

Awareness and Knowledge Among Dental Practitioners in Pakistan Regarding Management of Gunshot and Ballistic Injuries to Face: A Cross-Sectional Study

Azka Fatima¹, Muskan Sahetiya², Hira Karim³, Fleha Haseeb⁴, Muhammad Abdullah⁵, Muhammad Farrukh⁶

¹ BDS, Liaquat College of Medicine and Dentistry, Karachi, Pakistan

² BDS, Bibi Aseefa Dental College, Larkana, Pakistan

³ BDS, Bhattai Dental and Medical College, Mirpurkhas, Pakistan

⁴ BDS, Islamic International Dental College, Islamabad, Pakistan

⁵ BDS, de'Montmorency College of Dentistry, Lahore, Pakistan

⁶ BDS, Margalla Institute of Health Sciences, Rawalpindi, Pakistan

*Corresponding author: Azka Fatima, azkafatima1602@gmail.com

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ABSTRACT

Background: Facial gunshot and ballistic injuries are complex maxillofacial emergencies that may compromise the airway, circulation, oral function, facial aesthetics, and psychosocial well-being. Dental professionals may contribute to early recognition, stabilization, referral, and multidisciplinary care; however, their preparedness for such injuries in Pakistan remains insufficiently documented. **Objective:** This study assessed self-reported awareness, knowledge, confidence, prior exposure, perceived barriers, and training needs regarding the management of facial gunshot and ballistic injuries among dental professionals in Pakistan. **Methods:** A multicenter cross-sectional survey was conducted from November 2025 to January 2026 using a self-administered online questionnaire. General dental practitioners, house officers, postgraduate trainees, and oral and maxillofacial surgeons practicing in Pakistan were recruited through convenience sampling. Descriptive statistics were calculated using IBM SPSS Statistics version 27. **Results:** A total of 307 participants completed the survey. Most respondents identified airway, breathing, and circulation assessment as the first trauma priority (96.7%) and computed tomography as the gold-standard imaging modality (75.6%). Prior exposure to facial ballistic trauma was reported by 58.3%, but only 27.4% had received formal training. High confidence in clinical decision-making was reported by 47.5%, while 21.5% reported low confidence. The most common barriers were lack of guidance (43.4%) and limited resources (36.2%). Workshop interest was reported by 97.4% of participants. **Conclusion:** Dental professionals demonstrated basic theoretical awareness but important gaps in formal training, confidence, guideline awareness, and implementation support. Structured training, workshops, and curriculum integration are needed to improve preparedness for facial ballistic trauma management. **Keywords:** ballistic injuries, dental practitioners, facial trauma, gunshot wounds, maxillofacial trauma, Pakistan, trauma preparedness.

INTRODUCTION

Maxillofacial gunshot and ballistic injuries represent a severe and complex form of facial trauma because the airway, major blood vessels, craniofacial skeleton, oral cavity, dentition, nerves, and soft tissues are concentrated within a limited anatomical region. These injuries may rapidly become life-threatening due to airway obstruction, uncontrolled hemorrhage, aspiration of blood or debris, neurological compromise, and extensive hard- and soft-tissue destruction. Survivors may also experience long-term impairment in speech, mastication, swallowing, facial symmetry, vision, oral function, and

psychosocial well-being, particularly when injuries result in tissue loss, comminuted fractures, contamination, retained projectiles, or disfigurement (1,2).

Initial management of facial ballistic trauma follows established trauma-care principles, with immediate prioritization of airway, breathing, and circulation before definitive maxillofacial assessment. Airway compromise may occur due to bleeding, edema, soft-tissue collapse, displaced bone fragments, fractured teeth, secretions, or foreign material, making early recognition and stabilization essential. Once the patient is stabilized, computed tomography is widely used for evaluating the trajectory of injury, skeletal disruption, soft-tissue involvement, retained fragments, and associated craniofacial damage. Because these injuries often involve multiple anatomical and functional systems, effective management commonly requires coordination among oral and maxillofacial surgeons, emergency physicians, anesthesiologists, otolaryngologists, plastic and reconstructive surgeons, neurosurgeons, radiologists, rehabilitation professionals, and mental-health specialists (1,3,4).

Dental professionals may contribute to the early recognition, initial stabilization, referral, and multidisciplinary management of facial ballistic injuries, particularly in settings where general dentists, house officers, postgraduate trainees, and oral and maxillofacial surgery teams encounter trauma patients in emergency or referral pathways. However, dental education and clinical exposure often emphasize routine maxillofacial trauma such as fractures related to road traffic accidents, falls, or interpersonal violence, while firearm-related facial injuries receive comparatively limited attention. This gap is important because ballistic injuries differ from conventional blunt or low-energy trauma in their patterns of tissue cavitation, contamination, comminution, vascular compromise, infection risk, reconstructive complexity, and long-term functional consequences (1,5).

Clinical decision-making in facial ballistic trauma may be further complicated by uncertainty regarding wound debridement, retained projectile management, timing of reconstruction, infection control, reconstruction options, and follow-up for complications such as malocclusion, chronic infection, fistula formation, impaired mastication, speech difficulty, facial asymmetry, and osteomyelitis. Current literature also emphasizes that management practices may vary according to injury severity, local resources, surgical expertise, and institutional trauma protocols, which can create additional uncertainty for practitioners with limited exposure to such cases (6,7).

Beyond anatomical reconstruction, firearm-related facial injuries may produce major psychological and social consequences, especially when survivors experience facial deformity, functional disability, pain, altered self-image, anxiety, depression, social withdrawal, or reduced quality of life. Therefore, awareness among dental professionals should not be limited to surgical principles alone but should also include timely referral, rehabilitation planning, and recognition of psychosocial needs as part of comprehensive trauma care (8).

In Pakistan, firearm-related facial injuries may present across emergency departments, dental teaching hospitals, oral and maxillofacial units, and referral centers. Nevertheless, there is limited local evidence regarding how prepared dental professionals are to identify, triage, and participate in the early management of these injuries. The available gap is not only a surgical knowledge gap but also an educational and systems-level gap involving training exposure, confidence in decision-making, familiarity with guidelines, perceived barriers, and willingness to participate in structured trauma education. Understanding these factors is important for curriculum development, continuing professional education, workshop planning, and strengthening multidisciplinary trauma preparedness in dental and maxillofacial practice (1,9).

This study aimed to assess self-reported awareness, knowledge, confidence, prior clinical exposure, perceived barriers, and training needs regarding the management of facial gunshot and ballistic injuries among dental practitioners, house officers, postgraduate trainees, and oral and maxillofacial surgeons in Pakistan.

MATERIAL AND METHODS

This cross-sectional, multicenter survey was conducted among dental professionals in Pakistan from November 2025 to January 2026 to assess self-reported awareness and knowledge regarding the management of facial gunshot and ballistic injuries. The target population included general dental practitioners, house officers, postgraduate trainees, and oral and maxillofacial surgeons practicing in Pakistan. Undergraduate dental students were excluded because the study focused on practitioners and trainees who had entered clinical practice or supervised clinical training pathways.

Participants were recruited through a non-probability convenience sampling technique using an online self-administered questionnaire developed in Google Forms. The survey link was distributed through WhatsApp, personal professional networks, dental colleagues, institutes, and clinics across Pakistan. Participation was voluntary, and the first page of the questionnaire included study information and an electronic consent statement. Only participants who provided informed consent proceeded to complete the questionnaire.

The sample size was calculated using Cochran's formula at a 95% confidence level and 5% margin of error, yielding a required sample size of 385 participants. A total of 307 dental professionals completed the survey and were included in the final analysis. The questionnaire was developed after reviewing relevant literature on maxillofacial and ballistic injuries and included 21 items covering demographic characteristics, knowledge of ballistic trauma management, awareness of emergency priorities, imaging modalities, surgical management principles, prior clinical exposure, confidence in decision-making, perceived barriers, and attitudes toward training needs (1,10-12).

The questionnaire was organized into three sections. The first section collected demographic and professional information, including age, gender, designation, practice setting, and city. The second section assessed knowledge and awareness regarding ballistic trauma management, including recognition of trauma-care priorities, appropriate imaging, retained projectile considerations, tissue involvement, reconstructive options, and management-related complications. The third section assessed prior exposure to facial ballistic trauma, confidence in clinical decision-making, perceived barriers to effective management, awareness of guidelines, previous formal training, interest in specialized workshops, and attitudes toward mandatory training and psychological counseling.

For this study, knowledge and awareness were operationalized through item-level responses related to emergency assessment, imaging selection, clinical priorities, surgical principles, and complication recognition. Confidence was measured using self-reported Likert-scale responses regarding clinical decision-making. Formal training was defined as any reported prior structured educational exposure, course, workshop, or training related to gunshot or ballistic facial injury management. Prior clinical exposure was defined as having encountered at least one case of facial ballistic trauma in practice or training. Perceived barriers were assessed using predefined response categories, including lack of guidance, limited resources, conflicting senior opinions, time constraints, and limited access to literature.

Data were exported from Google Forms and analyzed using IBM SPSS Statistics version 27. Descriptive statistics were used to summarize the data. Categorical variables were reported as frequencies and percentages. Continuous demographic variables, where available, were summarized using appropriate descriptive measures. Results were presented in tabular and graphical form according to the nature of the variable. Responses were analyzed collectively to maintain participant confidentiality. No personal identifiers were reported in the analysis.

The study protocol was approved by the Research Ethics and Review Board of PRIDE Institute under reference number PRIDE/ERB/2025/051. Electronic informed consent was obtained from all participants

before data collection. Participation was voluntary, responses were kept confidential, and data were analyzed in aggregate form.

RESULTS

A total of 307 dental professionals participated in the study. The demographic profile of the participants is presented in Table 1. Females represented 60.9% of the sample, while males represented 39.1%. By professional designation, dental practitioners formed the largest group, followed by house officers, postgraduate trainees, and oral and maxillofacial surgeons.

Table 1. Demographic Distribution of Participants

Variable	Category	n	%
Gender	Male	120	39.1
	Female	187	60.9
Designation	Dental practitioner	128	41.7
	House officer	109	35.5
	Postgraduate trainee	51	16.6
	Oral and maxillofacial surgeon	19	6.2

The study sample was predominantly female, with 187 female participants compared with 120 male participants. Dental practitioners constituted the largest professional subgroup, accounting for 128 participants, while oral and maxillofacial surgeons represented the smallest subgroup, with 19 participants.

Table 2. Knowledge and Awareness Regarding Facial Ballistic Trauma Management

Knowledge or Awareness Item	Response Category	n	%
Gold-standard imaging modality for facial ballistic trauma	CT scan	232	75.6
First priority in trauma management	Airway, breathing, and circulation assessment	297	96.7
Retained bullet fragment management	Remove only if causing functional problems or complications	164	53.4
Common tissue involvement in near-range gunshot injuries	Both hard and soft tissues with extensive destruction	195	63.5
Reconstructive option for severe soft-tissue loss	Free tissue transfer/microsurgical free flap	193	62.9

Most participants correctly identified airway, breathing, and circulation assessment as the first management priority, with 297 respondents selecting this option. Computed tomography was identified as the gold-standard imaging modality by 232 participants. More than half of the respondents selected clinically selective removal of retained bullet fragments, recognized extensive hard- and soft-tissue destruction in near-range gunshot injuries, and identified free tissue transfer as the preferred reconstructive option for severe soft-tissue loss.

Table 3. Prior Exposure and Initial Response to Facial Ballistic Trauma

Variable	Category	n	%
Prior exposure to facial ballistic trauma	Yes	179	58.3
	No	128	41.7
Immediate action after encountering such cases	Patient stabilization	186	60.6
	Observation	66	21.5
	Referral	34	11.1
	Other or not specified	21	6.8

More than half of the participants reported prior exposure to at least one case of facial ballistic trauma. Patient stabilization was the most frequently reported immediate action, selected by 186 respondents, followed by observation and referral. A smaller proportion of responses fell outside the three explicitly reported categories.

Confidence in clinical decision-making was mixed. The proportions of participants who reported being confident and neutral were equal, with 95 participants in each category. A total of 58 participants reported being not confident, while 8 participants reported being very unconfident. Very confident responses were reported by 51 participants.

Table 4. Confidence in Clinical Decision-Making

Confidence Level	n	%
Very confident	51	16.6
Confident	95	30.9
Neutral	95	30.9
Not confident	58	18.9
Very unconfident	8	2.6

Table 5. Formal Training, Guideline Awareness, and Workshop Interest

Variable	Category	n	%
Formal training in gunshot or ballistic facial injury management	Yes	84	27.4
	No	223	72.6
Awareness of national or international guidelines	Yes	156	50.8
	No	151	49.2
Interest in attending a specialized ballistic trauma workshop	Yes	299	97.4
	No	8	2.6

Only 84 participants reported previous formal training in the management of gunshot or ballistic facial injuries, whereas 223 reported no such training. Awareness of national or international guidelines was almost evenly distributed, with 156 participants reporting awareness and 151 reporting no awareness. Interest in specialized training was high, with 299 participants expressing willingness to attend a workshop on ballistic trauma management.

Table 6. Reported Oral Cavity Complications Following Gunshot Facial Injuries

Complication	n	%
Malocclusion due to tooth or bone loss	159	51.8
Chronic infection	60	19.5
Difficulty in mastication or speech	56	18.2
Orocutaneous fistula	32	10.4

Malocclusion due to tooth or bone loss was the most frequently reported oral cavity complication, identified by 159 participants. Chronic infection and difficulty in mastication or speech were reported by 60 and 56 participants, respectively. Orocutaneous fistula was reported least frequently among the listed complications.

Table 7. Perceived Barriers to Effective Management of Facial Ballistic Trauma

Barrier	n	%
Lack of guidance	133	43.4
Limited resources	111	36.2
Conflicting senior opinions	30	9.9
Time constraints	19	6.3
Limited access to literature	13	4.3

Table 8. Attitudes Toward Mandatory Training and Psychological Counseling

Variable	Response Category	n	%
Mandatory training for dentists in Pakistan	Strongly agree	151	49.8
	Agree	127	41.9
	Neutral	22	7.3
	Disagree	2	0.7
	Strongly disagree	1	0.3
Psychological counseling as equally important as surgical treatment	Strongly agree	157	51.8
	Agree	127	41.9
	Neutral	19	6.3

Lack of guidance was the most commonly reported barrier, identified by 133 participants. Limited resources were the second most frequent barrier, reported by 111 participants. Conflicting senior opinions, time constraints, and limited access to literature were less frequently reported but remained relevant barriers to effective management.

Most participants supported mandatory training for dentists in Pakistan, with 151 strongly agreeing and 127 agreeing. Support for psychological counseling was also high, with 157 participants strongly agreeing and 127 agreeing that counseling is equally important as surgical treatment in rehabilitation after gunshot facial injuries. Neutral responses were limited for both items, and disagreement with mandatory training was uncommon.

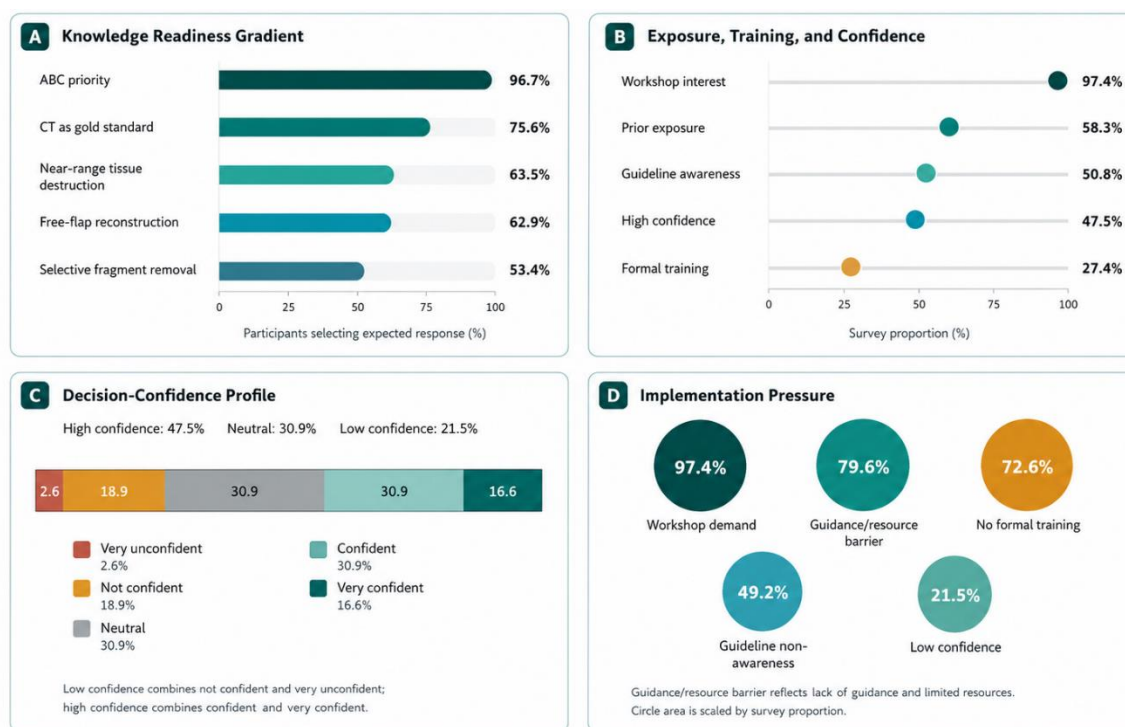


Figure 1 The panelled figure demonstrates a clear readiness imbalance among dental professionals, with strong recognition of emergency priorities but persistent implementation gaps. Knowledge indicators were highest for airway, breathing, and circulation assessment at 96.7% and CT recognition at 75.6%, while more specialized management domains showed lower proportions, including selective retained-fragment management at 53.4%, recognition of extensive hard- and soft-tissue destruction at 63.5%, and free-flap reconstruction selection at 62.9%. Although 58.3% of participants reported prior exposure to facial ballistic trauma, only 27.4% had formal training, and high confidence in clinical decision-making was reported by 47.5%. Implementation pressure remained substantial, with 72.6% lacking formal training, 49.2% lacking guideline awareness, and 79.6% reporting either lack of guidance or limited resources as major barriers. Workshop interest was very high at 97.4%, indicating strong perceived need for structured training and curriculum-level preparedness.

DISCUSSION

This cross-sectional survey assessed self-reported awareness, knowledge, confidence, clinical exposure, perceived barriers, and training needs regarding the management of facial gunshot and ballistic injuries among dental professionals in Pakistan. The findings indicate that participants had strong awareness of selected emergency principles, particularly the prioritization of airway, breathing, and circulation, which was identified by 96.7% of respondents. This is encouraging because early airway recognition and stabilization are central to the management of maxillofacial ballistic trauma, where bleeding, edema, displaced tissues, fractured teeth, and foreign material can rapidly compromise the airway (1,3,4). Similarly, 75.6% of participants identified computed tomography as the gold-standard imaging modality, supporting the presence of basic theoretical awareness regarding diagnostic evaluation in facial ballistic trauma (1,9,12).

Despite these favorable knowledge indicators, the study identified a clear gap between theoretical awareness and structured preparedness. Only 27.4% of participants reported formal training in the management of gunshot or ballistic facial injuries, while 72.6% had not received such training. This finding is important because ballistic facial trauma differs substantially from routine maxillofacial trauma in terms of tissue cavitation, contamination, comminution, vascular compromise, retained

fragments, reconstructive complexity, and long-term functional outcomes (1,6,7). Therefore, item-level awareness of selected emergency priorities cannot be interpreted as evidence of clinical competence. Rather, the findings suggest that dental professionals may recognize key concepts but may not have received adequate practical training to apply them confidently in emergency or multidisciplinary settings.

Confidence in decision-making was also mixed. Although 47.5% of participants reported being confident or very confident, 30.9% remained neutral and 21.5% reported low confidence. This pattern is consistent with the observed training gap and suggests that prior exposure alone may not be sufficient to develop readiness for managing complex ballistic injuries. More than half of the participants reported prior exposure to facial ballistic trauma, but formal training remained uncommon. This imbalance indicates that some professionals may encounter such cases without structured educational preparation, standardized protocols, or simulation-based training. Similar concerns have been raised in trauma education literature, where limited undergraduate and postgraduate exposure may contribute to uncertainty in early assessment, referral decisions, and multidisciplinary coordination (5,9).

The study also highlights important implementation barriers. Lack of guidance was the most frequently reported barrier, followed by limited resources. Together, these barriers suggest that improving preparedness requires more than individual knowledge enhancement; it also requires institutional protocols, clinical pathways, continuing professional development, and resource-sensitive trauma training. In settings where specialized maxillofacial trauma services may not be immediately available, dental professionals should at least be equipped to recognize life-threatening features, initiate basic stabilization, avoid harmful delays, and refer promptly to appropriate surgical and emergency-care teams. Standardized guidance may also reduce uncertainty related to retained projectile management, debridement, infection control, reconstruction timing, and follow-up care (6,7,10,12).

The findings related to complications further support the need for structured training. Malocclusion due to tooth or bone loss was the most frequently reported oral cavity complication, followed by chronic infection, difficulty in mastication or speech, and orocutaneous fistula. These complications reflect the functional burden of facial ballistic trauma and reinforce the need for long-term multidisciplinary rehabilitation. Management should not be limited to emergency stabilization or surgical repair alone; it should also include restoration of occlusion, oral function, speech, mastication, facial symmetry, infection control, and psychosocial recovery. The strong agreement among participants regarding the importance of psychological counseling also indicates awareness that firearm-related facial injuries can have substantial emotional and social consequences, especially when disfigurement, disability, anxiety, depression, or social withdrawal occur (8).

A major strength of this study is that it addresses an underexplored area of dental trauma preparedness in Pakistan and includes multiple professional categories, including dental practitioners, house officers, postgraduate trainees, and oral and maxillofacial surgeons. The study also provides practical educational implications, as 97.4% of respondents expressed interest in specialized workshops and most participants supported mandatory training. These findings suggest that dental professionals may be receptive to structured educational interventions. Curriculum-level integration of facial ballistic trauma management, short courses, simulation-based emergency drills, multidisciplinary workshops, and guideline-based continuing education may help address the observed gaps.

However, the findings should be interpreted in light of several limitations. The study used a convenience sampling technique and online questionnaire distribution, which may introduce selection bias and limit generalizability. Participants with greater interest in trauma care may have been more likely to respond. The questionnaire was self-developed, and formal validation, reliability testing, or objective competence assessment was not reported. Therefore, the results reflect self-reported awareness and knowledge rather than directly observed clinical ability. The study also relied mainly on descriptive statistics and did not assess associations between designation, prior exposure, formal training, guideline awareness, and

confidence. Future studies using validated instruments, larger probability-based samples, regional representation, and inferential analysis would help identify predictors of preparedness and training need more precisely.

CONCLUSION

Dental professionals in Pakistan demonstrated basic self-reported awareness of selected principles in the management of facial gunshot and ballistic injuries, particularly emergency prioritization and the role of computed tomography in assessment. However, substantial gaps were identified in formal training, confidence in clinical decision-making, guideline awareness, and access to practical guidance and resources. Although more than half of the participants had encountered facial ballistic trauma, most had not received structured training, indicating a gap between clinical exposure and preparedness. The strong support for mandatory training and the high level of interest in specialized workshops highlight the need to integrate ballistic trauma management into undergraduate, postgraduate, and continuing dental education. Structured protocols, simulation-based training, multidisciplinary workshops, and resource-appropriate clinical guidance may improve early recognition, referral, stabilization, and comprehensive rehabilitation of patients with facial gunshot and ballistic injuries.

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