

REVIEWS

Sports-related trauma in the cephalic region: mandibular fractures

Cecilia Bacali¹, Anne-Marie Constantin², Oana Almășan¹

¹ Prosthetic Dentistry and Dental Materials Department, "Iuliu Hațieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania

² Histology Department, "Iuliu Hațieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania

Abstract

Background. This study examines the implications of sports-related trauma on the cephalic region, and mandibular fractures particularly.

Aims. The paper presents the increasing risk of sports-related incidents, especially those involving trauma in the orofacial region.

Methods. Different types of fractures are described, with various focused specifications.

Results. The wide range of mandibular fractures is highlighted, with particular attention paid to the occurring areas. Mandibular fracture signs include pain, facial signs, and occlusal changes. Mandibular fracture diagnosis requires in addition to clinical examination, a multidisciplinary strategy that includes complementary paraclinical investigations such as panoramic radiography, frontal cephalogram, and computed tomography. To assess soft tissue involvement, magnetic resonance imaging is used, which offers an extensive evaluation approach to mandibular fractures.

Conclusions. The necessity of dental healthcare providers taking preventative measures to reduce the risk of orofacial injury from sports is emphasized. To monitor potential sports-related accidents in the head and neck region, multiple dental and medical professionals must collaborate.

Keywords: facial traumatism, sports accidents, jaw fractures, mandibular fractures.

Introduction

Accidents during sports are a have an increasing incidence, therefore this issue needs to be addressed immediately. Orofacial injuries resulting from sports events are frequently encountered (Shreya et al., 2022). The general well-being and functionality of the dental system are greatly influenced by tooth occlusion and the condition of the temporomandibular joint (TMJ), therefore, dental professionals must comply with all required precautions against orofacial damage brought on by sporting events (Stamos et al., 2020). For sports injuries in the cervical and facial area, minimally invasive procedures such as ultrasound-guided percutaneous needle electrolysis and needle therapy can be employed (Romero-Morales et al., 2021).

Among craniofacial traumatism, mandibular fractures are one of the most encountered cases of hospitalization, with an incidence varying from 20-50% in different medical centers (Kelley et al., 2005). Sports activity is a common

cause in its etiology, along with assaults, car accidents, and falls (Erdmann et al., 2008). The majority of the patients, more than 80%, are males, usually occurring in their second and third life decade (Sojot et al., 2001; Ellis et al., 1985). The fracture of the mandible is a consequence of an impact with a high force (44.6-74.4 N/m), similar values to those causing zygomatic bone fractures and four times less than those corresponding to the maxillary bone (Huelke, 1964).

The mandibular bone is one of the largest facial bones, in a U shape, connected through the condyles to the cranial bones by the temporomandibular joints. It comes into contact with the maxilla through the occlusal surface of the teeth (Koshy et al., 2010). The mandible contains the inferior alveolar nerve, which provides sensation for the lower lip and the chin area; the mental foramen is the orifice where it emerges from the bone. Mandibular fractures in the horizontal part of the bone and also in the angle can affect the nerve and its functions (Panesar & Susarla, 2021). Several types of fractures have been described:

Received: 2024, January 13; Accepted for publication: 2024, January 20

Address for correspondence: Histology Department, Iuliu Hațieganu University of Medicine and Pharmacy, No. 6 Louis Pasteur Street, 400349 Cluj-Napoca, Romania

E-mail: annemarie_chindris@yahoo.com

Corresponding author: Anne-Marie Constantin; annemarie_chindris@yahoo.com

<https://doi.org/10.26659/pm3.2024.25.1.52>

direct and indirect (the impact on symphysis can cause the fracture on that site or in the condylar neck area), favorable or unfavorable (according to fragments displacement due to muscle action), with horizontal, and vertical, oblique or combined direction (Rai, 2021). While complete fractures can occur in adults, green stick fractures are found in children (Yuen et al., 2023).

The fractures can be localized in different areas of the mandibular bone: symphyseal/parasymphyseal, horizontal area (canine and mental foramen area), angle, condyle, and coronoid process. The fractures usually occur in the anterior part of the bone (symphysis or parasymphyseal area 30-50%), to a lesser extent in the lateral area horizontal ramus 21-36%, angle 15-26%) and condyles (20-26%) (Fig. 1) and less frequently in the vertical ramus (2-4%) and in the coronoid process (1-2%) (Panesar & Susarla, 2021). The patients can present different symptoms such as pain, swelling, facial asymmetry, trismus, occlusal changes, reduced or lack of sensitivity in the lower lip and chin area, teeth trauma, and lacerations (Yuen et al., 2023).

Hypothesis

The study aimed to focus on the problems related to mandibular fractures due to sports-related trauma in the cranial area.

Material and methods

The paper addresses several fracture types according to the author's perspective and expertise, with particular emphasis on various paraclinical assessment varieties.

Results

The diagnosis of the fracture, especially in the head and neck region, is based on clinical examination combined with paraclinical investigations such as panoramic radiography (Fig. 2), frontal cephalogram (Fig. 3), computed tomography (Fig. 4) of the bone and magnetic resonance imaging (Fig. 5) for the soft tissue evaluation (Nardi et al., 2020).

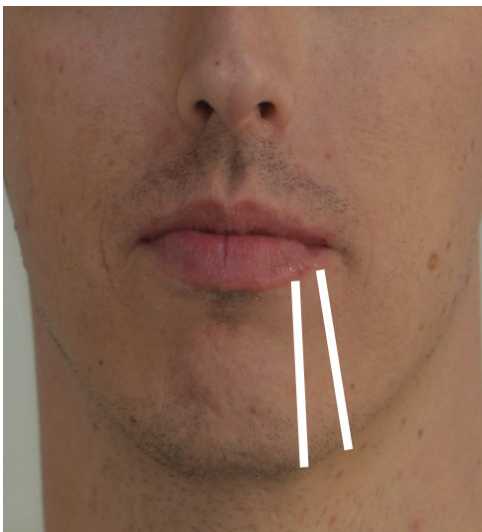


Fig. 1 – Evaluation of the bone and soft tissues (line: parasymphyseal fracture, canine area fracture).



Fig. 2 – Panoramic radiograph for bone diagnosing bone fractures: combined fracture of the horizontal and vertical ramus of the mandible.

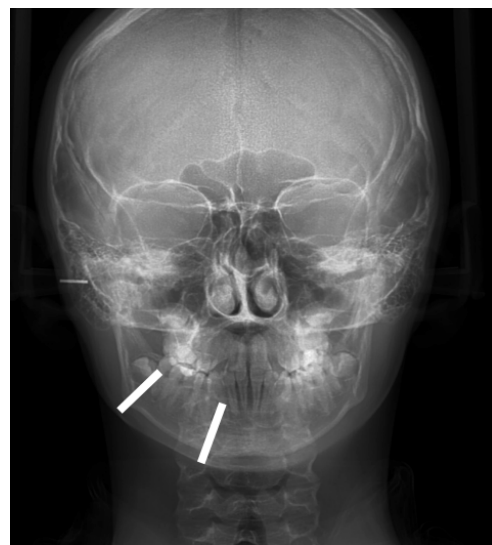


Fig. 3 – Frontal cephalogram: fracture of the angle of the mandible, including the third molar (line) and parasymphyseal fracture (line).



Fig. 4 – Cone beam computed tomography for diagnosis and treatment planning in case of trauma of the head and neck.

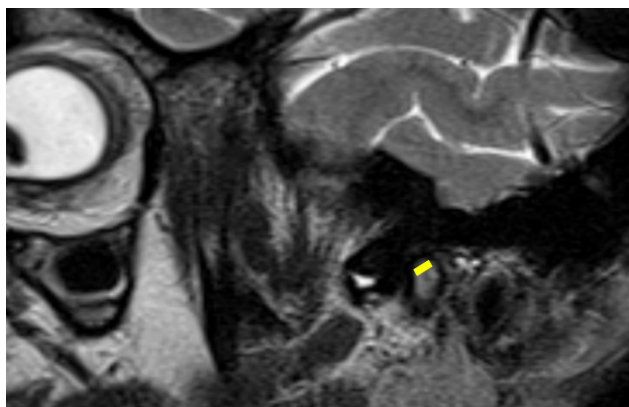


Fig. 5 – Magnetic resonance imaging of the temporomandibular joint: condylar fracture (line).

The treatment of the fracture is influenced by the localization of the fracture, the type (open, closed), patient's characteristics, and it consists of non-invasive approaches (Fig. 6), or reduction and immobilization with internal or intermaxillary fixations (Nasser et al., 2013) by using closed reduction (manual reduction/traction devices), or open reduction (surgical intervention using plates, screws) (Singarapu et al., 2023).

At sporting events, the use of oral appliances, and splints as well, can lower the risk of temporomandibular joint damage. Along with enhancing physical effectiveness and lowering the risk of additional cervical and face accidents, they also substantially contribute to the participant's well-being (Singarapu et al., 2023). It has been shown that pressure on the joint disk and mandibular condyle can be significantly reduced when wearing an occlusal appliance (Tribst et al., 2020).



Fig. 6 – Occlusal splints as a conservative treatment method.

Discussion

Trauma injuries are frequent in routine dental care, particularly mandibular fractures. Knowledge of the latest techniques in head and neck trauma rehabilitation, particularly when it comes to removable devices, like splints, might facilitate decision-making and render the process of post-treatment repair more straightforward.

Various guidelines have recently been introduced by the International Association of Dental Traumatology (IADT) and the Academy for Sports Dentistry (ASD), such as elementary preventative measures for dental

trauma throughout one's lifetime (O'Connell et al., 2024), the use of orthodontic treatment to prevent oral and dental trauma (Abbott et al., 2024), subsequent avoidance of dental trauma (Tewari et al., 2024) and education (Tewari et al., 2024, Suppl 1).

Research has examined the effectiveness of occlusal splint treatment in preventing and immediate resolution of condylar post-fracture disorders. The results indicate that using interocclusal splints can help prevent and manage the condition. Additionally, using splints led to less pain and more effective mouth opening (Prathap et al., 2020). Moreover, using splints for managing youngsters' jawbone fractures is both secure and effective (Khairwa et al., 2015).

While conservative treatment is the favored method for managing mandibular fractures, studies have demonstrated that, in adults with condylar head fractures, a surgical procedure can enhance temporomandibular joint function and morphological features compared to alternative therapies. (Ren et al., 2020).

In difficult cases, surgical interventions must be performed for the treatment of post-traumatic facial defects to restore proper bone structure (Bharti et al., 2023). For the treatment of zygomaticomaxillary complex injuries, surgical treatment using mini plates was found to be the most effective rehabilitation currently available (Singh Payak et al., 2023).

Regarding fractures in professional footballers, though only 10% of them experienced facial fractures, nearly all players returned to competing at a comparable professional stage after treatment, it was shown that long-term consequences of fractures remain unidentified (Ngai et al., 2023).

Understanding the underlying processes, attributes, and implications of fractures in the head and neck region as well as overseeing alternatives to therapy is crucial for improving general sporting activities security and developing targeted strategies, as these injuries can have significant repercussions for both appearance and functionality. To track the progression of a potential sports injury in the head and neck area, a team of specialists including a prosthodontist, orthodontist, temporomandibular joint specialist, and maxillofacial surgeon must collaborate. We can endeavor to avoid injuries altogether and, if they do occur, lessen their effects only by collaborating. Sequential execution of the course of action is yet another choice, ranging from the simplest to the most challenging treatment option.

Conclusions

1. Sports accidents can cause several injuries in the cephalic area, as a consequence of different types of impact forces.
2. Mandibular fractures are among the most frequent facial fractures, influenced by the characteristics and position of the mandibular bone.
3. Localization of the fracture depends on several factors the area of contact, the intensity of the force, and the age of the patient.
4. Symptoms can vary, according to the type of fracture, but they usually have extraoral and intraoral

manifestations.

5. The diagnosis is established after a detailed facial and oral examination, associated with paraclinical examination.

6. Non-invasive treatment is possible in favorable situations, but surgical interventions cannot be avoided in severe fractures.

7. As the fractures in the head and neck area can have severe esthetic and functional consequences, it is mandatory to improve overall sports safety and establish specific strategies, by recognizing the mechanisms, characteristics, and outcomes of the fractures and managing the treatment possibilities.

8. A temporomandibular joint specialist, a prosthodontist, an orthodontist, and a maxillofacial surgeon must work together to monitor a possible sports accident in the head and neck region.

Conflict of interests

None declared.

Acknowledgments

The authors express their gratitude to Associate Professor Oana Almășan for providing the illustrations.

References

- Abbott PV, Tewari N, Mills SC, Stasiuk H, Roettger M, O'Connell AC, Levin L. The International Association of Dental Traumatology (IADT) and the Academy for Sports Dentistry (ASD) guidelines for prevention of traumatic dental injuries: Part 7: Orthodontics for the prevention of dental and oral trauma. *Dent Traumatol.* 2024;40 Suppl 1:16-17. doi: 10.1111/edt.12927.
- Bharti P, Gupta H, Kumar A. Treatment of Post-traumatic Facial Deformities. *J Maxillofac Oral Surg.* 2023;22(4):972-978. doi: 10.1007/s12663-023-01892-w.
- Ellis E, Moos KF, El-Attar A. Ten years of mandibular fractures: An analysis of 2,137 cases. *Oral Surg Oral Med Oral Pathol.* 1985;59(2):120-129. doi: 10.1016/0030-4220(85)90002-7.
- Erdmann D, Follmar KE, DeBruijn M, Bruno AD, Jung S-H, Edelman D, Mukundan S, Marcus JR. A Retrospective Analysis of Facial Fracture Etiologies. *Ann Plast Surg.* 2008;60(4):398-403. doi: 10.1097/SAP.0b013e318133a87b.
- Huelke DF. Location of mandibular fractures related to teeth and edentulous regions. *J Oral Surg Anesth Hosp Dent Serv.* 1964;22:396-405. PMID: 14178798.
- Kelley P, Crawford M, Higuera S, Hollier LH. Two Hundred Ninety-Four Consecutive Facial Fractures in an Urban Trauma Center: Lessons Learned. *Plast Reconstr Surg.* 2005;116(3):42e-49e. doi: 10.1097/01.prs.0000177687.83247.27.
- Khairwa A, Bhat M, Sharma A, Sharma R. Management of Symphysis and Parasymphysis Mandibular Fractures in Children Treated with MacLennan Splint: Stability and Early Results. *Int J Clin Pediatr Dent.* 2015;8(2):127-32. doi: 10.5005/jp-journals-10005-1298.
- Koshy J, Feldman E, Chike-Obi C, Bullocks J. Pearls of mandibular trauma management. *Semin Plast Surg.* 2010;24(4):357-374. doi: 10.1055/s-0030-1269765.
- Nardi C, Vignoli C, Pietragalla M, Tonelli P, Calistri L, Franchi L, Preda L, Colagrande S. Imaging of mandibular fractures: a pictorial review. *Insights Imaging.* 2020;11(1):30. doi: 10.1186/s13244-020-0837-0.
- Nasser M, Pandis N, Fleming PS, Fedorowicz Z, Ellis E, Ali K. Interventions for the management of mandibular fractures. *Cochrane Database Syst Rev.* 2013;(7):CD006087. doi: 10.1002/14651858.CD006087.pub3.
- Ngai ASH, Beasley I, Materne O, Farooq A, Tabben M, Chebbi S, Ellouze Z, Arnáiz J, Alkhelaifi K, Bahr R, Chamari K. Fractures in professional footballers: 7-years data from 106 team seasons in the Middle East. *Biol Sport.* 2023;40(4):1117-1124. doi: 10.5114/biolSport.2023.125588.
- O'Connell AC, Abbott PV, Tewari N, Mills SC, Stasiuk H, Roettger M, Levin L. The International Association of Dental Traumatology (IADT) and the Academy for Sports Dentistry (ASD) guidelines for prevention of traumatic dental injuries: Part 2: Primary prevention of dental trauma across the life course. *Dent Traumatol.* 2024;40 Suppl 1:4-6. doi: 10.1111/edt.12924.
- Panesar K, Susarla SM. Mandibular Fractures: Diagnosis and Management. *Semin Plast Surg.* 2021;35(4):238-249. doi: 10.1055/s-0041-1735818.
- Prathap V, Tarun S, S LS, Balasubramanian S, Panneerselvam E, Vb KR. Do Splints Play a Role in the Management of Condylar Postfracture Syndrome After Mandibular Angle Fractures?-A Randomized Controlled Clinical Trial. *J Oral Maxillofac Surg.* 2020;78(2):241-247. doi: 10.1016/j.joms.2019.09.028.
- Rai A. Fractures of the Mandible. In: Bonanthaya K, Panneerselvam E, Manuel S, Kumar VV, Rai A, editors. *Oral and Maxillofacial Surgery for the Clinician [Internet].* Singapore: Springer Nature Singapore. 2021 [cited 2024 Jan 12]. p. 1053-1084. Available from: https://link.springer.com/10.1007/978-981-15-1346-6_52.
- Ren R, Dai J, Zhi Y, Xie F, Shi J. Comparison of temporomandibular joint function and morphology after surgical and non-surgical treatment in adult condylar head fractures. *J Craniomaxillofac Surg.* 2020;48(3):323-330. doi: 10.1016/j.jcms.2020.01.019
- Romero-Morales C, Bravo-Aguilar M, Abuín-Porras V, Almazán-Polo J, Calvo-Lobo C, Martínez-Jiménez EM, López-López D, Navarro-Flores E. Current advances and novel research on minimal invasive techniques for musculoskeletal disorders. *Dis Mon.* 2021;67(10):101210. doi: 10.1016/j.disamonth.2021.101210.
- Shreya S, Baliga SD, Baliga SS. Sports-related facial trauma in the Indian population - A systematic review. *J Indian Soc Pedod Prev Dent.* 2022;40(1):3-8. doi: 10.4103/jisppd.jisppd_505_20.
- Singarapu R, Panneerselvam E, Balasubramaniam S, Nakkeeran KP, Ramanathan M, Raja Vb K. The Role of Mouthguards in Preventing Temporomandibular Joint Injuries During Contact Sports: A Prospective Study. *Front Dent.* 2023;20:12. doi: 10.18502/fid.v20i12.12661.
- Singh Payak A, Bhadouria P, Singh A, Nair G, Randhawa RK, Thakur S, Singh Makkad R. Management of zygomatico maxillary complex fractures. *Bioinformation.* 2023;19(1):120-125. doi: 10.6026/97320630019120.
- Sojot AJ, Meisami T, Sandor GK, Clokie CM. The epidemiology of mandibular fractures treated at the Toronto general hospital: A review of 246 cases. *J Can Dent Assoc.* 2001;67(11):640-644. PMID: 11841744.
- Stamos A, Mills S, Malliaropoulos N, Cantamessa S, Dartevelle J, Gündüz E, Laubmeier J, Hoy J, Kakavas G, Le Garrec S, et al. The European Association for Sports Dentistry, Academy for Sports Dentistry, European College of Sports and Exercise Physicians consensus statement on sports dentistry integration in sports medicine. *Dental Traumatol.* 2020;36(6):680-684. doi: 10.1111/edt.12593.

- Tewari N, Abbott PV, O'Connell AC, Mills SC, Stasiuk H, Roettger M, Levin L. The International Association of Dental Traumatology (IADT) and the Academy for Sports Dentistry (ASD) guidelines for prevention of traumatic dental injuries: Part 5: Secondary prevention of dental injuries. *Dent Traumatol.* 2024;40 Suppl 1:12-13. doi: 10.1111/edt.12929.
- Tewari N, Abbott PV, O'Connell AC, Mills SC, Stasiuk H, Roettger M, Levin L. The International Association of Dental Traumatology (IADT) and the Academy for Sports Dentistry (ASD) guidelines for prevention of traumatic dental injuries: Part 6: Education. *Dent Traumatol.* 2024;40 Suppl 1:14-15. doi: 10.1111/edt.12932.
- Tribst JPM, Dal Piva AMDO, Bottino MA, Kleverlaan CJ, Koolstra JH. Mouthguard use and TMJ injury prevention with different occlusions: A three-dimensional finite element analysis. *Dent Traumatol.* 2020;36(6):662-669. doi: 10.1111/edt.12577.
- Yuen H-W, Hohman MH, Mazzoni T. Mandible Fracture. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2024 Jan 12]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK507705/>