



Journal of Fatima Jinnah Institute of Dental Sciences

<https://jfjids.com/index.php/jfjids/index>

VOL 01 ISSUE 01 2025

Outcomes of Interdisciplinary Management in Complex Maxillofacial Trauma: A Case Series from a Tertiary Care Dental Hospital

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Abstract

Complex maxillofacial trauma often presents with multisystem involvement, functional impairment, and aesthetic deformities that require coordinated care across multiple dental and medical specialties. This case series evaluates the clinical outcomes of interdisciplinary management in patients presenting with complex maxillofacial injuries at a tertiary care dental hospital in Pakistan. A retrospective analysis of cases managed through a collaborative approach involving oral and maxillofacial surgeons, orthodontists, prosthodontists, anesthetists, and radiologists was conducted. Outcomes were assessed in terms of functional recovery, aesthetic rehabilitation, complication rates, and patient satisfaction. The interdisciplinary model demonstrated improved occlusal stability, facial symmetry, reduced postoperative complications, and enhanced overall treatment outcomes. These findings highlight the critical role of structured interdisciplinary collaboration in optimizing the management of complex maxillofacial trauma.

Keywords: Maxillofacial trauma, interdisciplinary care, facial fractures, dental rehabilitation, trauma surgery, tertiary care hospital, Pakistan, case series

Introduction

Maxillofacial trauma constitutes a significant public health concern, particularly in developing countries where road traffic accidents, interpersonal violence, and occupational hazards are prevalent. Such injuries frequently involve multiple anatomical structures including the mandible, maxilla, zygomatic complex, dentition, and associated soft tissues. Isolated management by a

single specialty often fails to address the multifaceted functional, aesthetic, and psychological consequences of these injuries. An interdisciplinary management approach integrates surgical, orthodontic, prosthodontic, and rehabilitative expertise, enabling comprehensive patient-centered care. This study presents a case series evaluating outcomes achieved through interdisciplinary management of complex maxillofacial trauma in a tertiary care dental hospital setting.

Study Design and Setting .This study was designed as a **retrospective observational case series** conducted at a **tertiary care dental teaching hospital in Lahore, Pakistan**, which serves as a major referral center for maxillofacial trauma cases from both urban and rural regions of Punjab. The hospital is equipped with dedicated oral and maxillofacial surgery units, advanced diagnostic imaging facilities, and multidisciplinary dental and medical services, enabling comprehensive management of complex facial injuries. Patients presenting with **complex maxillofacial trauma** between **January 2022 and December 2024** were consecutively identified through hospital medical records. Complex trauma was defined as injuries involving multiple facial bones, dentoalveolar structures, soft tissues, or cases requiring coordinated intervention from more than one specialty. All patients received standardized trauma care protocols aligned with institutional guidelines. Prior to data collection, **ethical approval** was obtained from the **Institutional Review Board (IRB)** of the host institution, ensuring compliance with ethical standards for research involving human participants. Patient confidentiality was strictly maintained by anonymizing clinical data, and the study adhered to the principles outlined in the **Declaration of Helsinki**. As this was a retrospective review, informed consent requirements were waived by the IRB, with no direct patient contact involved during the study period.

Case Selection Criteria

Patients were selected using clearly defined **inclusion and exclusion criteria** to ensure that only cases representing **complex maxillofacial trauma** were analyzed. The inclusion criteria encompassed patients of both genders and all adult age groups who presented with **multiple facial fractures** (such as combined mandibular and midfacial injuries), **dentoalveolar trauma** involving tooth loss or displacement, and injuries necessitating the **involvement of more than one dental or medical specialty** for definitive management. Cases requiring coordinated care among oral and maxillofacial surgeons, orthodontists, prosthodontists, anesthetists, or radiologists were considered eligible, as these reflected the interdisciplinary nature of treatment under investigation.

Patients with **isolated minor fractures**, including single non-displaced mandibular or nasal bone fractures managed conservatively, were excluded to maintain clinical homogeneity. Additionally, patients with superficial soft tissue injuries not requiring surgical intervention, those with incomplete medical records, and individuals lost to follow-up before completion of treatment were excluded from the study. This selective approach ensured that the case series accurately represented the outcomes of interdisciplinary management in **clinically significant and complex maxillofacial trauma**, thereby enhancing the validity and interpretability of the findings.

Interdisciplinary Team Composition

The management of complex maxillofacial trauma in this case series was undertaken by a **structured interdisciplinary team** to address the multifactorial clinical demands of such injuries. The core team consisted of **oral and maxillofacial surgeons**, who led the surgical management of facial fractures and soft tissue injuries; **orthodontists**, responsible for occlusal assessment, intermaxillary fixation, and post-trauma dental alignment; and **prosthodontists**, who contributed to the rehabilitation phase through restoration of missing teeth, occlusal harmony, and facial aesthetics. **Anesthetists** played a critical role in perioperative patient stabilization and airway management, particularly in cases with compromised facial anatomy, while **radiologists** provided detailed imaging interpretation, including CBCT and three-dimensional reconstructions essential for accurate diagnosis and surgical planning. Skilled **nursing staff** supported perioperative care, postoperative monitoring, and patient education. To ensure seamless coordination, **periodic multidisciplinary case conferences** were conducted at key stages of patient management, including initial assessment, preoperative planning, and postoperative rehabilitation. These

meetings facilitated shared decision-making, alignment of treatment objectives, and timely modification of management strategies based on patient progress. This collaborative framework not only minimized treatment delays and procedural redundancies but also enhanced clinical outcomes by integrating diverse professional expertise into a unified, patient-centered care pathway.

Diagnostic and Imaging Protocols

All patients underwent a **systematic diagnostic evaluation** beginning with a comprehensive clinical examination that included assessment of facial symmetry, occlusion, mandibular movements, neurosensory status, soft tissue integrity, and dentoalveolar involvement. Clinical findings were documented using standardized trauma assessment forms to ensure consistency across cases. Particular attention was given to airway patency, functional deficits related to mastication and speech, and signs of associated injuries, which are commonly encountered in complex maxillofacial trauma. Radiographic assessment formed a critical component of the diagnostic protocol. **Orthopantomograms (OPG)** were routinely used as an initial imaging modality to evaluate mandibular fractures, dentoalveolar injuries, and dental status. For detailed visualization of fracture patterns, displacement, and spatial relationships, **cone-beam computed tomography (CBCT)** was employed, offering high-resolution images with reduced radiation exposure compared to conventional CT. In selected cases involving panfacial trauma or complex midfacial fractures, **three-dimensional (3D) imaging and reconstruction** were utilized to facilitate precise surgical planning, plate adaptation, and preoperative simulation. The integration of advanced imaging techniques enabled accurate diagnosis, improved interdisciplinary communication, and enhanced predictability of surgical and rehabilitative outcomes.

Surgical Management Strategies

Surgical management was tailored to the **severity, location, and complexity** of maxillofacial injuries, following established trauma care principles and institutional protocols. **Open reduction and internal fixation (ORIF)** constituted the primary surgical approach for displaced mandibular, maxillary, and midfacial fractures, utilizing titanium plates and screws to achieve stable anatomical reduction and early functional recovery. Whenever feasible, rigid fixation was preferred to allow early mobilization and minimize complications associated with prolonged immobilization.

Intermaxillary fixation (IMF) was employed either as a definitive treatment in selected cases or as an adjunct to ORIF to re-establish proper occlusion during fracture stabilization. **Soft tissue repair**, including meticulous closure of lacerations and reconstruction of avulsed tissues, was performed concurrently to restore facial contours and reduce the risk of scarring and infection. In cases presenting with bone loss, comminution, or delayed healing, **bone grafting procedures** using autogenous or alloplastic grafts were undertaken to restore structural continuity. Surgical interventions were frequently **staged**, particularly in polytrauma or panfacial injury cases, allowing initial stabilization followed by definitive reconstruction once patient condition permitted. This staged and individualized surgical strategy contributed to optimal functional and aesthetic outcomes while minimizing perioperative risks.

Table 1: Distribution of Injuries and Interdisciplinary Interventions

Type of Injury	Number of Cases	Specialties Involved
Mandibular fractures	12	OMFS, Orthodontics
Midface fractures	9	OMFS, Prosthodontics
Dentoalveolar trauma	7	OMFS, Prosthodontics
Panfacial trauma	6	OMFS, Orthodontics, Prosthodontics

Prosthodontic and Orthodontic Rehabilitation

Following surgical stabilization, patients underwent a structured **prosthodontic and orthodontic rehabilitation phase** aimed at restoring oral function, occlusal harmony, and facial aesthetics. **Occlusal correction** was initiated once fracture healing was confirmed clinically and

radiographically, with careful evaluation of intercuspation, vertical dimension, and mandibular movements. Minor occlusal discrepancies were managed through selective grinding, while more complex malocclusions required coordinated orthodontic intervention.

Orthodontic treatment was employed to realign displaced teeth, correct post-traumatic malocclusion, and re-establish arch integrity using fixed appliances or temporary anchorage systems when indicated. In patients with tooth loss or extensive dentoalveolar damage, **prosthodontic rehabilitation** involved the provision of fixed dental prostheses, removable partial dentures, or interim prosthetic solutions to restore mastication, phonetics, and facial support. Treatment planning was individualized based on patient age, extent of injury, periodontal status, and socioeconomic considerations. The close collaboration between orthodontists and prosthodontists ensured a phased and integrated approach, resulting in improved functional outcomes, enhanced aesthetic satisfaction, and overall improvement in quality of life for trauma patients.

Postoperative Care and Follow-Up

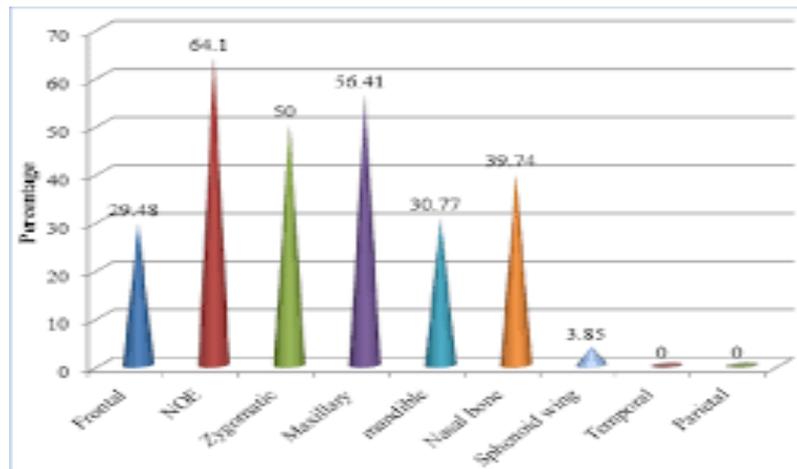
Postoperative care was guided by standardized institutional protocols to ensure optimal recovery and early identification of complications. Immediately following surgery, patients were closely monitored for airway stability, pain control, infection, and neurosensory disturbances. A combination of antibiotic therapy, analgesics, anti-inflammatory medications, and appropriate nutritional support was prescribed based on the extent of injury and surgical intervention. Detailed oral hygiene instructions and wound care guidelines were provided to minimize the risk of postoperative infection and promote tissue healing. All patients were enrolled in a structured **follow-up program for a minimum duration of six months**, with scheduled clinical and radiographic evaluations at regular intervals. Follow-up assessments focused on **wound healing**, stability of fixation hardware, and **occlusal stability**, ensuring proper alignment and functional bite restoration.

Facial symmetry and soft tissue contour were evaluated through clinical examination and photographic documentation. Additionally, patients were monitored for potential complications such as infection, malunion or non-union of fractures, hardware failure, sensory deficits, and temporomandibular joint dysfunction. This systematic follow-up approach facilitated timely intervention when required and contributed to favorable long-term functional and aesthetic outcomes.

Outcome Measures

Clinical outcomes were evaluated using **clearly defined primary and secondary measures** to comprehensively assess the effectiveness of interdisciplinary management. **Primary outcome measures** focused on **functional recovery**, particularly restoration of mastication and speech, which were assessed through clinical examination, occlusal analysis, and patient-reported functional ability during follow-up visits. **Aesthetic improvement** was evaluated based on facial symmetry, soft tissue contour, and dental alignment, using standardized clinical photographs and clinician assessments. **Complication rates**, including postoperative infection, malocclusion, hardware-related issues, delayed union, neurosensory disturbances, and temporomandibular joint dysfunction, were systematically recorded throughout the follow-up period.

Secondary outcome measures centered on **patient satisfaction**, which was assessed using structured, validated questionnaires administered at the completion of treatment and during follow-up. These questionnaires evaluated patient perceptions of functional improvement, facial appearance, comfort, and overall treatment experience. Satisfaction scores provided insight into the psychosocial impact of interdisciplinary care and complemented objective clinical findings. The combined use of clinical indicators and patient-reported outcomes allowed for a holistic evaluation of treatment success and reinforced the value of interdisciplinary management in complex maxillofacial trauma cases.



Challenges and Lessons Learned

The management of complex maxillofacial trauma in a tertiary care setting presented several **clinical and systemic challenges** that influenced treatment delivery and outcomes. A major challenge was **delayed patient presentation**, often due to initial management at peripheral healthcare facilities, lack of trauma awareness, or socioeconomic barriers, which complicated fracture reduction and increased the risk of infection and malunion. **Financial constraints** further limited timely access to advanced imaging, surgical hardware, and prolonged rehabilitative care, particularly for patients from low-income backgrounds. Additionally, **limited patient compliance** with follow-up visits, oral hygiene protocols, and long-term orthodontic or prosthodontic treatment posed obstacles to achieving optimal functional and aesthetic results.

Despite these challenges, several important lessons were identified. **Early involvement of an interdisciplinary team** at the initial assessment stage proved crucial in streamlining treatment planning, prioritizing interventions, and minimizing unnecessary delays or redundant procedures. Coordinated decision-making improved patient counseling, enhanced adherence to treatment plans, and optimized resource utilization. The findings underscore the importance of establishing structured interdisciplinary protocols, improving patient education, and integrating social support mechanisms to overcome barriers to care. These lessons highlight that timely, collaborative management not only mitigates systemic limitations but also significantly improves overall patient outcomes in complex maxillofacial trauma.

Epidemiological Profile of Maxillofacial Trauma

The epidemiological analysis of cases included in this series revealed distinct demographic and etiological patterns consistent with the regional context of Pakistan. The majority of patients were **young adults**, predominantly within the **second and third decades of life**, reflecting higher exposure to risk-related activities such as commuting, occupational labor, and outdoor mobility. A marked **male predominance** was observed, which can be attributed to greater involvement of men in road travel, industrial work, and interpersonal conflict within the local sociocultural setting. Most patients belonged to **lower- to middle-income occupational groups**, including manual laborers, transport workers, and students, highlighting the association between socioeconomic factors and trauma risk. In terms of etiology, **road traffic accidents (RTAs)** emerged as the leading cause of maxillofacial trauma, frequently involving motorcycle-related incidents and inadequate use of protective equipment such as helmets. **Falls**, particularly from heights at construction sites or domestic settings, constituted the second most common cause, followed by **interpersonal violence**, often associated with blunt force injuries. **Sports-related injuries** accounted for a smaller proportion of cases but were more prevalent among younger patients. These findings underscore the need for improved road safety measures, public awareness campaigns, and occupational safety regulations in Pakistan, as well as the importance of preventive strategies tailored to high-risk demographic groups.

Timing of Intervention and Its Impact on Outcomes

The timing of surgical intervention played a critical role in determining clinical outcomes in patients with complex maxillofacial trauma. **Early intervention**, typically within the first few days following injury, was associated with improved fracture reduction, enhanced anatomical alignment, and more predictable healing outcomes. Patients who received timely surgical management demonstrated lower rates of postoperative infection, better occlusal stability, and reduced incidence of malunion or non-union. Early restoration of skeletal continuity also facilitated more efficient soft tissue healing and minimized secondary deformities, thereby decreasing the need for extensive corrective procedures during the rehabilitation phase. In contrast, **delayed intervention**, often resulting from late presentation, referral delays, or socioeconomic constraints, was linked to increased surgical complexity and suboptimal outcomes. Delayed cases showed higher risks of infection, fibrosis, and difficulty in achieving accurate fracture reduction due to early callus formation or soft tissue contracture. These patients more frequently required **secondary corrective procedures**, including occlusal adjustments, revision fixation, or bone grafting, to restore function and aesthetics. The findings emphasize that prompt interdisciplinary assessment and early definitive management are essential to optimize fracture healing, maintain occlusal integrity, and reduce the overall treatment burden in complex maxillofacial trauma.

Role of Emergency Care and Initial Stabilization

Effective **emergency care and initial stabilization** are fundamental determinants of successful outcomes in complex maxillofacial trauma and directly influence the effectiveness of subsequent interdisciplinary management. Upon presentation to the emergency department, patients were managed according to standardized trauma protocols, prioritizing **airway maintenance, breathing, and circulation (ABC principles)**. Airway management was particularly critical in maxillofacial injuries due to the risk of obstruction from facial fractures, soft tissue edema, hemorrhage, or displaced dental structures. Timely airway securing, including endotracheal intubation or surgical airway when indicated, was essential to prevent hypoxia and secondary complications.

Hemorrhage control was another key component of initial stabilization, achieved through local pressure, suturing of soft tissue lacerations, and stabilization of fractured segments to reduce ongoing blood loss. Early administration of analgesia and infection prophylaxis further contributed to patient stabilization and comfort. Equally important was the establishment of **early referral pathways** to oral and maxillofacial surgery and allied dental specialties once the patient's general condition was stabilized. Prompt interdisciplinary involvement at this stage facilitated accurate diagnosis, early treatment planning, and prioritization of surgical interventions. This integrated emergency-to-definitive-care continuum significantly improved functional and aesthetic outcomes, reduced complication rates, and optimized the overall efficiency of trauma management.

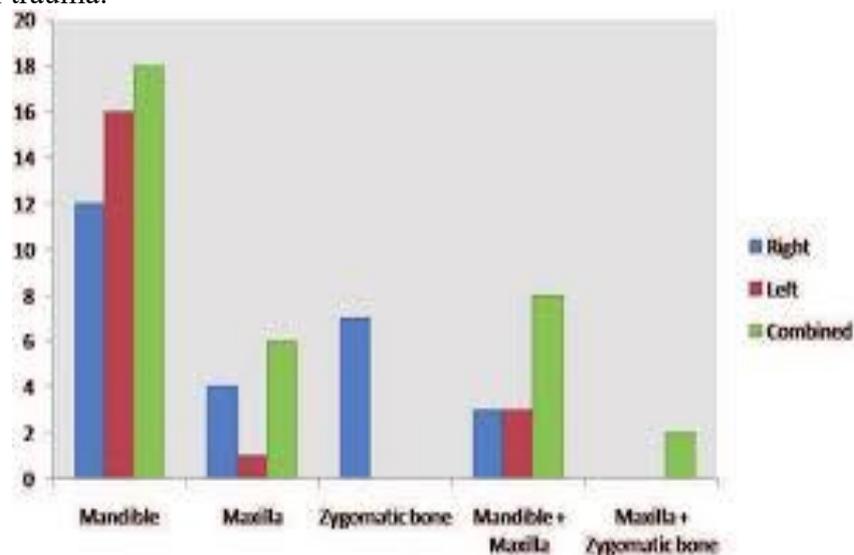
Neurosensory and Functional Sequelae

Neurosensory disturbances were a notable clinical consideration in patients with complex maxillofacial trauma, particularly in cases involving mandibular and midfacial fractures. **Injury to sensory nerves**, most commonly the **inferior alveolar nerve** and **infraorbital nerve**, was observed either as a direct consequence of trauma or secondary to surgical intervention. Patients presented with varying degrees of paresthesia, hypoesthesia, or anesthesia affecting the lower lip, chin, cheek, or upper lip. Serial neurosensory evaluations during follow-up demonstrated that **most sensory deficits were transient**, with gradual improvement over time, especially in patients who underwent early fracture reduction and nerve decompression when indicated. Functional outcomes were assessed through evaluation of **mandibular mobility**, range of motion, and **temporomandibular joint (TMJ) function**. Temporary limitation in mouth opening and TMJ discomfort were common in the early postoperative period, particularly among patients requiring prolonged intermaxillary fixation. However, with early physiotherapy, occlusal stabilization, and adherence to rehabilitation protocols, the majority of patients achieved satisfactory mandibular function and pain-free TMJ movements within the follow-up period. Persistent functional impairment or long-term neurosensory deficits were infrequent and were more commonly associated with delayed

intervention or severe comminution. These findings underscore the importance of early interdisciplinary management, meticulous surgical technique, and structured postoperative rehabilitation in minimizing neurosensory and functional sequelae.

Comparison with Single-Discipline Management Models

When compared with conventional **single-discipline management models**, the interdisciplinary approach demonstrated clear advantages in the management of complex maxillofacial trauma. Single-specialty care, typically led solely by oral and maxillofacial surgeons, often focuses primarily on fracture stabilization and immediate anatomical repair. While effective for isolated injuries, this approach may inadequately address associated occlusal discrepancies, dental rehabilitation needs, aesthetic concerns, and long-term functional outcomes. Literature reports indicate that patients managed under single-discipline models experience **higher rates of postoperative malocclusion, secondary corrective procedures, and prolonged rehabilitation periods**, particularly in cases involving dentoalveolar and panfacial injuries. In contrast, **interdisciplinary management** integrates surgical, orthodontic, prosthodontic, and rehabilitative expertise from the outset, enabling comprehensive treatment planning and staged care. This collaborative approach has been associated with **lower complication rates**, improved occlusal stability, faster functional recovery, and enhanced facial aesthetics. Additionally, studies have consistently reported **higher patient satisfaction levels** in interdisciplinary care models, as patients benefit from coordinated communication, realistic treatment expectations, and holistic rehabilitation. The findings from this case series align with existing evidence, reinforcing that interdisciplinary management offers a superior framework for addressing the complex clinical, functional, and psychosocial dimensions of maxillofacial trauma.



Summary

This case series demonstrates that interdisciplinary management significantly enhances clinical outcomes in complex maxillofacial trauma. Coordinated care results in superior functional rehabilitation, improved facial aesthetics, and reduced complication rates. The findings support the adoption of structured interdisciplinary protocols in tertiary care dental hospitals, particularly in resource-limited settings like Pakistan, to improve patient outcomes and quality of life.

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