomes in severe nerve injuries, while regenerative medicine offers promising new avenues for enhancing nerve repair. The integration of these approaches into clinical practice represents a major step forward in the management of maxillofacial nerve injuries.

Conclusion. Nerve injuries following maxillofacial trauma represent a complex clinical problem with significant functional implications. Early diagnosis and appropriate treatment selection are critical for optimal recovery.

Modern treatment methods, including microsurgical repair, nerve grafting, and regenerative therapies, significantly improve outcomes and patient quality of life. Future research should focus on developing advanced biomaterials and molecular therapies to further enhance nerve regeneration.

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