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REVIEW ARTICLE / DERLEME

The Role of Sports Dentistry in Athlete Health and Performance: A Narrative Review

Spor Diş Hekimliğinin Sporcu Sağlığı ve Performansındaki Yeri: Anlatısal Bir Derleme

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ABSTRACT

Sports dentistry is a specialized branch of dentistry that focuses on the prevention, diagnosis, and management of diseases and injuries affecting the stomatognathic system within the context of sports and physical activity. Recent research indicates that elite athletes experience a high prevalence of dental caries, erosion, trauma, and periodontal disease. These oral health issues may impact both overall health and athletic performance. Therefore, sports dentistry is increasingly recognized as an essential component of sports medicine. Safeguarding athletes' oral health, addressing injuries and pathologies, and enhancing performance necessitate a multidisciplinary approach. A member of this multidisciplinary team is the sports dentist. Effective coordination between sports physicians and sports dentists facilitate comprehensive care of the stomatognathic system. This narrative review aims to raise awareness of sports dentistry by exploring its scope and examining its impact on athlete health and performance in light of current literature.

Keywords: Athlete health, sports dentistry, athletic performance, oral health, multidisciplinary approach

ÖZ

Spor diş hekimliği; spor ve egzersizle ilişkili olarak gelişen ağız-çene sistemi hastalıkları ile yaralanmaların önlenmesi, tanısı ve tedavisiyle ilgilenen özel bir diş hekimliği dalıdır. Son yıllarda yapılan araştırmalar, elit sporcularda yüksek oranda diş çürüğü, diş erozyonu, dental travmalar ve periodontal hastalık olduğunu göstermiştir. Bu durum hem sporcu sağlığını hem de spor performansını doğrudan etkileyebilir. Bu nedenle, spor diş hekimliği, spor hekimliğinin temel bir bileşeni olarak giderek daha fazla kabul görmektedir. Sporcu sağlığının korunması, gelişen sakatlıkların ve/veya hastalıkların tedavisi, sportif performansın arttırılmasına yönelik katkıların ve araştırmaların yapılması multidisipliner yaklaşımları gerektirmektedir. Bu multidisipliner ekibin bir üyesi de spor diş hekimidir. Spor hekimleri ile spor diş hekimleri arasındaki ekip çalışması ve yakın iş birliği, stomatognatik sistemin etkili bir şekilde yönetilmesini mümkün kılar. Bu anlatısal derleme, spor diş hekimliğinin kapsamını, sporcu sağlığı ve performansı üzerindeki etkilerini güncel literatür ışığında inceleyerek bu alandaki farkındalığı artırmayı hedeflemektedir.

Anahtar Sözcükler: Sporcu sağlığı, spor diş hekimliği, sportif performans, oral sağlık, multidisipliner yaklaşım.

INTRODUCTION

The World Health Organization (WHO) defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" [1]. This comprehensive perspective also underpins contemporary assessments of athlete health. Rather than limiting athlete health to the mere absence of

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pathology, current models regard it as a multidimensional construct encompassing physical performance, psychological balance, and social adaptation. Athletes-individuals with exceptional physical capabilities and rigorous training and competition schedules-must therefore be evaluated through a similarly holistic lens.

Maintaining and enhancing athlete health requires collaboration across multiple scientific disciplines. For decades, sports nutrition and sports psychology have formed core pillars of this multidisciplinary framework, safeguarding both performance and general well-being [2]. Dentistry began contributing to sports-related health services in the 1960s and has expanded its role through original research in sports dentistry since the early 2000s [3-5].

Emerging evidence shows that neglected oral health leads not only to localized diseases but also to systemic complications [6, 7]. Poor oral status has been associated with diabetes, cardiovascular disease, and lower respiratory tract infections [7]. Psychosocial consequences-such as reduced self-confidence, decreased social interaction and social isolation-are equally significant [8]. For athletes, dental infections, periodontal disease, or problematic third molars have been associated with disruptions in training and competition, and may contribute to reduced athletic performance [9]. Even among Olympic-level athletes, oral health is frequently suboptimal [10], a situation attributed to irregular dental visits, scheduling conflicts with training, financial concerns, and limited awareness of the performance-related implications of oral disease [10]. While direct evidence in athletic populations remains limited, general dental literature suggests that good oral health may support efficient digestion and overall systemic well-being, which could indirectly influence athletic output [7, 8].

Today, a multidisciplinary approach is widely adopted to preserve athletes' health and enhance performance. Within this framework, sports dentists play an indispensable role by preventing, identifying, and managing common oral conditions among athletes [4]. Tooth decay, erosion, traumatic injuries, xerostomia, and bruxism all fall within their scope of practice [11]. Moreover, because certain dental medications are prohibited in sports, the field holds additional significance [12].

This narrative review outlines the definition, historical development, and clinical responsibilities of sports dentistry while examining its intersection with sports medicine and related disciplines. It draws on peer-reviewed literature as well as consensus documents and position statements from leading international organizations such as the International Olympic Committee (IOC) and the European Association for Sports Dentistry (EA4SD). Specifically, we explore the impact of oral health on athletic performance, highlight preventive strategies, and propose athlete-centered dental protocols.

For the purposes of this narrative review, the authors consulted peer-reviewed literature from major scientific databases, including PubMed, Scopus, and Web of Science. The search was guided by key terms and concepts such as "sports dentistry," "oral health in athletes," "athletic performance," "stomatognathic system," and "mouthguards." Priority was given to recent publications (primarily from the last two decades) as well as consensus documents and position statements from recognized international bodies, including the International Olympic Committee (IOC) and the European Association for Sports Dentistry (EA4SD), to ensure a clinically relevant and up-to-date synthesis of the field.

SPORTS DENTISTRY

Sports dentistry is a specialized branch of dentistry dedicated to protecting athletes' oral health and managing dental conditions that may compromise performance. Officially recognized by the International Olympic Committee (IOC) in 2008, this discipline focuses on the prevention, diagnosis, and treatment of sport-related injuries to intra- and extraoral tissues [13]. Dental services have, however, been available at the Olympic Games since the 1920s, and the inclusion of dentists in the IOC Medical Commission in 1999 provided formal structure to the field. Innovations such as custom-fitted mouthguards and on-field emergency protocols for managing tooth fractures, soft-tissue lacerations, and

maxillofacial trauma-particularly in football, boxing, and other contact sports-have since emerged [14].

Today, sports dentistry is an integral component of multidisciplinary sports medicine, playing a key role in safeguarding athlete health and optimizing performance [15-17].

Two principal domains guide the practice of sports dentistry: the physiological changes induced by exercise and the prevention of orofacial injuries. Saliva regulates oral pH, modulates the microbiome, and facilitates enamel remineralization [18]. However, exercise-induced tachypnea and dehydration reduce salivary flow, weakening the body's natural defense mechanisms. Additionally, oxidative stress caused by physical activity can trigger inflammatory responses in periodontal tissues [11]. As a result, sports dentists develop preventive strategies by monitoring salivary pH, microbial load, and ecological balance [19].

Orofacial trauma, bruxism, and temporomandibular joint (TMJ) disorders are common among both professional and recreational athletes [5]. Preventive measures include the use of personalized mouthguards, educational programs, and injury surveillance databases [14]. Through clinical practice and research, sports dentistry plays a vital role in promoting athlete welfare.

A Holistic Approach to Athlete Health and the Role of Sports Dentistry

Consensus statements from the European Association for Sports Dentistry (EA4SD), the Academy of Sports Dentistry (ASD), and the European College of Sports and Exercise Physicians (ECOSEP) emphasize the necessity of multidisciplinary collaboration and call for routine dental assessments within athlete health screenings [4]. Optimizing athlete health and performance requires the integration of sports dentistry with sports medicine, nutrition, physiology, and psychology. Collaboration spans stomatognathic assessment, infection control, and nutritional planning [3].

Excessive carbohydrate intake elevates caries risk, while the acidity of sports drinks promotes dental erosion [20]. Accordingly, sports dietitians and sports dentists collaborate to mitigate these effects [21, 22]. Oral motor activity can influence postural control and sport-specific performance, highlighting the functional relevance of dental-motor interactions in athletes [23].

In sum, oral diseases-from dental caries to temporomandibular disorders-can impair performance and trigger systemic complications. Although factors such as diet, hydration, and physiological stress significantly influence oral health, their management lies at the intersection of multiple disciplines. Sports dentists should not operate in isolation but rather collaborate with sports nutritionists, physicians, and psychologists to ensure that oral health strategies are aligned with performance goals and evidence-based medical practice. Regular oral examinations, preventive interventions, and cross-disciplinary cooperation are imperative.

Effects of the Stomatognathic System on Oral and Systemic Health

The stomatognathic system comprises the maxillofacial skeleton; dento-alveolar structures, temporomandibular joint (TMJ), and associated neuromuscular networks [24]. Dysfunction within this complex can precipitate far-reaching physiological sequelae. Malocclusion or mandibular dysfunction has been observed in some studies to correlate with increased upper-airway resistance and has been proposed as a potential contributor to obstructive sleep apnoea, though robust evidence in athletic populations remains limited [25]. Chronic orofacial pain and bruxism enhance sympathetic activity and impair cardiovascular regulation [26-28]. Asymmetric masticatory muscle activation has been suggested to potentially destabilise the cervico-thoracic region and may be associated with reduced lower-limb force production and proprioceptive acuity, although further research is needed to confirm this relationship [29]. Temporomandibular joint disorders may be associated with alterations in postural alignment and gait biomechanics, while periodontal inflammation has been linked to an elevated systemic inflammatory burden, which may, in turn, be related to delayed musculoskeletal recovery and an increased risk of recurrent injury [11].

Collectively, these data suggest that stomatognathic dysfunction may impact respiratory, cardiovascular, postural, and performance parameters. The relationship between stomatognathic dysfunction and postural or biomechanical outcomes appears complex and multifactorial, requiring further high-quality research to clarify its significance in athletes.

Risk Factors Affecting Oral Health in Athletes

Athletes encounter numerous risk factors for oral disease, including physiological, nutritional, psychological, and traumatic influences [30].

1. Physiological changes related to exercise

During strenuous activity, salivary flow and secretory immunoglobulin A (s-IgA) levels decline [31-32], weakening mucosal immunity. The resulting "open window" of transient immunosuppression heightens susceptibility to oral infection [31-32]. Salivary biomarkers-such as pH, buffering capacity, microbial load, and s-IgA-are therefore invaluable for monitoring oral and systemic health [33]. Exercise-induced dehydration and reduced salivary flow weaken the mouth's natural defense mechanisms and directly influence the preventive strategies employed in sports dentistry. Therefore, hydration protocols should be evaluated not only for their impact on athletic performance but also for their role in maintaining oral microbial homeostasis.

2. Athlete nutrition

Frequent consumption of carbohydrate-rich, acidic sports drinks, gels, and snacks accelerates dental erosion and caries [20]. Sticky formulations of protein powders and creatine promote plaque accumulation, while dehydration suppresses salivary flow, favoring periodontal disease [21, 22]. Sports dentists, in close coordination with sports nutritionists, should promote strategies to reduce oral health risks, such as minimizing the frequency of carbohydrate consumption, choosing less acidic formulas, gargling with water after consumption, and appropriately timing oral hygiene.

3. Sports-related psychological stress

Increased stress reduces salivation and contributes to bruxism, leading to myofascial pain, TMJ dysfunction, and performance decrements [34].

4. Oral microbiota, inflammation, and hygiene practices

Exercise may alter the oral microbiome, although the functional consequences remain unclear [35]. Intense training-induced immunosuppression and xerostomia exacerbate plaque formation, while inadequate oral hygiene practices-such as the use of fluoride gel by only 11% of athletes and lack of interdental cleaning by 44%-further increase the risk [36, 37].

5. Traumatic factors

Contact and combat sports carry a high risk of dental trauma, particularly when proper protection is not used [14, 38].

Common Oral Health Problems and Epidemiological Findings in Athletes

Large-scale studies confirm high prevalence rates of dental caries, erosion, periodontal disease, temporomandibular joint (TMJ) disorders, and orofacial trauma among athletes [10, 30, 39, 40].

Dental Caries

Carvalho et al. reported that 66% of athletes were at high risk of caries and 52% had active lesions; nonetheless, carbohydrate intake was not significantly associated with caries incidence [15].

Dental Erosion

The prevalence of erosion ranges from 36% to 85%, primarily driven by the consumption of acidic beverages [20, 30].

Periodontal Disease

Gingivitis affects 58%-97% of athletes, and periodontitis affects 5%-41% [11]. Pericoronitis, apical periodontitis, and pulpitis also occur with notable frequency [11].

Malocclusion and TMJ Disorders

Stress-induced bruxism and TMJ dysfunction may manifest as pain, restricted movement, and malocclusion,

with downstream effects on posture and balance [29].

Orofacial Injuries

Approximately one-sixth of all sports injuries involve the orofacial region; 60%-80% of these injuries are preventable with the use of custom-made mouthguards [4, 14].

The Effect of Oral Health on Athletic Performance

Intense physical activity can lead to systemic inflammation, causing structural and immunological changes in oral tissues, which increase the risk of developing periodontal disease [11, 41]. Conversely, chronic inflammatory stress caused by oral infections may suppress the immune system, negatively affect systemic health, and potentially contribute to delayed muscle recovery [11]. Current evidence suggests an association between oral health status and athletic performance, but a direct cause-effect relationship has not been established. In a controlled study on athletes, posterior maxillary and mandibular tooth loss was associated with a measurable decrease in quadriceps muscle strength, suggesting a potential neuromuscular link between dental occlusion and lower-body performance [42]

The literature often emphasizes that athletes generally have poor oral health, which negatively impacts their athletic performance [10, 36, 40, 41]. During the 2012 London Olympics, more than 40% of athletes reported dissatisfaction with their oral health. Of these, 28% observed a negative impact on their quality of life, and 18% reported a negative impact on their training and performance [10].

Research shows that dental caries has a statistically significant negative effect on quality of life and performance. However, no direct significant relationship has been found between dental erosion or periodontal disease and athletic performance [10]. In another study, 17%-30% of athletes reported oral pain, and 3%-9% indicated that this condition prevented them from participating in training or competitions [11]. These findings highlight the importance of oral health for achieving optimal athletic performance.

The incidence of dental trauma in contact sports (e.g., basketball, ice hockey, rugby) ranges from 14% to 47%, while the prevalence of dental caries ranges from 15% to 75%, dental erosion from 36% to 85%, and periodontal disease occurs in approximately 15% of cases [30]. Between 5% and 18% of athletes report that oral health issues directly and negatively impact their performance [30].

Preventive Oral Health Services for Athletes

Preventive health services for athletes are provided through periodic health examinations. Oral health assessments should be integrated into these examinations, as preventable conditions such as dental caries, erosion, and periodontal disease can seriously affect performance [36]. These assessments allow for the early diagnosis of oral diseases, thereby preventing the negative effects of acute and chronic problems on athletic performance.

The integration of sports dentists into the athlete healthcare team is critically important. Sports dentistry supports athletic performance through diagnostic and treatment programs that improve oral health and contribute to performance enhancement by promoting the use of intraoral appliances and standard mouthguards [18]. For example, in golfers, the use of bilateral molar occlusion-supported mouthguards or stabilization splints has been shown to result in significant increases in club head speed and driving distance compared to those who do not use such equipment [43].

Intensive training programs may limit access to preventive dental care; additionally, athletes and support teams may lack sufficient knowledge about oral health. Athletes should undergo dental examinations every 6-9 months. Early diagnosis, replacement of fillings when necessary and radiographic evaluations to identify hidden issues are essential. Early intervention for wisdom tooth problems is particularly important in young athletes, as the presence of impacted wisdom teeth increases the risk of jaw fractures fourfold [13].

Personalized preventive programs should be designed according to the sport discipline, dietary habits, and individual risk factors. Saliva may be used as an important biomarker in determining personalized diet and training protocols in the future [31]. Athletes and coaches should receive regular training on the use of personalized mouthguards, fluoride and probiotic-supported oral hygiene, the effects of nutrition on oral health, and early symptom recognition. Mechanical plaque control-brushing twice daily with fluoride toothpaste and flossing-along with regular professional cleanings, forms the cornerstone of optimal oral hygiene in athletes [19, 31].

Nutrition education programs should emphasize the negative effects of frequent consumption of high-carbohydrate, acidic, and sugary sports foods and beverages on oral health. While an oral-health-optimized diet has been shown to reduce gingival inflammation in non-athletic adults [22], tailored dietary strategies for athletes-balancing performance needs with oral health-require further investigation. Sports clubs and organizations should collaborate with dentists to incorporate periodic examinations and preventive measures into routine services. Hydration strategies should promote water or fluoridated alternatives to acidic sports drinks, and simple behavioral changes, such as rinsing the mouth after drinking, should be encouraged [18].

Mouthguards

Protective equipment such as mouthguards, face masks, and helmets is used to prevent sports injuries. A mouthguard is an elastic device placed inside the mouth to reduce trauma to the teeth and surrounding tissues. There are extra oral, intraoral, and combination types. Intraoral mouthguards can be monomaxillary or bimaxillary, fitting on one or both jaws, and these devices play an important role [44]. Mouthguards not only prevent dental and soft tissue injuries but also distribute impact force, thereby preventing mandibular fractures and orthodontic damage. While some studies suggest that they may reduce concussions and neck injuries, more evidence is needed in this area. Since the 1960s, the use of mouthguards has been mandatory in many sports. The American Dental Association reports that approximately 200,000 injuries per year are prevented by mouthguards in football alone [14].

Establishing standards for mouthguards in sports and introducing them into the field of sports science is one of the responsibilities of sports dentistry. Three main types of mouthguards used by athletes-pre-made models, boil-and-bite models, and custom-made models by dentists-have been studied. Among these, custom-made models provide the highest level of protection [5]. Custom-made mouthguards significantly reduce tooth, dental arch, and soft tissue injuries by increasing opposing tooth contact [38]. However, irregular use and poor hygiene increase the risk of oral lesions and infections. Therefore, mouthguards must be used properly, cleaned daily, and stored in hygienic conditions (in perforated containers in a dry environment). For effective cleaning, 0.5% sodium hypochlorite, hydrogen peroxide, or special foams are recommended; however, care must be taken to avoid deforming the device [19].

The positive effects of mouthguards on performance are still under discussion. It is suggested that by altering the position of the lower jaw, they may increase the patency of blood vessels and nerves in the temporomandibular joint (TMJ), thereby improving oxygen circulation and enhancing muscle strength and endurance [45]. Increases in arm strength have been observed in professional football players using custom mouthguards [46]. It has been demonstrated that mandibular position and intraoral appliances can positively affect not only upper body strength but also endurance, post-competition recovery, concentration, and stress response [47]. Although certain small-scale studies suggest possible benefits, current evidence is insufficient to conclude that mouthguards or occlusal splints provide measurable performance enhancement.

Dentists should obtain detailed medical and dental histories from athletes and prepare mouthguards after radiographic examination. The thickness, flexibility, and comfort of the mouthguard-which should not obstruct breathing-are important. Additionally, athletes, coaches, and parents should be educated and encouraged to use mouthguards. A preventive approach is a fundam-

ental responsibility of both dentists and athletes. Considering that even a minor impact can cause serious dental trauma, the use of mouthguards should be mandatory for all athletes [48].

Anti-Doping and Conscious Prescription Practices in Sports Dentistry

Sports dentists must be thoroughly familiar with the World Anti-Doping Agency (WADA) Prohibited List and its annual updates, as many commonly used dental medications may contain substances that are prohibited in-competition or at all times [49, 50].

Importantly, epinephrine (adrenaline) used in local dental anesthesia is permitted under WADA regulations. According to the 2025 Prohibited List (Section S6.b), epinephrine is only prohibited when administered via systemic routes (e.g., intravenous, intramuscular, or inhalation); its use in local infiltration or nerve blocks for dental procedures does not require a Therapeutic Use Exemption (TUE) [51].

However, certain necessary dental treatments-such as intra-articular, periapical, or soft-tissue injections of glucocorticoids (e.g., triamcinolone, dexamethasone) for temporomandibular joint (TMJ) inflammation or pericoronitis-involve substances that are prohibited in-competition when administered by injection. In such cases, athletes must apply for a Therapeutic Use Exemption (TUE) before receiving treatment. A TUE allows the use of a prohibited substance for legitimate medical reasons, provided that four criteria are met: (1) the condition would significantly impair health if untreated; (2) the substance does not enhance performance beyond a return to normal; (3) there is no reasonable permitted therapeutic alternative; and (4) the necessity is not due to prior use of a prohibited substance [WADA International Standard for Therapeutic Use Exemptions (ISTUE), 2025]. TUE applications are submitted through the athlete's National Anti-Doping Organization (NADO) or the relevant International Federation, depending on their competition level [51].

A survey of Brazilian dentists revealed that many lack sufficient knowledge of anti-doping rules, highlighting the urgent need for targeted education [52]. This lack of awareness poses a serious risk to athletes, as dentists who unknowingly prescribe medications containing banned substances could have severe consequences for the athlete's career. Additionally, the long-term use of anabolic androgenic steroids can cause gingival overgrowth [53], which may lead to significant problems in terms of both aesthetics and periodontal health. Sports dentists have a professional responsibility to verify the status of every medication using WADA's online resources and, when in doubt, consult with the athlete's medical team or anti-doping officer before prescribing or administering treatment [49].

Practical Advice for Athletes

Oral hygiene practices:

Brush twice daily for two minutes with fluoride toothpaste; avoid vigorous rinsing to maximize fluoride uptake; replace toothbrushes every 2-3 months [54, 55].

Dietary considerations:

Reduce frequency and duration of exposure to acidic and sugary sports beverages; rinse with water after consumption to neutralize oral pH [21, 22]. Choose low-cariogenic snacks (e.g., cheese, nuts, fresh fruit) when possible [56, 57].

Hydration:
Maintain adequate hydration to support salivary flow and reduce xerostomia-related caries risk, particularly during prolonged training sessions [31, 37].

Risk behavior:

Avoid tobacco and oral piercings, which are associated with increased risks of periodontal disease, oral cancer, and infection [7, 37].

Trauma management:

Avulsed permanent teeth should be re-implanted as soon as possible-ideally within 15-30 minutes-to maximize periodontal ligament survival and long-term prognosis. If immediate replantation is not feasible, the tooth should be stored in a suitable medium such as cold milk, Hank's Balanced Salt Solution (HBSS), or saliv-

a to maintain cell viability until professional care is available [24].

Use of custom mouthguards and performance-enhancing occlusal splints:

Recent systematic reviews have shown that properly designed custom mouthguards and occlusal splints can not only prevent orofacial injuries but also positively impact neuromuscular coordination, postural balance, and muscle strength in athletes. When tailored to the individual's occlusion and sport type, these devices may offer both protective and performance benefits [58].

CONCLUSION

Sports dentistry plays a vital role in maintaining athletes' oral health, which is closely linked with overall well-being and athletic performance. Due to the high prevalence of dental caries, erosion, periodontal disease, and orofacial trauma among athletes, oral health represents a key component of comprehensive athlete care. The complex relationship between the stomatognathic system and systemic health underscores the importance of early diagnosis, preventive strategies, and interdisciplinary collaboration involving sports physicians, dentists, nutritionists, and physiotherapists. The role of the sports dentist is supportive and preventive. Customized mouthguards, saliva analysis, and athlete-specific oral hygiene protocols help minimize oral health-related disruptions to training and competition. While numerous studies indicate an association between oral health status and athletic performance, current evidence does not yet establish a definitive cause-effect relationship. Future research should continue to explore the impact of oral health on sports performance and develop evidence-based guidelines for athlete-centered dental care.

Conflict of Interest / Çıkar Çatışması

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