Review Article

Epidemiological analysis and emergency nursing care of oral and craniomaxillofacial trauma: a narrative review

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Background and Objective: We conducted a literature review on the epidemiology and emergency nursing care of oral and craniomaxillofacial trauma in order to facilitate rescue and care planning. Traumatic accidents alter oral and craniomaxillofacial anatomy and physiology, resulting in craniomaxillofacial scars and deformities, temporomandibular disorders, and oromandibular dysfunction. Such trauma affects speech, chewing, and eating; results in long hospitalization and burdensome healthcare expenses; and in severe cases may lead to potentially life-threatening complications such as respiratory obstruction and brain injury.

Methods: EMBASE, MEDLINE, and PubMed were investigated for relevant systematic reviews. By conducting a literature review of reports on oral and craniomaxillofacial trauma to summarize the epidemiological characteristics and emergency care of oral and craniomaxillofacial trauma.

Key Content and Findings: Numerous studies, both domestic and foreign, have investigated the epidemiological characteristics of oral and craniomaxillofacial trauma and have reported different incidences of this trauma, with significant inter- and intraregional variation. The studies show that most patients with maxillofacial trauma are young adults, and males consistently outnumber females. Maxillofacial trauma can be physical or chemical, though most are physical injuries, the road traffic accident (RTA) is the leading cause of oral and maxillofacial trauma. Oral and maxillofacial trauma can be simple soft tissue trauma, simple bone trauma, or soft tissue plus bone trauma, the brain injury is the most common concomitant injury of patients with maxillofacial trauma. Different studies have reached different conclusions about the temporal distribution of maxillofacial trauma. Several important emergency care models in the management of oral and craniomaxillofacial trauma have resulted in improved outcomes. These include accurate assessment, effective airway maintenance, careful management. The more common use of virtual surgical planning, surgical navigation, computer-aided surgery and 3D printing will no doubt continue to improve accuracy and efficiency in the management of these patients.

Conclusions: By conducting a literature review of domestic and foreign reports on oral and craniomaxillofacial trauma to summarize the epidemiological characteristics and emergency care of oral and craniomaxillofacial trauma, we aimed to provide a reference for the rescue and care planning for patients with oral and craniomaxillofacial trauma.

Keywords: Oral and craniomaxillofacial; trauma; epidemiology; emergency nursing care

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Introduction

Traumatic accidents can alter oral and craniomaxillofacial anatomy and physiology, resulting in craniomaxillofacial scars and deformities, temporomandibular disorders, and oromandibular dysfunction in the oral and craniomaxillofacial regions, an important part of the human body (1). According to extensive data over the last two decades in the US, oral and craniomaxillofacial trauma accounts for 5.9% to 34% of all trauma accidents. Oral and craniomaxillofacial trauma results in varying degrees of appearance changes, which can significantly impact the person's marriage, school, work, and social life, especially in women, young people, highly educated individuals, individuals engaging in international business, and urban populations. Patients may develop negative emotions such as fear, anxiety, and low self-esteem, as well as posttraumatic stress disorder in severe cases (2). The causes of maxillofacial trauma have changed over time. Numerous domestic and foreign studies showed that road traffic accident is the leading cause of oral and maxillofacial trauma (3,4). However, recent studies are reaching different conclusions. The leading cause of maxillofacial injuries varies by country or region (5,6). Foreign studies show that the leading cause in other countries is violence; in particular, violence against women was and is still a global crisis around the world (7). We present the following article in accordance with the Narrative Review reporting checklist (available at https://apm.amegroups.com/article/view/10.21037/apm-21-2995/rc).

Methods

EMBASE, MEDLINE, and PubMed were investigated for relevant systematic reviews. Literatures related to the epidemiology and emergency nursing care of oral and craniomaxillofacial trauma were systematically reviewed. A search for relevant systematic reviews was conducted in MEDLINE, EMBASE, and PUBMED from June 2002 to Aug 2020. Briefly, trials that Oral and craniomaxillofacial, trauma, epidemiology, emergency nursing care were deemed eligible for inclusion. Articles of conference abstracts were excluded. Full search terms can be provided on request. Titles and abstracts were screened for inclusion, followed by a full-text review by two independent reviewers. See *Table 1* for details.

Epidemiological characteristics of oral and craniomaxillofacial trauma

Incidence

Numerous studies (3,8), both domestic and foreign, have investigated the epidemiological characteristics of oral and craniomaxillofacial trauma and have reported different incidences of this trauma, with significant inter- and intraregional variation. Current data show that maxillofacial trauma accounts for 11% to 34% of all emergency injuries (9).

Age and sex composition

Most patients with maxillofacial trauma are young adults. Zhou *et al.* (10) retrospectively analyzed the clinical data from 2000 to 2009 of 1,131 patients with maxillofacial trauma and found that the peak age group was 21 to 30 (26.9%). Emodi *et al.* (1) retrospectively analyzed the clinical data from 2009 to 2014 of 1,097 patients with maxillofacial trauma and found that the peak age group was 16 to 25 (23.3%). Kim *et al.* (11), however, found that the peak age group was 0 to 9 years (25%, N=1,806). Park *et al.* (12) summarized the clinical data of 1,742 patients who visited the emergency room of the dental hospital of Yonsei University, Korea, and found that the peak age group was <10 years (20.7%). Moreover, different studies have reached widely different conclusions about the sex composition of these patients, but males consistently outnumber females. See *Table 2* for details.

Causes of injury

Maxillofacial trauma can be physical or chemical, though most are physical injuries. According to international guidelines, physical injuries are categorized as falls, non-fall nonimpact injuries, violent strike injuries, road traffic accidents (RTAs), sports injuries, work injuries, and other injuries. Toxic substances such as strong acid and strong alkali cause local skin injury and systemic injury, which is called chemical injury. The damage of chemicals includes oxidation, corrosion, protoplasm poisoning, dehydration and blistering. Anatomically, injuries can involve the zygomatic-maxillary complex, zygomatic arch, and orbital floor fractures, or they can be mandibular fractures (mandibular angle, body, median joint, ascending branch, condyle) (13).

Table 1 The search strategy summary

Items	Specification
Date of search (specified to date, month and year)	March 2, 2021
Databases and other sources searched	EMBASE, MEDLINE, and PubMed
Search terms used (including MeSH and free text search terms and filters)	Oral and craniomaxillofacial; trauma; epidemiology; emergency nursing care
Timeframe	June 2002 to Aug 2020
Inclusion and exclusion criteria (study type, language restrictions etc.)	Trials that oral and craniomaxillofacial, trauma, epidemiology, emergency nursing care were deemed eligible for inclusion. Articles of conference abstracts were excluded
Selection process (who conducted the selection, whether it was conducted independently, how consensus was obtained, etc.)	Full search terms can be provided on request. Titles and abstracts were screened for inclusion, followed by a full-text review by two independent reviewer
Any additional considerations, if applicable	None

Table 2 Sex composition of patients with maxillofacial trauma

Authors	Year	Sample (n)	Males (n)	Females (n)
Kim *et al.* (11)	2019	1,806	1,070	736
Park *et al.* (12)	2015	1,742	1,244	498
Zhou *et al.* (10)	2015	1,131	881	250
Liu *et al.* (13)	2011	1,254	1,032	222

The causes of maxillofacial trauma have changed over time. Numerous domestic and foreign studies showed that RTA is the leading cause of oral and maxillofacial trauma (14,15). However, recent studies are reaching different conclusions (16,17). Shi *et al.* (18) analyzed the epidemiological data from January 2014 to December 2017 of 5,762 non-hospitalized patients with maxillofacial trauma and found that falls were the leading cause of injury (72.9%), which is consistent with the findings of Emodi (1). The leading cause of maxillofacial injuries varies by country or region. Foreign studies show that the leading cause in Finland, Sweden, and the US is violence (19,20); in particular, violence against women was and is still a global crisis around the world (7,21,22).

Types/sites of trauma

Oral and maxillofacial trauma can be simple soft tissue trauma, simple bone trauma, or soft tissue plus bone trauma. Anatomically, oral and maxillofacial trauma can occur in the zygomatic area, forehead, cheek, or orbital area (4). Domestic and foreign epidemiological studies show that most maxillofacial injuries are simple soft tissue injuries, and the most common site of soft tissue injury is the lip (18,23). The incidence of maxillofacial fractures, especially mandibular fractures, is high in patients with maxillofacial injuries (24,25). Wang *et al.* (3) analyzed the clinical data of 3,050 patients with maxillofacial injury and found that the most common fracture site was the zygomatic complex (26.9%), followed by the naso-orbital ethmoid (24.7%) and the mandible (20.5%). Emodi *et al.* (1) showed that the incidence of zygomatic fracture, nasal fracture, and orbital fracture was 27.8%, 23.8%, and 33.5%, respectively.

Maxillofacial trauma with multiple-system injury

Scheyerer *et al.* (26) retrospectively analyzed the data of 487 patients with severe maxillofacial trauma and found that 72% of the patients had intracranial hemorrhage, 12% had neck injury, 33% had thoracic injury, 19% had abdominal injury, 23% had spinal injury, and 58% had limb injuries. Chen *et al.* (27) conducted a clinical epidemiological analysis of 653 cases of oral and maxillofacial trauma in Qingdao, China, and found that brain injury was the most common concomitant injury (12.40%), followed by facial nerve injury (3.37%), eye injury (2.45%), upper limb injury (4.90%), thoracic injury (3.98%), and lower limb injury (3.98%). Most studies show that brain injury is the most common concomitant injury of patients with maxillofacial trauma. This is because maxillofacial trauma induces brain injury via bone conduction and the oscillation effect due to gravity.

Temporal distribution of maxillofacial trauma

Shi *et al.* (18) retrospectively analyzed 5,762 non-hospitalized patients with maxillofacial trauma and found that the third quarter was the peak season (30.1%), followed by the fourth quarter (29.4%). Kim *et al.* (11) showed that the peak time of maxillofacial trauma was May (11.9%), followed by October (9.7%). Moreover, 52.2% of the patients came to the emergency room on weekends, especially between 9:00 pm and 12:00 am (24.8%), followed by 6:00 am to 9:00 pm (23.8%), which is consistent with the findings of Santos *et al.* (28).

Emergency care management model for patients with oral and craniomaxillofacial trauma

Assessment of oral and craniomaxillofacial trauma

Most patients with oral and craniomaxillofacial trauma seeking emergency care have systemic tissue and organ injuries. Therefore, the safety of patients is the priority during assessment, rescue, and treatment. Advanced trauma life support (ATLS), the treatment guidelines for rapid rescue of trauma patients, were developed by The Committee on Trauma of the American College of Surgeons. ATLS prioritizes the "ABCDE" method during emergency assessment: A: airway maintenance with cervical protection; B: breathing with ventilation; C: circulation with hemorrhage; D: disability and neurological status; and E: exposure/environment. Some foreign researchers point out the ATLS guidelines fail to emphasize local oral and craniomaxillofacial trauma during the early treatment stage and believe that local treatment is an integral part of the systemic treatment of patients with multiple injuries. Therefore, emergency nurses need to pay attention to both systemic and local treatment. In other words, in addition to managing the overall condition of trauma patients efficiently, accurately, and effectively according to the ATLS guidelines, emergency nurses must assess any oral and maxillofacial injury and its severity and notify the oral and craniomaxillofacial surgeon for consultation, as needed.

Effective airway maintenance, prompt management of life-threatening bleeding, and early diagnosis of brain injury

Emergency nurses should quickly assess the airway condition of patients with oral and maxillofacial trauma. Because of its rich blood supply, the oral and maxillofacial region is prone to bleeding after injury. Moreover, tissue edema and displacement or falling of the tongue base, clogged secretions, and dislodged dentures and teeth may cause airway obstruction; mandibular fractures may cause the soft palate to sink, resulting in the fall of the tongue and airway obstruction, which if not treated promptly may result in suffocation (29). Emergency suction devices should be available 24/7, and tracheal intubation or tracheotomy may be performed as needed. The main blood vessels in the maxillofacial region are the internal maxillary artery and its branches. Therefore, the bleeding sites are often around the mouth and nose, which are difficult to manage with compression or vascular ligation. In case of life-threatening bleeding, the patient should receive rehydration and blood transfusion promptly, and blood pressure and blood volume should be closely monitored. Maxillofacial trauma, especially maxillary fractures, can easily induce brain injury. Breathing, circulation, and the level of consciousness should be closely monitored. Therefore, computed tomography should be promptly scheduled and performed to facilitate early diagnosis, the routine use of a head CT scan for all severely injured patients is recommended to ensure that no concomitant injury is overlooked. The injury severity score (ISS) is a summary measure of injury severity when multiple injuries are present. It is calculated by squaring the three highest abbreviated injury scale (AIS) scores in three different body regions, and adding the values to obtain a total that falls within an ascending scale of severity from 1 (minor) to 75 (maximally injured). Once the injury level of brain injury is confirmed, patients should be closely monitored for vital signs and receive treatments to reduce intracranial pressure and secondary brain hemorrhage. Patients with clinical indications should undergo surgical treatment in a timely manner to prevent death.

Careful management of debridement and suture to promote wound healing

The oral and craniomaxillofacial region is an important part of the human body, and accidents may cause maxillofacial soft tissue injury and changes in oral anatomy and physiology. During early debridement and suturing, maximum preservation of soft tissue is the key to restore the facial appearance and prevent deformity (30). Dislodged intact teeth should be replanted later. Teeth near the fracture line may be retained and secured in the case of grade I to II dislodgment and no periodontal

infection in order to facilitate fracture reduction and occlusion restoration. Medical supplies in the suture operating room should be categorized and well arranged, equipment and devices should be sterilized regularly, medical waste should be disposed of according to hospital rules, and valuable equipment should be managed by designated personnel and checked for integrity after each use. Suture supplies should be recorded daily, including the use, sterilization, and expiry date. Upon discharge, patients and their families should be provided a hospital-designed health education sheet on cosmetic suturing for craniomaxillofacial trauma, including descriptions of the precautions and steps to take for post-suture wound care. For example, patients should not make exaggerated facial expressions and should keep the wound dry and free of pressure. Moreover, patients should be instructed to have light and nutritious meals and avoid raw, cold, or spicy food. Furthermore, patients should be informed about when to follow up, change the dressing, and remove the sutures; in what situations to contact the doctor immediately; the time and location of specialist clinic visits (for patients with fractures); and how to make an appointment online or via WeChat. It is also important to educate patients about the significant role of high-tech digital healthcare technologies, such as 3D printing and computer design systems, in oral and maxillofacial trauma repair to enhance the patient's confidence in the treatment.

Standardizing oral care procedures to prevent oral infections

Oral and maxillofacial trauma may cause restricted mouth opening and occlusal dysfunction. Oral bleeding, saliva secretion, discharge of wound secretions, and retention of food residues further affect oral hygiene and oral wound healing (31). Oral care solutions should be selected based on oral pH; the frequency of oral care is based on the stage of wound healing and the wound condition. For example, cleaning is not advised during the granulation period, and normal saline should be used as mouthwash (frequent uses). Oral care devices should be carefully selected for patients with severe maxillofacial injury, brittle wounds, or hemorrhaging wounds. Patients with maxillary and mandibular fractures and intermaxillary fixation should not use any mouthpiece. Oral care procedures should be standardized, and nurses should undergo relevant training to prevent oral infections.

Emergency care management model for young adults and family

Most patients with maxillofacial trauma are young adults. Oral and craniomaxillofacial trauma results in varying degrees of appearance changes, which can significantly impact the person's marriage, work, and social life, especially in young adults, Patients may develop negative emotions such as anxiety, and low self-esteem, as well as posttraumatic stress disorder in severe cases. Moreover, the patient's families often feel overwhelmed in the wake of accidents. Therefore, emergency nurses must assess any oral and maxillofacial injury and its severity and notify the oral and craniomaxillofacial surgeon for consultation, pay attention to both systemic and local treatment, manage the overall condition of trauma patients efficiently, accurately, and effectively according to the ATLS guidelines. It is important for emergency nurses to communicate with young adults and families, and provide sympathy, support, educate them about the significant role of high-tech digital healthcare technologies.

Building a good nurse-patient relationship and meeting the patient's cosmetic needs

Facial scars, deformities, and appearance changes will affect the patients' future life, family, and work. As a result, patients may become pessimistic and feel hopeless (32). This is more pronounced in women, as they report being more concerned about how post-trauma appearance changes may affect their school, work, marriage, and family life, which may result in negative emotions such as anxiety and affect physical and mental health (33). Moreover, the patient's families often feel overwhelmed in the wake of traumatic accidents and often experience anxiety and stress due to a lack of understanding of the surgical treatment and its outcomes, the patient's needs for long-term care, their healthcare expenses, and the patient's negative emotions. Therefore, it is important for emergency nurses to communicate with these patients, listen to them, and provide support, sympathy, and encouragement. Nurses should use plain language to explain how trauma is treated and the potential complications, such as facial dysfunction, to help these patients understand the occurrence, development, and treatment outcomes of trauma. Moreover, it is important to educate patients about rapidly advancing medical technologies such as 3D printing in order to

enhance patient confidence and compliance and mitigate their low self-esteem and depression (18).

The progress of treatment for oral and craniomaxillofacial trauma

The incidence of oral and craniomaxillofacial trauma is rising. Most trauma patients are young adults, and RTA is the leading cause of oral and maxillofacial trauma. The most common injuries are simple soft tissue injury and mandibular fractures. Brain injury is the most common concomitant injury. To complete as much of the skeletal soft tissue reconstruction as possible during the initial hospitalization because early bony reconstruction supports the soft tissue and decreases wound contracture. Many advances have been made in the management of oral and maxillofacial trauma. The more common use of virtual surgical planning, surgical navigation, computer-aided surgery and 3D printing will no doubt continue to improve accuracy and efficiency in the management of these patients. The continued focus on improvement in safety should continue to have a positive effect in preventing oral and maxillofacial trauma. Emergency department should establish an oral/maxillofacial trauma emergency care team, incorporate oral/craniomaxillofacial emergency care into the textbook, organize oral/craniomaxillofacial emergency practice drills, improve the overall skill level of this emergency team, and cultivate predictive thinking among emergency nurses to improve treatment outcomes.

Current status and future direction of oral and craniomaxillofacial emergency care in China

With the rapid economic and social development and the growth of the transportation network, the incidence of oral and craniomaxillofacial trauma in China has risen over the years. The Department of Oral and Craniomaxillofacial Surgery of our hospital is a national key department, and we treat 21,341 emergency cases of craniomaxillofacial trauma each year. Our limited emergency nursing staff can no longer meet the needs of our patients. Moreover, emergency nurses need to further improve their emergency care services for oral and craniomaxillofacial trauma. Most emergency patients are in critical, complex condition, but the nurses currently do not have enough knowledge to accurately assess the condition of a patient with complex oral/craniomaxillofacial trauma or provide proper care. This is caused by the lack of relevant courses on craniomaxillofacial trauma and the resulting lack of relevant knowledge and practice in oral and craniomaxillofacial emergency care among emergency nurses. Therefore, it is important to incorporate oral and craniomaxillofacial emergency care into textbooks to establish a more comprehensive education system. Furthermore, nursing students should spend more time in the oral and maxillofacial emergency care unit to put all they have learned into practice. Hospital and nursing management should regularly host seminars on oral medicine and craniomaxillofacial care for nurses to learn and discuss the epidemiological characteristics of oral and craniomaxillofacial trauma and common types of cases in order to improve their knowledge about oral and maxillofacial care. Furthermore, rescue and care procedures for oral and maxillofacial trauma should be standardized, treatment guidelines should be developed, and an oral/maxillofacial trauma emergency care team should be established to conduct regular oral and craniomaxillofacial emergency practice drills, strengthen continuing education and training of emergency nurses, and improve their ability to manage emergencies. Rescue equipment and medicines should be managed by designated personnel, regularly reviewed and sterilized, stored at a designated location, and regularly inspected and maintained. In addition, emergency nurses should be encouraged to actively participate in research projects led by the emergency head nurse to improve the overall level of the oral and craniomaxillofacial emergency team.

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Footnote

Reporting Checklist: The authors have completed the Narrative Review reporting checklist. Available at https://apm.amegroups.com/article/view/10.21037/apm-21-2995/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://apm.amegroups.com/article/view/10.21037/apm-21-2995/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related

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