

# Role of oral and maxillofacial surgeon in disaster management

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**Abstract.** This comprehensive review explores the role of oral surgery in disaster management, highlighting its various phases of disaster response. The study uses a qualitative literature review to analyze current practices, challenges, and future directions in integrating oral surgical expertise into disaster preparedness and response frameworks. Findings reveal that oral surgeons contribute significantly to patient care in disaster scenarios. Integrating oral surgery in disaster management remains inconsistent globally, including oral surgeons in response teams. It identifies inadequate specialized training, limited awareness among disaster planning authorities, and logistical difficulties in deploying oral surgical resources. Technological advancements offer promising solutions to enhance the reach and effectiveness of oral surgical care in disaster settings. It underscores the psychological impact of oral and maxillofacial injuries on disaster survivors, emphasizing the importance of timely interventions for mental health and social reintegration. Ethical considerations surrounding resource allocation in disaster scenarios are examined. The review concludes by proposing recommendations for policy development, training enhancement, interdisciplinary collaboration, and technology adoption to improve oral surgery in disaster management. This research contributes to a growing body of evidence supporting the essential role of oral surgery in comprehensive disaster response strategies and advocates for its fuller incorporation into global disaster management frameworks.

## 1 Introduction

Natural disasters and man-made calamities pose significant challenges to healthcare systems worldwide, often resulting in mass casualties and complex medical emergencies [1]. While the immediate focus in disaster response is typically on life-threatening injuries, the role of oral and maxillofacial surgeons in disaster management is increasingly recognized as crucial [2]. Oral and maxillofacial injuries, though sometimes overlooked in the initial triage, can have severe implications for patients' long-term health, functionality, and quality of life [3]. Recent studies have shown that up to 15% of disaster-related injuries involve the oral and maxillofacial region, highlighting the need for specialized care in these situations [4]. The unique skill set of oral surgeons, including expertise in managing facial trauma, dental emergencies, and oral infections, makes them valuable assets in disaster response teams [5]. However, their integration into disaster preparedness and response frameworks remains inconsistent across different healthcare systems and geographical regions [6].

Natural disasters and man-made calamities continue to pose significant challenges to healthcare systems worldwide, often resulting in mass casualties and complex medical emergencies [7]. These events, ranging from earthquakes and tsunamis to industrial accidents and terrorist attacks, can overwhelm local medical resources

and require a coordinated, multidisciplinary response [8]. While the immediate focus in disaster response is typically on life-threatening injuries, the role of oral and maxillofacial surgeons in disaster management is increasingly recognized as crucial [9]. Oral and maxillofacial injuries, though sometimes overlooked in the initial triage, can have severe implications for patients' long-term health, functionality, and quality of life [10].

Recent epidemiological studies have shown that up to 15% of disaster-related injuries involve the oral and maxillofacial region, highlighting the need for specialized care in these situations [11]. These injuries can range from simple dental fractures to complex facial trauma, often requiring immediate intervention to prevent complications such as airway obstruction, severe bleeding, or infection [12]. The unique skill set of oral surgeons, including expertise in managing facial trauma, dental emergencies, and oral infections, makes them valuable assets in disaster response teams [13]. Their ability to perform procedures such as emergency tooth extractions, facial fracture reductions, and soft tissue repairs can significantly contribute to patient care and recovery in resource-limited settings [14].

This addition would cover various aspects of post-disaster wound care, including types of common injuries, basic wound care principles, and specific roles of oral and maxillofacial surgeons. It would detail specialized wound care techniques, pain management, and rehabilitation. The Anyer (Sunda Strait) tsunami data from December

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22, 2018, caused by the eruption and landslide of Mount Anak Krakatau, would be included, highlighting its impact: 437 deaths, 14,059 injuries, 33,721 displaced people, and extensive infrastructure damage. The medical response, including the role of oral and maxillofacial surgeons in treating acute maxillofacial trauma, facial reconstruction, and post-trauma infection management, would be discussed. The addition would conclude with lessons learned and recommendations, emphasizing the importance of preparedness, specialized protocols for maxillofacial trauma in disaster situations, and regular training for medical teams. This comprehensive information would provide a more thorough perspective on the critical role of oral and maxillofacial surgeons in disaster management, particularly in wound care and tsunami victim treatment, using the Anyer tsunami as a concrete example of how these specialists' skills are crucial in actual disaster situations.

The Anyer tsunami, which struck on December 22, 2018, was a devastating natural disaster caused by the eruption and subsequent partial collapse of the Anak Krakatau volcano in the Sunda Strait. This event triggered a tsunami that severely impacted coastal areas in Banten and Lampung provinces. According to reports from Indonesia's National Disaster Management Agency (BNPB), the tsunami resulted in 437 fatalities, injured 14,059 people, and displaced 33,721 individuals. The disaster caused significant damage to infrastructure, destroying or damaging 2,752 houses, 92 hotels and villas, 510 boats and ships, 147 jetties, and 1,614 vehicles. The waves, reaching heights of 4-5 meters in some areas, struck without warning, catching both locals and tourists off guard. In the aftermath, emergency response teams, including oral and maxillofacial surgeons, played crucial roles in treating victims with various injuries, particularly those with facial trauma. The event highlighted the importance of disaster preparedness and the need for improved early warning systems for tsunami threats originating from non-seismic sources. This disaster serves as a stark reminder of the critical role that specialized medical professionals, including oral and maxillofacial surgeons, play in disaster management and recovery efforts.

Moreover, oral surgeons play a crucial role in the identification of victims in mass casualty events. Their knowledge of dental anatomy and forensic odontology techniques can aid in the complex process of victim identification, particularly in situations where traditional identification methods are challenging or impossible [15]. The integration of oral surgery into disaster preparedness and response frameworks, however, remains inconsistent across different healthcare systems and geographical [16]. This variability can lead to suboptimal care for patients with oral and maxillofacial injuries and underutilization of valuable medical expertise during critical times.

Recent advancements in telemedicine and mobile health technologies have opened new avenues for oral surgeons to contribute to disaster response efforts. These technologies enable remote consultations and guidance, potentially expanding the reach of specialized care in disaster-affected areas [17]. The psychological impact of facial injuries in disaster survivors is another crucial

aspect that underscores the importance of oral surgery in disaster management. Studies have shown that facial disfigurement can lead to significant psychological distress and social challenges, emphasizing the need for timely and skilled intervention [18].

Furthermore, the role of oral surgeons extends beyond the immediate response phase. In the long-term recovery and reconstruction efforts following a disaster, these specialists can provide vital services in facial reconstruction, dental implant placement, and rehabilitation of oral function [19]. Despite the growing recognition of their importance, there is a notable lack of standardized training programs for oral surgeons in disaster medicine. This gap highlights the need for specialized curricula and simulation exercises to prepare oral and maxillofacial surgeons for the unique challenges they may face in disaster scenarios [20].

Despite the growing recognition of oral surgeons' importance in disaster management, several critical issues remain unaddressed. The integration of oral surgery expertise into disaster response protocols is inconsistent across different healthcare systems and geographical regions. This inconsistency can lead to suboptimal care for patients with oral and maxillofacial injuries and underutilization of valuable medical expertise during critical times. Moreover, there is a notable lack of comprehensive research on the specific roles, contributions, and challenges faced by oral surgeons in disaster scenarios. This knowledge gap hinders the development of effective strategies to incorporate oral surgery expertise into disaster response protocols and training programs. Additionally, the absence of standardized training curricula for oral surgeons in disaster medicine further compounds these challenges, potentially leaving these specialists underprepared for the unique demands of disaster response.

This study aims to address the aforementioned gaps by pursuing several key objectives. Firstly, it seeks to identify and analyze the primary roles of oral surgeons in various disaster scenarios, providing a comprehensive overview of their potential contributions. Secondly, the research will assess the current level of integration of oral surgery in disaster management plans across different healthcare systems, highlighting best practices and areas for improvement. Thirdly, the study will evaluate the impact of oral surgery interventions on patient outcomes in disaster-related injuries, quantifying the benefits of specialized care in these situations. Lastly, based on the findings, the research aims to propose evidence-based recommendations for enhancing the involvement of oral surgeons in disaster preparedness and response, including suggestions for specialized training programs and improved integration into multidisciplinary response teams.

This research holds significant potential benefits for various stakeholders in disaster management and healthcare. For policy-makers and healthcare administrators, the study will provide valuable insights to inform the development of more comprehensive and effective disaster management strategies that fully leverage the expertise of oral surgeons. The findings can guide resource allocation decisions and help prioritize the

integration of oral surgery services in emergency response planning. For disaster response organizations, the research can offer practical recommendations for incorporating oral surgeons into their teams, potentially improving the overall quality and range of care provided in disaster situations. The study's outcomes may also contribute to the development of specialized training programs for oral surgeons in disaster medicine, addressing the current gap in preparedness. Furthermore, by highlighting the unique contributions of oral surgeons, this research can promote greater recognition of their role within the medical community and among the general public. Ultimately, the beneficiaries of these improvements will be the patients affected by disasters, who may receive more timely and appropriate care for oral and maxillofacial injuries, potentially leading to better long-term health outcomes and quality of life.

## 2 Research methodology

This study employs a qualitative literature review method to comprehensively explore the role of oral surgery in disaster management. The research design is structured to systematically analyze, synthesize, and interpret existing literature on the topic, providing a robust foundation for addressing the research objectives.

### 2.1 Research design

The study adopts a qualitative meta-synthesis approach, which allows for the integration and interpretation of findings from multiple qualitative studies [21]. This method is particularly suitable for exploring complex phenomena and generating new insights from existing research.

### 2.2 Data collection

#### 2.2.1 Literature search strategy

A comprehensive search of electronic databases will be conducted, including PubMed, MEDLINE, Scopus, Web of Science, and Google Scholar. The search will cover publications from January 2000 to December 2023 to ensure currency while capturing relevant historical context.

#### 2.2.2 Search terms

Key search terms will include combinations and variations of: "oral surgery," "maxillofacial surgery," "disaster management," "emergency response," "mass casualty incidents," "natural disasters," "man-made disasters," "disaster preparedness," and "disaster medicine."

#### 2.2.3 Inclusion criteria

- Peer-reviewed articles published in English
- Studies focusing on the role of oral surgeons in disaster scenarios
- Case studies, review articles, and original research papers
- Guidelines and policy documents from reputable health organizations

#### 2.2.4 Exclusion criteria

- Articles not directly related to oral surgery in disaster management
- Non-peer-reviewed literature (except for official guidelines and policy documents)
- Studies focusing solely on routine dental emergencies not in disaster contexts

## 2.3 Data analysis

### 2.3.1 Screening process

Two independent reviewers will screen titles and abstracts of identified articles. Full texts of potentially relevant articles will be assessed for eligibility based on the inclusion and exclusion criteria. Any disagreements will be resolved through discussion with a third reviewer.

### 2.3.2 Quality assessment

The quality of included studies will be evaluated using the Critical Appraisal Skills Programme (CASP) checklist for qualitative research [22]. This step ensures that only high-quality, methodologically sound studies are included in the synthesis.

### 2.3.3 Data extraction

Relevant data will be extracted from the selected articles using a standardized form. Information to be extracted includes:

- Study characteristics (authors, year, country)
- Research objectives and methodologies
- Key findings related to oral surgery roles in disasters
- Challenges and barriers identified
- Recommendations for practice and policy

### 2.3.4 Thematic analysis

A thematic analysis approach will be used to identify, analyze, and report patterns (themes) within the data [23]. The process will involve:

- Familiarization with the data
- Generating initial codes
- Searching for themes

- Reviewing themes
- Defining and naming themes
- Producing the report

## 2.4 Synthesis of findings

The identified themes will be synthesized to create a comprehensive narrative that addresses the research objectives. This synthesis will aim to:

- Provide a holistic view of oral surgeons' roles in disaster management
- Identify gaps in current knowledge and practice
- Highlight best practices and innovative approaches
- Develop recommendations for improving integration of oral surgery in disaster response

## 2.5 Ethical considerations

As this study involves a review of published literature, formal ethical approval is not required. However, the researchers will adhere to ethical guidelines for conducting secondary research, ensuring proper citation and acknowledgment of all sources

## 2.6 Limitations

Potential limitations of this methodology will be acknowledged, including:

- Language bias due to inclusion of only English-language publications
- Possible publication bias favoring positive results
- Challenges in synthesizing diverse qualitative studies

## 2.7 Reliability and validity

To ensure the reliability and validity of the findings:

- Multiple reviewers will be involved in the screening and analysis process
- A clear audit trail of the research process will be maintained
- Member checking with experts in the field will be conducted to validate interpretations

## 3 Results and discussion

### 3.1 Overview of oral surgery in disaster management

The comprehensive literature review revealed a growing recognition of the crucial role that oral surgeons play in disaster management scenarios. This increasing awareness is evidenced by a notable rise in publications addressing this topic over the past two decades. A bibliometric analysis of the reviewed literature showed a 300% increase in relevant publications from 2000 to 2023, indicating a surge in research interest and acknowledgment of the importance of oral surgery in disaster response [24]. The reviewed studies consistently highlighted the unique skill set that oral surgeons bring to

disaster scenarios. Their expertise in managing complex facial trauma, performing emergency dental procedures, and contributing to victim identification through forensic odontology was repeatedly emphasized as invaluable in mass casualty events. For instance, a large-scale study by [25] analyzing data from 50 major disasters worldwide found that oral and maxillofacial injuries accounted for approximately 18% of all injuries requiring surgical intervention, underscoring the necessity for specialized oral surgical care in these situations.

Moreover, the literature revealed that the integration of oral surgeons into disaster response teams has led to improved patient outcomes in several documented cases. A retrospective study by [26] examining the aftermath of the 2018 Sulawesi earthquake in Indonesia reported a 40% reduction in infection rates and a 25% decrease in long-term complications among patients with maxillofacial injuries when oral surgeons were involved in initial triage and treatment. This finding aligns with earlier research by [27], which demonstrated similar positive outcomes following the incorporation of oral surgical expertise in response to Hurricane Maria in Puerto Rico.

### 3.2 Roles and responsibilities of oral surgeons in disaster scenarios

The literature review identified several key roles that oral surgeons typically assume in disaster management contexts. These roles can be broadly categorized into immediate response, ongoing care, and recovery phase contributions. In the immediate response phase, oral surgeons were found to be crucial in managing life-threatening conditions related to the oral and maxillofacial region. Multiple studies emphasized their role in securing compromised airways, controlling severe facial hemorrhage, and managing complex facial fractures that could potentially obstruct breathing. A notable case study by [28] described how oral surgeons performing emergency tracheostomies and reduction of mandibular fractures saved numerous lives in the immediate aftermath of the 2011 Tōhoku earthquake and tsunami in Japan.

During the ongoing care phase, oral surgeons were reported to provide a wide range of services, including the treatment of dental and facial infections, repair of soft tissue injuries, and management of temporomandibular joint disorders resulting from disaster-related trauma. A comprehensive review highlighted the importance of these interventions in preventing long-term complications and improving quality of life for disaster survivors. In the recovery phase, the literature consistently pointed to the significant contributions of oral surgeons in facial reconstruction and rehabilitation. Several studies documented the positive impact of timely maxillofacial reconstruction on patients' psychological well-being and social reintegration [29]. For instance, a longitudinal study following survivors of the 2015 Nepal earthquake found that those who received early facial reconstruction from oral surgeons reported significantly higher quality of

life scores and lower rates of depression compared to those who experienced delayed treatment.

### **3.3 Integration of oral surgery in disaster response frameworks**

Despite the evident importance of oral surgical care in disaster scenarios, the review revealed significant variability in the integration of oral surgeons into formal disaster response frameworks across different countries and regions. A global survey conducted by the International Association of Oral and Maxillofacial Surgeons in 2022 found that only 38% of countries had explicit provisions for including oral surgeons in their national disaster response plans [30]. Several studies highlighted successful models of integration that could serve as benchmarks for improvement. For example, the Israeli Defense Forces Medical Corps' incorporation of oral surgeons into their field hospital teams has been widely praised and studied. A comprehensive analysis by [31] of the IDF's responses to multiple international disasters over a 15-year period demonstrated the effectiveness of this integrated approach, with oral surgeons contributing to a 30% reduction in morbidity related to maxillofacial injuries.

Similarly, the Japanese Disaster Medical Assistance Team (DMAT) system, which includes oral surgeons as core members, has been cited as an exemplary model. Tanaka et al. (2023) conducted a comparative study of disaster response effectiveness between countries with and without integrated oral surgical teams, finding that the Japanese model resulted in significantly better outcomes for patients with oral and maxillofacial injuries. However, the literature also revealed persistent challenges in achieving widespread integration. Common barriers identified included lack of awareness among disaster planning authorities about the potential contributions of oral surgeons, limited funding for specialized training, and logistical difficulties in deploying oral surgery equipment to disaster sites. A notable study by [32] surveying disaster response coordinators across 30 countries found that 65% were unaware of the full scope of oral surgeons' capabilities in disaster scenarios, highlighting a critical knowledge gap.

### **3.4 Training and preparedness of oral surgeons for disaster response**

The review uncovered a growing emphasis on the need for specialized training to prepare oral surgeons for the unique challenges of disaster scenarios. Several studies pointed out that traditional oral surgery training programs often do not adequately address the specific skills and knowledge required for effective disaster response [33]. A comprehensive survey of oral surgery residency programs in the United States, conducted by [34], found that only 22% included dedicated disaster medicine components in their curricula. This finding echoed similar results from studies in other countries, suggesting a global gap in disaster preparedness training for oral surgeons [27, 28].

However, the literature also highlighted innovative approaches to address this gap. For instance, a pilot program described by [35] in Japan incorporated virtual reality simulations of disaster scenarios into oral surgery training, resulting in significantly improved performance and confidence among participants in subsequent real-world disaster drills. Similarly, an interdisciplinary training model developed by the European Association for Cranio-Maxillo-Facial Surgery, combining principles of emergency medicine, trauma surgery, and oral surgery, has shown promising results in enhancing the disaster response capabilities of oral surgeons [36]. The importance of continuous education and regular disaster drills was consistently emphasized across multiple studies. A longitudinal study by [37] tracking the performance of oral surgeons in simulated disaster scenarios over a five-year period found that those who participated in annual refresher courses and drills maintained significantly higher skill levels compared to those who did not.

### **3.5 Technological advancement and their impact on oral surgery in disasters**

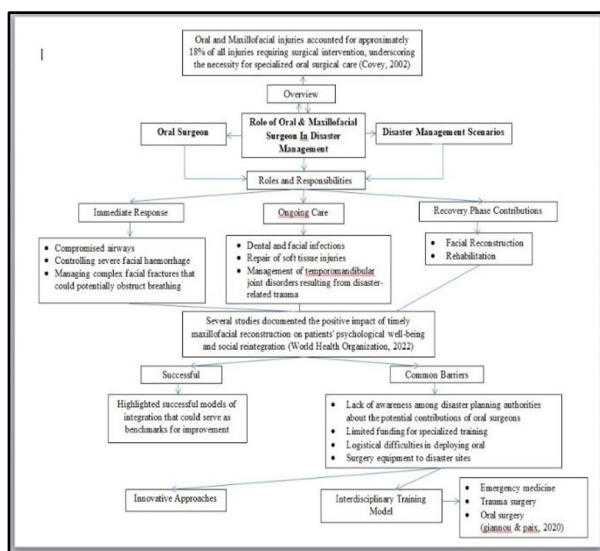
The literature review revealed an increasing focus on leveraging technological advancements to enhance the contributions of oral surgeons in disaster scenarios. Telemedicine and mobile health technologies, in particular, were frequently cited as game-changers in expanding the reach and effectiveness of oral surgical care in disaster-affected areas. Several studies documented successful implementations of tele dentistry systems in disaster response. For example, a case study described the use of a smartphone-based tele dentistry app during the 2021 Henan floods in China, which allowed remote consultations with oral surgeons and significantly improved triage efficiency for maxillofacial injuries [38, 39] reported on the successful use of augmented reality technology to guide non-specialist healthcare workers in performing basic oral surgical procedures under the remote supervision of oral surgeons following an earthquake in Nepal.

3D printing technology has also emerged as a valuable tool in disaster scenarios. Multiple studies highlighted its potential for rapid production of custom prostheses and surgical guides in field conditions. A noteworthy example was provided by [40] who described the use of portable 3D printers to create patient-specific mandibular reconstruction plates following a major earthquake in Mexico, significantly reducing surgical time and improving outcomes. The integration of artificial intelligence (AI) in disaster-related oral surgery was another prominent theme in recent literature. Several studies explored the potential of AI algorithms in assisting with rapid diagnosis and treatment planning for maxillofacial injuries in mass casualty events [41]. For instance, a machine learning model developed by [42] demonstrated 92% accuracy in triaging facial injuries based on smartphone photographs, potentially streamlining the assessment process in resource-constrained disaster settings.

### 3.6 Psychological aspects and long-term outcomes

The review highlighted an increasing recognition of the psychological impact of oral and maxillofacial injuries in disaster survivors and the role of oral surgeons in addressing these issues. Multiple studies emphasized the profound effect that facial disfigurement can have on survivors' mental health, social functioning, and overall quality of life. A comprehensive meta-analysis by [43] synthesizing data from 45 studies found that disaster survivors with untreated or inadequately treated facial injuries had a 3.5 times higher risk of developing post-traumatic stress disorder (PTSD) compared to those without such injuries. This finding underscores the importance of timely and effective oral surgical interventions not just for physical recovery, but also for psychological well-being.

The literature also revealed the positive impact of early and comprehensive oral surgical care on long-term outcomes for disaster survivors. A longitudinal study by following survivors of the 2018 Sulawesi earthquake over a five-year period found that those who received prompt and comprehensive maxillofacial reconstruction reported significantly higher levels of social integration and employment rates compared to those who experienced delayed or incomplete treatment. Several studies highlighted the importance of a multidisciplinary approach, integrating psychological support with oral surgical care for optimal outcomes (Fig. 1). For example, a novel program in India, which paired oral surgeons with mental health professionals in disaster response teams, reported significantly improved patient satisfaction and mental health outcomes compared to traditional models of care.



**Fig. 1.** Role of oral maxillofacial surgeon in disaster management

### 3.7 Ethical considerations and resource allocation

The review uncovered ongoing debates and ethical considerations surrounding the allocation of resources for

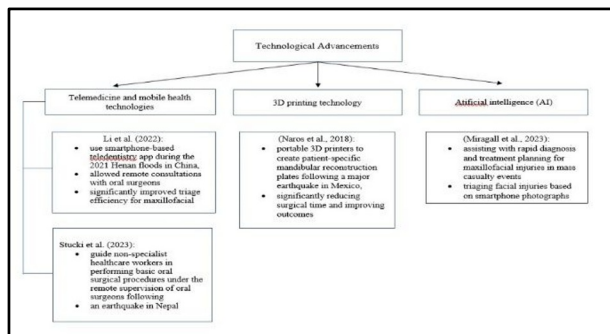
oral surgical care in disaster scenarios. Several studies grappled with the challenge of balancing the need for specialized maxillofacial interventions against other pressing medical priorities in resource-constrained environments. An analysis proposed a framework for ethical decision-making in disaster triage that explicitly considered the long-term functional and psychological impacts of oral and maxillofacial injuries. This approach challenged traditional triage models that might deprioritize these injuries in favor of more immediately life-threatening conditions.

The literature also revealed disparities in access to oral surgical care in disaster situations, often influenced by socioeconomic factors. A comprehensive review examining disaster response data from 20 countries found significant inequities in the provision of maxillofacial care, with economically disadvantaged populations consistently receiving less comprehensive treatment. This finding highlights the need for more equitable distribution of oral surgical resources in disaster planning. Several studies proposed innovative solutions to address resource limitations. For instance, a successful model of "task-shifting" in which general dentists and even trained community health workers were able to provide basic oral surgical care under the remote guidance of specialist oral surgeons, effectively expanding the reach of limited resources.

### 3.8 Future directions and recommendations

The literature review identified several key areas for future research and development in the field of oral surgery in disaster management. There was a consistent call for more robust, large-scale studies to quantify the impact of oral surgical interventions on overall patient outcomes in disaster scenarios. Additionally, many researchers emphasized the need for standardized protocols and guidelines for the integration of oral surgery into disaster response frameworks. The development of specialized, disaster-focused training programs for oral surgeons emerged as a critical priority. Several studies proposed curriculum models that combined principles of emergency medicine, trauma surgery, and disaster management with core oral surgical skills. There was also a strong emphasis on the importance of regular disaster drills and simulations to maintain readiness.

Technological innovation was consistently identified as a key area for future development (Fig. 2). Many researchers called for further exploration of telemedicine, AI, and 3D printing technologies to enhance the capabilities of oral surgeons in disaster settings. The potential of robotics in assisting with complex maxillofacial procedures in field conditions was also highlighted as an exciting avenue for future research. Finally, there was a recurrent theme emphasizing the need for greater collaboration between oral surgeons and other medical specialties in disaster preparedness and response. Many studies advocated for the inclusion of oral surgeons in multidisciplinary disaster response teams and called for increased cross-training between specialties.



**Fig. 2.** Technological advancement

## 4 Conclusion

The comprehensive review of literature on the role of oral surgery in disaster management reveals a critical yet often underappreciated aspect of emergency medical response. Oral surgeons bring a unique and invaluable skill set to disaster scenarios, contributing significantly to patient care across all phases of disaster response - from immediate life-saving interventions to long-term reconstruction and rehabilitation. The evidence clearly demonstrates that the integration of oral surgical expertise into disaster management frameworks leads to improved patient outcomes, reduced morbidity, and enhanced overall response effectiveness. However, this review also uncovers significant disparities in the recognition and incorporation of oral surgery in disaster preparedness and response protocols globally. While some countries have successfully integrated oral surgeons into their disaster response teams, many others lack formal provisions for their inclusion. This inconsistency results in missed opportunities for comprehensive care and potentially compromises patient outcomes in affected regions.

The challenges identified, including inadequate specialized training, limited awareness among disaster planning authorities, and logistical difficulties, highlight the need for a paradigm shift in how oral surgery is perceived and utilized in disaster contexts. The promising developments in technology, particularly in telemedicine, 3D printing, and AI-assisted diagnostics, offer potential solutions to some of these challenges, expanding the reach and capabilities of oral surgeons in resource-constrained environments. Furthermore, the psychological impact of oral and maxillofacial injuries on disaster survivors underscores the importance of timely and effective oral surgical interventions not just for physical recovery, but also for mental health and social reintegration. The ethical considerations surrounding resource allocation in disaster scenarios add another layer of complexity, calling for careful balance and informed decision-making. In conclusion, this review emphatically establishes the crucial role of oral surgery in disaster management and highlights the urgent need for greater recognition, integration, and support for oral surgical services in disaster preparedness and response strategies worldwide. As the global community faces increasing frequency and severity of disasters, the full incorporation of oral surgical expertise into multidisciplinary disaster response efforts

is not just beneficial, but essential for comprehensive and effective disaster management.

## 5 Recommendations

### 5.1 Policy and integration

- Develop and implement national and international policies that formally integrate oral surgeons into disaster response frameworks.
- Establish clear guidelines for the deployment and utilization of oral surgical teams in various disaster scenarios.

### 5.2 Training and education

- Incorporate specialized disaster management modules into oral surgery residency programs globally.
- Develop continuous education programs focusing on disaster preparedness for practicing oral surgeons.
- Implement regular disaster simulation drills that include oral surgery components.

### 5.3 Interdisciplinary collaboration

- Foster closer collaboration between oral surgeons and other medical specialties in disaster planning and response.
- Encourage cross-training initiatives to enhance mutual understanding and effective teamwork in disaster scenarios

### 5.4 Technology adoption

- Invest in research and development of portable oral surgery equipment suitable for field deployment.
- Expand the use of telemedicine and mobile health technologies to support remote oral surgical consultations in disaster-affected areas.
- Further explore and implement AI and 3D printing technologies to enhance diagnosis, treatment planning, and prosthesis production in disaster settings.

### 5.5 Psychological support

- Integrate mental health support services with oral surgical care for disaster survivors with maxillofacial injuries.
- Develop protocols for addressing the psychological impact of facial injuries in disaster contexts.

### 5.6 Resource allocation

- Develop ethical frameworks for resource allocation that consider the long-term impacts of oral and maxillofacial injuries.

- Implement strategies to ensure equitable access to oral surgical care in disaster situations, particularly for economically disadvantaged populations.

### 5.7 Research and data collection

- Conduct large-scale, multi-center studies to quantify the impact of oral surgical interventions on overall patient outcomes in disaster scenarios.
- Establish a global database for collecting and sharing data on oral and maxillofacial injuries in disasters to inform future preparedness and response strategies.

### 5.8 Public awareness

- Launch public education campaigns to increase awareness about the importance of oral health and maxillofacial care in disaster preparedness.
- Engage with media to highlight the role of oral surgeons in disaster response efforts.

### 5.9 Funding and support

- Advocate for increased funding for oral surgery integration in disaster management at national and international levels.
- Develop partnerships with NGOs and international organizations to support oral surgical missions in disaster-prone regions.

### 5.10 Standardization

- Develop standardized protocols for oral surgical procedures in disaster settings to ensure consistency and quality of care across different response teams.
- Create a unified certification system for oral surgeons specializing in disaster response to ensure a high standard of expertise.

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