

Sports dentistry: a comprehensive review

Ashish Pandey

Sr. Professor & Head Daswani Dental College, affiliated with Rajasthan University of Health Sciences, Jaipur, Rajasthan, India

Correspondence: Ashish Pandey, Sr. Professor & Head Daswani Dental College, affiliated with Rajasthan University of Health Sciences, Jaipur, Rajasthan, India, +91 8853582863, Email ashishpande26@yahoo.co.in

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Abstract

Sports dentistry is an evolving field, focusing on the prevention, diagnosis, and management of dental and orofacial injuries in athletes. With the increasing global participation in contact sports, dental professionals play a critical role in safeguarding athletes' oral health and performance. This article provides a comprehensive review of the latest advancements in sports dentistry, including protective gear innovation, management of dental trauma, and the integration of digital technology in preventive care. Emphasis is placed on the role of mouthguards, the importance of interdisciplinary collaboration, and recent

developments in biomaterials that enhance the efficacy of dental protection. The review also discusses emerging trends in the field, such as bioactive materials and their application in sports-related dental injuries, and highlights areas where further research is necessary. Ultimately, this article aims to broaden the understanding of sports dentistry's crucial role in athlete health and performance optimization.

Keywords: sports dentistry, dental trauma, mouthguards, biomaterials, athlete oral health, dental protection, orofacial injuries

Introduction

Sports dentistry has emerged as a specialized field within dentistry, focusing on the prevention, diagnosis, and treatment of oral and maxillofacial injuries resulting from athletic activities. The increasing participation in contact sports such as football, rugby, hockey, and combat sports like boxing and mixed martial arts has led to a surge in sports-related dental injuries. According to recent studies, over 30% of athletes in contact sports suffer from orofacial injuries, making it imperative for dental professionals to be well-versed in managing such injuries and preventing them through appropriate protective measures.¹ The scope of sports dentistry has expanded beyond injury management to include preventive strategies, aesthetic considerations, and performance-enhancing interventions. For example, advancements in mouthguard technology have improved not only the protective capabilities of these devices but also their comfort and usability, encouraging greater compliance among athletes. Furthermore, the integration of digital technology into sports dentistry, such as 3D imaging and custom-made protective gear, has revolutionized the field.² This article aims to explore the latest developments in sports dentistry, including the use of advanced biomaterials, digital fabrication techniques, and preventive care protocols. It also highlights the critical role of interdisciplinary collaboration between dental professionals, sports physicians, and athletic trainers in optimizing the oral health and performance of athletes.

Mouthguards: a cornerstone of prevention

One of the most essential aspects of sports dentistry is the prevention of dental injuries through the use of mouthguards. These devices are particularly crucial in contact sports, where the risk of dental trauma is significantly higher. Mouthguards function by absorbing and dispersing the force of impacts, thereby reducing the likelihood

of tooth fractures, avulsions, and soft tissue injuries.³ Recent innovations in mouthguard design have focused on enhancing their protective capabilities while improving athlete compliance. Traditionally, mouthguards were bulky and uncomfortable, leading to poor compliance among athletes. However, advancements in materials science have led to the development of thinner, more flexible mouthguards made from thermoplastic materials that offer superior protection without compromising comfort.⁴ Custom-made mouthguards, fabricated using digital scanning and 3D printing technologies, provide a perfect fit for each athlete, ensuring optimal protection and comfort.⁵ In addition to preventing dental injuries, there is emerging evidence that mouthguards may play a role in improving athletic performance. Some studies suggest that custom-made mouthguards can enhance respiratory function, reduce muscle fatigue, and improve balance by maintaining optimal jaw alignment during physical exertion.⁶ While further research is needed in this area, the potential performance benefits of mouthguards underscore their importance in sports dentistry.

Management of dental trauma in sports

Despite the best preventive measures, dental trauma remains a common occurrence in sports. Dental professionals must be well-equipped to manage a range of injuries, including tooth fractures, avulsions, and soft tissue lacerations. The immediate management of dental trauma is critical in preserving the athlete's oral health and minimizing long-term damage.⁷ For avulsed teeth, the timing of replantation is crucial. Teeth that are replanted within 30 minutes of the injury have a higher chance of survival, while delays in replantation significantly reduce the prognosis. The use of storage media such as saline, milk, or specialized dental storage solutions can help preserve the viability of the periodontal ligament cells until replantation is possible.⁸ Dental professionals working with athletes should ensure that they are familiar with the protocols for managing avulsed teeth and educate athletes

and sports teams on the importance of prompt treatment. In cases of tooth fractures, the management strategy depends on the severity of the fracture. Minor enamel fractures may require simple smoothing or bonding, while more severe fractures involving the dentin or pulp may necessitate restorative procedures such as composite bonding, root canal therapy, or even crown placement.⁹ Advances in dental materials, particularly the development of bioactive materials that promote healing and tissue regeneration, have improved the outcomes of restorative treatments for dental trauma.¹⁰

Advances in biomaterials for sports dentistry

The field of sports dentistry has benefited greatly from the development of advanced biomaterials that enhance the protection and repair of dental tissues. One such innovation is the use of bioactive materials in the fabrication of protective devices and restorative treatments. Bioactive materials interact with the surrounding tissues to promote healing and regeneration, making them particularly useful in managing sports-related dental injuries.¹¹ In recent years, researchers have explored the use of bioactive glass in mouthguard fabrication. Bioactive glass is known for its ability to bond with natural tissues and release ions that stimulate bone and tissue regeneration. When incorporated into mouthguards, bioactive glass may help reduce inflammation and promote the healing of minor soft tissue injuries, providing additional benefits beyond mechanical protection.¹² Similarly, bioactive materials have been integrated into dental restorative materials used in the management of sports-related dental trauma. For example, bioactive composites and cements can promote the remineralization of tooth structure, enhancing the long-term prognosis of restorative treatments following traumatic injuries.¹³

The role of digital technology in sports dentistry

Digital technology has revolutionized many aspects of dentistry, and sports dentistry is no exception. Digital scanning and 3D printing technologies have enabled the production of highly accurate and customized protective gear for athletes. Digital impressions, taken using intraoral scanners, provide precise measurements of the athlete's dentition, which can be used to fabricate custom mouthguards that offer superior fit and protection compared to traditional boil-and-bite models.¹⁴ In addition to improving the fabrication of mouthguards, digital technology has enhanced the diagnostic capabilities of dental professionals working with athletes. Cone-beam computed tomography (CBCT) and other advanced imaging techniques allow for detailed evaluation of dental and maxillofacial structures, enabling more accurate diagnosis and treatment planning for sports-related injuries.¹⁵ These technologies also facilitate the monitoring of healing and the early detection of complications following dental trauma.

Emerging trends and future directions

As the field of sports dentistry continues to evolve, several emerging trends are poised to shape its future. One such trend is the growing interest in the use of regenerative medicine techniques to treat sports-related dental injuries. Stem cell therapy, for example, holds promise for the regeneration of damaged dental tissues and may offer new treatment options for athletes suffering from severe dental trauma.¹⁶ Another area of interest is the development of smart mouthguards equipped with sensors that monitor impact forces and detect potential concussions. These devices, which are currently in the experimental stage, could provide real-time data to athletes and

medical teams, allowing for the early detection of head injuries and prompt intervention.¹⁷ Finally, the increasing awareness of the link between oral health and overall athletic performance is driving greater collaboration between dental professionals, sports physicians, and athletic trainers. Research has shown that poor oral health can negatively impact athletic performance by causing pain, infections, and systemic inflammation.¹⁸ By working together, healthcare professionals can ensure that athletes maintain optimal oral health, thereby enhancing their performance and reducing the risk of injury.

Conclusion

Sports dentistry is an essential and rapidly growing field that addresses the unique oral health needs of athletes. By focusing on injury prevention, timely and effective management of dental trauma, and integrating cutting-edge technologies such as digital imaging and advanced biomaterials, dental professionals can significantly reduce the risk of sports-related dental injuries and enhance athletes' overall well-being. The development of bioactive materials and the growing interest in regenerative medicine provide promising new avenues for treatment, ensuring that sports dentistry remains at the forefront of both preventive and therapeutic dental care. The collaboration between dental professionals, sports teams, and athletic trainers is critical to improving athletes' oral and systemic health. Future advancements, such as smart mouthguards and regenerative techniques, will further strengthen the field, providing athletes with better protection and care. As the sports industry continues to grow globally, sports dentistry must continue evolving to meet the increasingly complex needs of athletes at all levels of competition.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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