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MAXILLOFACIAL INJURIES IN COMBAT SPORTS: PREVALANCE AND PREVENTION – A LITERATURE REVIEW

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ABSTRACT

Introduction and Purpose: An increasing number of individuals are engaging in combat sports. Although these activities offer numerous health benefits, they also carry a significant risk of maxillofacial injuries.

Such injuries may include facial bone fractures, dental trauma, soft tissue damage, as well as injuries to the nose and eyes. There are effective methods to reduce this risk, such as the use of mouthguards, helmets, and face masks. However, awareness regarding the use of this protective equipment remains low, and there are no formal requirements mandating their use. The aim of this study is to compare the prevalence of different types of maxillofacial injuries in combat sports and to explore strategies for their prevention.

Materials and Methods: The review is based on throughout analysis of the materials selected from PubMed, Scopus and Google Scholar using following keywords: maxillofacial trauma, maxillofacial injury, combat sports, martial arts, orofacial injury, dental trauma, dental injury, mouthguards, helmets, facemasks

Conclusions: Research shows that the level of awareness regarding the prevention of maxillofacial injuries is low among both athletes and coaches. This highlights the importance of increasing education and awareness in this area. Furthermore, there is a clear need for additional long- term randomized controlled trials to investigate the incidence and characteristics of these injuries, which would contribute to the development of evidence-based prevention strategies.

KEYWORDS

Maxillofacial Trauma, Maxillofacial Injury, Combat Sports, Martial Arts, Orofacial Injury, Dental Trauma, Dental Injury, Mouthguards, Helmets, Facemasks

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Introduction

Sport activity is vital for health; however, some types of sports, such as martial arts, may also lead to health damage. To begin with, it is essential to clarify the definition of combat sports, also referred to as martial arts, to provide a clear understanding of the topic. These sorts of sports include one-on-one combat between competitors. We can divide them into two groups: “striking combat sports” (e.g., karate, boxing, and taekwondo) and “grappling sports,” which include close-quarter combat techniques (e.g., judo or wrestling). (1) They have gained popularity in recent years, for instance, in the United States, more than 6 million people have been practising them between 2010 and 2021. (2) The increasing number of individuals participating in combat sports, both amateur and professional, has led to a higher incidence of injuries, with the majority affecting the maxillofacial region. (3) Moreover, not only adults train, but also children. Data indicate that more than 5% of pediatric injuries from boxing and martial arts involved the face. (4) These findings show why it is essential to understand better the risks of participating in such sports. A more explicit recognition of these dangers may guide the development of evidence-based regulations on protective equipment, particularly for the head and neck region, and support the spread of this knowledge among athletes, coaches, and the parents of young participants. The purpose of this review is to analyse how common maxillofacial injuries are in combat sports and what ways of preventing them are available.

Epidemiology of maxillofacial injuries in combat sports

Rates of different head and neck injuries caused by combat sports differ among martial arts disciplines, which are shaped by factors like rules of the sport, whether striking or grappling predominates, and the level at which athletes compete.

A systematic review which analysed 27 studies established an overall pooled prevalence of dentofacial injuries among combat sports practitioners worldwide of approximately 30% (5), alongside a dental pooled prevalence of 25%. (5)

Prevalence of dentofacial trauma differs by discipline. Jiu-Jitsu had the highest pooled prevalence of dentofacial injuries at 52.9%. (5) What is more, it is notably the discipline most likely to cause neck injuries. (6) Conversely, judo was associated with the lowest pooled prevalence of dentofacial injuries, recorded at 25.0%(5).

Nevertheless, a 20-year cross-sectional study, utilising data from the American National Electronic Injury Surveillance System database from 2000 to 2019, indicates that judo has the highest rates of neck injuries resulting in hospital visits. (6) The pooled prevalence of dentofacial injuries for karate was 43.5%. (5) It was, along with kickboxing, most likely to cause facial injuries (6). Taekwondo exhibited a pooled dentofacial injury prevalence of 37.5% (5) and was recognised as the martial art most likely to result in a head injury. (6) The pooled prevalence of dentofacial injuries in wrestling was documented at 45.9%. (5) The injury rate within MMA competitions ranges from 22.9 to 28.6 injuries per 100 fight participations, with facial lacerations being the most prevalent type of injury. (7)

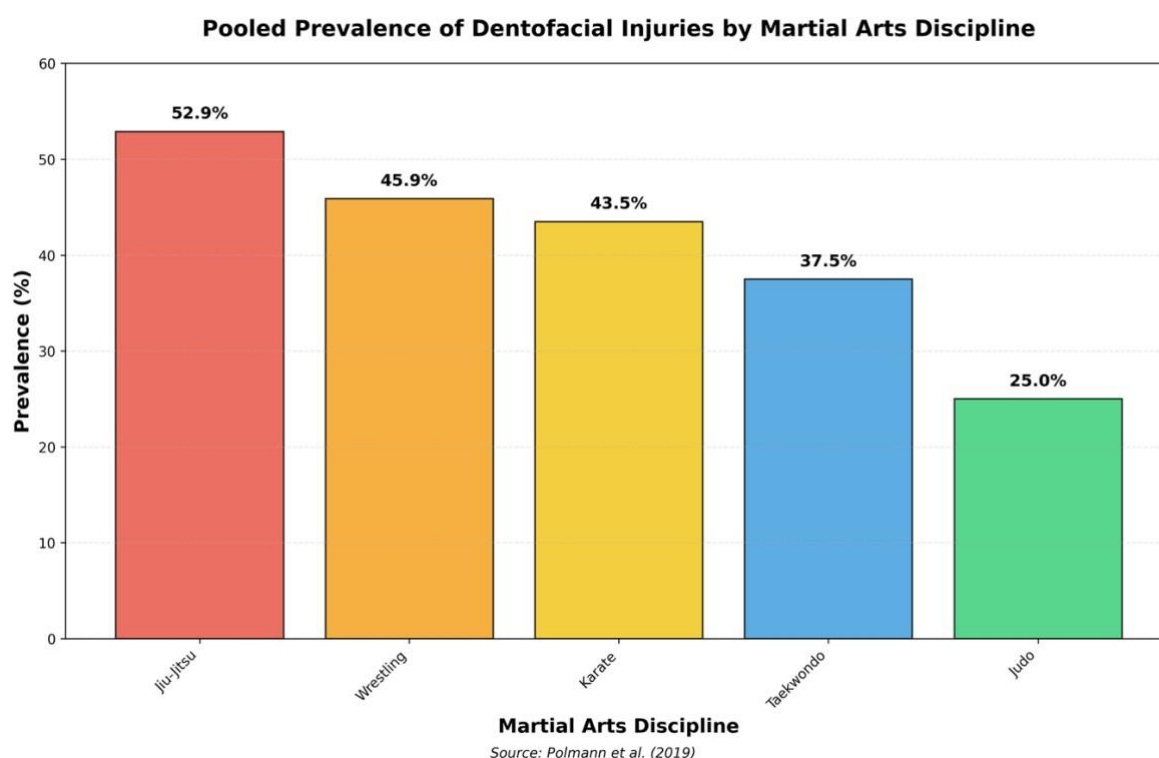


Fig. 1. Pooled Prevalence of Dentofacial Injuries by Martial Arts Discipline, Polmann et. al. (2019)

Data indicate a tendency for particular types of injuries to occur in “striking combat sports” and “grappling combat sports”. Sports like boxing, karate, and Muay Thai (“striking combat sports”) can have high rates of head and facial injuries, including abrasions, fractures, and concussions. In contrast, Brazilian jiu-jitsu, judo, and wrestling, collectively referred to as “grappling combat sports,” are associated with a significant frequency of joint injuries, predominantly affecting the elbow, knee, and shoulder. (7)

Moreover, the frequency of these injuries is influenced not only by the type of combat sport, but also by individual factors such as an athlete’s sex, age, and level of experience—whether they train recreationally or compete professionally.

Male athletes, especially young ones, are more prone to experience a maxillofacial injury in comparison to female athletes. (8-10) In one study on Ultimate Fighting Championship (UFC) fighters, males accounted

for 91.2% of maxillofacial injuries, while females accounted for 8.8%. (8) This might be because males can generate more power because they are usually heavier. (8) Another outcome from this study is that despite the difference in frequency among men and women, the distribution of injury types and location is similar between genders. (8) The only exception is mandibular fractures, which occurred only in male athletes. (8)

There is a lack of agreement regarding the impact of age on the likelihood of craniofacial injuries in martial arts. Some studies suggest that adolescents are more prone to injuries, especially ocular trauma. (10) The highest frequency of sports-related facial bone fractures is observed in the 11 to 20-year-old age group, which accounts for 40.3% of such injuries. (11) A study among 179 Brazilian jiu-jitsu athletes found that there is a higher prevalence of orofacial injuries among experienced athletes than beginners, especially lacerations and abrasions. (9) That might be because experienced athletes reach a higher technical level. (9)

Clinical Consequences and Management

It should be taken into consideration that craniofacial injuries can affect various anatomical regions, including bone fractures, dental trauma and soft tissue injuries, which heal differently. Because of this, coaches, sideline officials, and parents of minor athletes need to have basic knowledge about managing these injuries.

Nasal fractures are a common type of injury, particularly in MMA and boxing. Punches usually cause them. When considering pediatric patients, nose fractures account for 70% of all facial fractures. (4) Managing such traumas includes non-operative approaches, immediate closed reduction and protective facemasks recommended after returning to training (3, 4, 8, 11, 12). Regarding soft tissues, a study comparing professional boxing and MMA found that eyelid and eyebrow lacerations constituted the majority of eye injuries in both sports. (13) The removal of mandatory head guards in boxing was associated with a notable increase in facial cuts. (14) Contusions are also frequent, for instance, in karate. (14) A systematic review identified cheekbone contusions (0.71%–11.4%) and lip lacerations (11.4%–15%) as prevalent dentofacial traumas. (5) The primary steps of managing soft tissue injuries involve cleansing the wound, inspecting for deeper injuries, and then choosing an appropriate closure method like surgical adhesives or sutures. (11) Eye injuries are a concern in such sports because these sports include striking the face. The most common eye injury is a corneal abrasion, which occurs in approximately 40% of cases (15-18). Other issues are orbital fractures, subconjunctival haemorrhage, and contusions. About 6% of martial arts-related injuries can be sight-threatening and lead to partial or complete vision loss. A focused eye examination should begin with a visual inspection for deformities, foreign bodies, or lacerations, followed by a visual acuity test using a Snellen chart, which is considered the vital sign of the eye. (10)

Participating in this type of sport can lead to external apical root resorption in orthodontic patients undergoing fixed orthodontic treatment, due to an increased risk of maxillofacial injuries. (19)

The risk of temporomandibular disorder (TMD) is increased because of repetitive clenching of the teeth during training, which causes muscle strain. (20) Professional karate-do fighters have been shown to have a high prevalence of TMD. (7) The way of preventing this complication is by using custom-made mouthguards, which stabilise the electromyographic (EMG) activity of masticatory muscles. (20) Children and young adults are part of the population in which dental trauma occurs the most commonly. Among the different types of dental injuries in the primary dentition, luxation is the most common, whereas crown fractures are more frequent in the permanent dentition. The guidelines from the International Association of Dental Traumatology include the most comprehensive review of current dental literature on this topic. However, for patients, the most important thing is to follow basic rules and then refer to a specialist. If the patient has experienced a loss of consciousness, emergency medical services should be called immediately, and first aid should be administered. If not, and if a fracture or tooth avulsion has occurred, the tooth or its fragments should be located, including careful inspection of the oral soft tissues. This step is crucial for determining whether aspiration of the tooth into the airways has occurred. Once the tooth has been found, it should be stored in a moist environment; before that, it may be gently rinsed with saline. It is important not to scrape the root surface, as it contains

periodontal ligament cells. Suitable storage media include Hank's Balanced Salt Solution, saline, milk, or the patient's saliva. To reduce swelling of soft tissues, a cold compress may be applied. A dentist should be consulted as soon as possible, ideally within 30 minutes of the incident, since the chances of successful replantation of a permanent tooth decrease with the passage of time. (21-24)

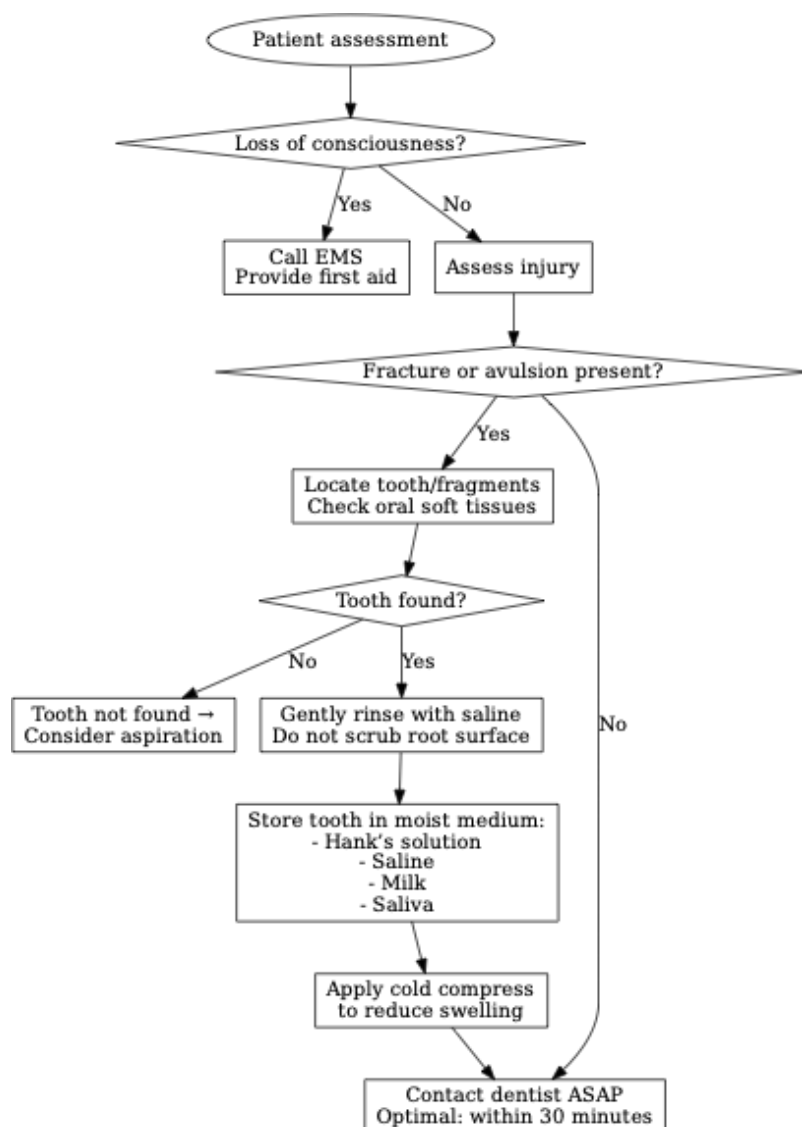


Fig. 2. Management protocol for dental trauma in pediatric and adult patients. (Fouad et. al. 2020)

Prevention Strategies

Prevention equipment, which can help reduce the number of maxillofacial injuries, includes mouthguards, helmets, and facemasks. Mouthguards are a critical piece of protective equipment in combat sports. However, their effectiveness varies depending on the type of mouthguards used. There are three main types of mouthguards: Type I (stock), Type II ('boil and bite' or ready-made), and Type III (custom-made). (20) Custom-made mouthguards, which provide the best wearability. They are fabricated from the athlete's oral impressions. (20). Not only are they the most comfortable, but they are also the most adequate to prevent dental trauma. (9) Despite all the above advantages, still many athletes do not possess any, for instance, among Brazilian jiu-jitsu athletes, 62,6% of them do not possess a mouthguard. (9) Cited reasons for not having a mouthguard include a lack of interest, a lack of awareness about the appliance, the cost involved, an annoying feeling and perceived negative impact on performance. (9) (25) The last reason is proved to be false; a meta-analysis of 10 studies demonstrated that $\dot{V}O_2$ max (maximal oxygen uptake) was reduced in maximal aerobic efforts with mouthguards (all types) compared to control conditions. (26) Headguards have a positive impact on lowering face laceration and skull fractures. (27) Studies on amateur boxing showed that the removal of mandatory headgear led to a notable increase in facial cuts. (1) On the other hand, some research suggests that headguards offer a high level of protection against linear impacts, especially when combined with heavier, padded gloves. They provide less protection against rotational and angular impacts, which are particularly dangerous for causing traumatic brain injuries. (27) There is a lack of data about facemasks. Only one study was found on this topic. It concludes that in karate, the introduction of face masks for competitors under sixteen has helped to reduce the incidence of facial injuries. (14)

Conclusion

The knowledge and attitude about mouthguards is low among faculty students, physical education teachers and athletes. (28) There should be taken actions that will raise awareness among athletes, coaches and parents of underage athletes about the risk of injury to the orofacial region associated with combat sports. Leaflets and mobile applications serve as practical tools for conducting these activities. (25) Prevention is the most effective strategy to reduce the number of injury incidents. It could be helpful to introduce safety regulations by governing bodies, for instance, by mandating the use of mouthguards. (26) It is also crucial for dentists to be involved in raising awareness regarding the management of craniofacial injuries and in emphasising the necessity of seeking specialist care as promptly as possible.

(29) What is more, there is a notable absence of randomised control trials, longitudinal research designs, and direct measurements of head injuries. Much of the existing evidence is indirect, relying on self-reporting or observational methods with small, non-representative samples. (14) A more standardised approach is recommended, which means uniform records and methodology to collect data about maxillofacial injuries across different combat sports.

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Author's Contribution:

Conceptualization: Zuzanna Krupa, Julia Skowrońska-Borsuk, Bartłomiej Czerwec, Adam Borsuk; methodology: Zuzanna Krupa, Julia Borkowska, Julia Sposób ; check: Bartłomiej Czerwec, Adrianna Pękacka, Martyna Narożniak; data curation: Malwina Wojtas, Joanna Pergoł; investigation: Zuzanna Krupa, Julia Skowrońska Borsuk, Joanna Pergoł, Julia Sposób.; resources: Julia Sposób, Malwina Wojtas; writing-rough preparation: Zuzanna Krupa, Julia Skowrońska-Borsuk, Adam Borsuk, Martyna Narożniak, Adrianna Pękacka; writing-review and editing: Zuzanna Krupa, Julia Skowrońska-Borsuk, Julia Borkowska; visualization: Zuzanna Krupa; supervision: Julia

Skowrońska-Borsuk, Adam Borsuk; project administrator: Zuzanna Krupa

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