**Comment**
Oral health in focus for high-performance athletes

**Abstract**

**Introduction:** Sports competition is increasingly technological and scientific. Studies show a relationship between oral health and elite athlete performance. Knowing the interaction between stomatognathic system behavior and the athlete's habits, helps the dentist to develop and implement preventive-curative planning for the maintenance of general health, inducing athlete positive performance.
**Objective:** Giving an overview and to highlight some aspects that may contribute to the better performance of elite athletes concerning oral conditions as a cause or as a consequence of the professional practice of sports.
**Conclusion:** The preventive or curative dental follow-up to elite athletes is imperative to guarantee the maintenance of their physical performance. Multidisciplinary research has to be developed to demonstrate how Dentistry can contribute directly to improving the performance of this category of athletes. The investment in preventive, interceptive and curative Dentistry in kids and teenage athletes can directly impact on their performance, favoring their professionalization. The interaction between Dentistry and Nutrition must exist on avoiding that the athlete's diet does not harm their oral health.
*Keywords: oral health, athletes, Dentistry, sport, stomatognathic system.*

              Sports competition is becoming increasingly technological and scientific, considering that milliseconds can be decisive. The performance of athletes depends on the interaction between human systems and metabolism, and any change in their physiology will impact the entire functioning of the body. Between these structures, the study of the stomatognathic system (SS) and its correlation, can contribute to the advancement of performance in sport.
              The SS is formed by static structures (mandible, maxilla, dental arches, temporomandibular joints, and hyoid bone) and dynamic structures (masticatory, supra and infrahyoid muscles and tongue, lips and cheek) that act together for the chewing, swallowing, breathing, phonation and sucking functions performing.([1](#_ENREF_1)) In developing these functions, there is a neuromuscular relationship with the rest of the body, for exemple, studies related malocclusion and corporal posture,([2-4](#_ENREF_2)) hence the interest in its study with sports biomechanics. Oral health involves the condition of the teeth and the way how they occlude; the condition of correlated structures, including soft and hard tissues and; the temporomandibular joints, with all their complexity. Odontogenic infections interfere on the immunologic system and the inflammatory chemical mediator’s level altering the human body general function. Besides this, pain development and teeth lost can influencing in the feeding and quality of life.([2](#_ENREF_2), [4](#_ENREF_4), [5](#_ENREF_5)) Discrepancies in the jaws, regarding size, width and how they relate to each other and the cranial base, can lead to changes in posture, breathing, nutrition, and sleep quality.([5-8](#_ENREF_5))
              Ashley et al ([7](#_ENREF_7)), conducted a systematic review, investigating the oral health in high-performance athletes concluding that it is deficient, with the occurrence of dental caries in 75% of athletes, besides other problems such as periodontal disease, dental erosion, and dental trauma. These odontogenic diseases negatively affect athletes performance and training.([6](#_ENREF_6), [9](#_ENREF_9))
              This commentary aims to summarize and highlight some aspects that may contribute to the better performance of elite athletes regarding oral conditions as a cause or as a consequence of professional sports practice.

*Routines in sports practice as determinants for oral health damage*
              Each sport has its peculiarities and should be analyzed individually for oral health damage and its prevention. So the sports dentist should be aware of athlete eating habits, exercise and time that it follows, thus being able to individualize the dental treatment.
              The risk of dental caries, periodontal disease, and dental erosion increases due to acidic and sugar-rich drinks ingestion, high-frequency, high-calorie diets, and the stress caused by exhaustive training.([10](#_ENREF_10)) Stress also contributes to the development of dental clenching and bruxism, with consequent abfraction,([8](#_ENREF_8)) erosion and abrasion injuries. The dehydration and stress predispose to xerostomy,([8](#_ENREF_8)) adding one more risk factor to carie disease, periodontal disease, mucositis, and fungal infection, in addition to bad breath.
              Water sports, which involve training in pools with low pH treated water, can lead to tooth erosion injuries. Besides, chlorine contributes to teeth staining and dental calculus formation, predisposing the athlete to periodontal disease.([11](#_ENREF_11))
              Finally, contact or combat sports increase the likelihood of dental and facial trauma, indicating the use of adequate protection, as the different types of mouthguards.([12](#_ENREF_12), [13](#_ENREF_13))

*Oral health and it's impacting on sporting performance*
              The buccal environment has a rich microflora that, when balanced in a health situation, does not cause systemic change and is not harmful. However, in the presence of odontogenic infections, inflammation mediators and pathogenic microorganisms spread through the bloodstream, causing damage to other systems, such as the cardiovascular and musculoskeletal systems. ([6](#_ENREF_6), [9](#_ENREF_9))
              Considering oral functions, it has been discussed how malocclusion and the joints temporomandibular function can affect the athlete's performance. Literature is controversial about the relationship between posture and balance and occlusion.([2-4](#_ENREF_2), [7](#_ENREF_7), [14](#_ENREF_14), [15](#_ENREF_15)) Taking into account the neuromuscular system and, the close relationship of the stomatognathic system to the skull and the cervical-scapular muscular system, changes on mandibular position, appears to modify the body posture as a whole, which could have consequences for sports performance.

*Understanding and reflecting on the relationship between oral health and sporting performance*
              The professional practice of sports brings the responsibility to athletes to take care of their body, physically and mentally. The medical, physiotherapeutic, nutritional and psychological follow-up seems to be already established to guarantee the athletes' health and performance. However, surprisingly, oral health is not included among the priorities in their planning.
              The odontogenic infections are originated from carious lesions, periodontal diseases, and traumas, by friction or impact. Except for the trauma due to impact, these situations are entirely predictable and controlled by planning dental care.
              Considering that the routine training is cyclical, becoming more intense near the competitions and, during these, it becomes impracticable to stop to perform any dental treatment, it is essential to have a protocol of dental care aimed at the best use of training times and their intervals, preventing complications in the decisive moments for the athlete. A protocol with examinations and restoration of oral health can prevent dental pain, inflammation or infections, temporomandibular disorders, or even, traumas, which could weaken other systems or turn it impossible some competition. The drugs needed to treat an odontogenic problem can also interfere with doping tests and should be used with caution near competitions.
              The high rates of dental caries, periodontal disease and dental erosion among elite athletes in many countries demonstrate that there is a lack of information about the benefits of preventive and also outpatient oral health care needing guidance.([5](#_ENREF_5), [16](#_ENREF_16))
              To prevent dental caries and dental erosion related to frequent intake of supplements, carbohydrates and acidic beverages, the dentist and nutritionist, should jointly participate in the athlete's dietary orientation, ensuring their nutrition and oral health concomitantly.
              Although the literature is controversial about the stomatognathic system and musculoskeletal system relation,([2](#_ENREF_2), [4](#_ENREF_4), [15](#_ENREF_15)) occlusal problems like a crossbite, transverse maxillary deficiency and other factors causing mandibular deviation and neuromuscular adjustment, should be treated since the child and youth leagues.

              Considering the potential of the young athletes to develop and professionalize themselves achieving high performance, the oral health care, as preventive, interceptive and curative form, from kids and teenage sports categories will lead the Dentistry to contribute in fact to a significant increase in its performance.

 REFERENCES

1. Baldo Mvc. *Fisiologia Oral - Série Fundamentos de Odontologia*. Santos, editor. São Paulo2013.

2. Parrini S, Comba B, Rossini G, Ravera S, Cugliari G, De Giorgi I, et al. Postural changes in orthodontic patients treated with clear aligners: A rasterstereographic study. *J Electromyogr Kinesiol*. 2018 Feb;38:44-8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/29156321>. S1050-6411(17)30144-X [pii]

10.1016/j.jelekin.2017.11.002.

3. Dias AA, Redinha LA, Silva LM, Pezarat-Correia PC. Effects of Dental Occlusion on Body Sway, Upper Body Muscle Activity and Shooting Performance in Pistol Shooters. *Appl Bionics Biomech*. 2018;2018:9360103. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/30140310>. 10.1155/2018/9360103.

4. Khan MT, Verma SK, Maheshwari S, Zahid SN, Chaudhary PK. Neuromuscular dentistry: Occlusal diseases and posture. *J Oral Biol Craniofac Res*. 2013 Sep-Dec;3(3):146-50. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25737904>. 10.1016/j.jobcr.2013.03.003

S2212-4268(13)00027-4 [pii].

5. Gallagher J, Ashley P, Petrie A, Needleman I. Oral health and performance impacts in elite and professional athletes. *Community Dent Oral Epidemiol*. 2018 Dec;46(6):563-8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/29938820>. 10.1111/cdoe.12392.

6. Henriques P, Sukekava F. The Importance of Oral Health in High Performance Athletes: A Brief Review. *Journal of Dentistry and Oral Health*. 2017;2:1-4. Available.

7. Ashley P, Di Iorio A, Cole E, Tanday A, Needleman I. Oral health of elite athletes and association with performance: a systematic review. *Br J Sports Med*. 2015 Jan;49(1):14-9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25388551>. 10.1136/bjsports-2014-093617

bjsports-2014-093617 [pii].

8. Needleman I, Ashley P, Fine P, Haddad F, Loosemore M, de Medici A, et al. Oral health and elite sport performance. *Br J Sports Med*. 2015 Jan;49(1):3-6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25263651>. 10.1136/bjsports-2014-093804

bjsports-2014-093804 [pii].

9. Jeffcoat MK, Jeffcoat RL, Gladowski PA, Bramson JB, Blum JJ. Impact of Periodontal Therapy on General Health: Evidence from Insurance Data for Five Systemic Conditions. *American Journal of Preventive Medicine*. 2014 2014/08/01/;47(2):166-74. Available from: <http://www.sciencedirect.com/science/article/pii/S0749379714001536>. https://doi.org/10.1016/j.amepre.2014.04.001.

10. Needleman I, Ashley P, Fairbrother T, Fine P, Gallagher J, Kings D, et al. Nutrition and oral health in sport: time for action. *Br J Sports Med*. 2018 Dec;52(23):1483-4. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/29853456>. 10.1136/bjsports-2017-098919

bjsports-2017-098919 [pii].

11. Rose KJ, Carey CM. Intensive swimming: can it affect your patients' smiles? *J Am Dent Assoc*. 1995 Oct;126(10):1402-6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/7594012>. S0002-8177(15)61275-2 [pii]

10.14219/jada.archive.1995.0051.

12. Fernandes LM, Neto JCL, Lima TFR, Magno MB, Santiago BM, Cavalcanti YW, et al. The use of mouthguards and prevalence of dento-alveolar trauma among athletes: A systematic review and meta-analysis. *Dent Traumatol*. 2019 Feb;35(1):54-72. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/30222244>. 10.1111/edt.12441.

13. ADA. Using mouthguards to reduce the incidence and severity of sports-related oral injuries. *J Am Dent Assoc*. 2006 Dec;137(12):1712-20; quiz 31. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17138717>. S0002-8177(14)64802-9 [pii]

10.14219/jada.archive.2006.0118.

14. Solleveld H, Flutter J, Goedhart A, VandenBossche L. Are oral health and fixed orthodontic appliances associated with sports injuries and postural stability in elite junior male soccer players? *BMC Sports Sci Med Rehabil*. 2018;10:16. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/30377533>. 10.1186/s13102-018-0105-5

105 [pii].

15. Ohlendorf D, Riegel M, Lin Chung T, Kopp S. The significance of lower jaw position in relation to postural stability. Comparison of a premanufactured occlusal splint with the Dental Power Splint. *Minerva Stomatol*. 2013 Nov-Dec;62(11-12):409-17. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24270202>. R18Y2013N11A0409 [pii].

16. Needleman I, Ashley P, Meehan L, Petrie A, Weiler R, McNally S, et al. Poor oral health including active caries in 187 UK professional male football players: clinical dental examination performed by dentists. *Br J Sports Med*. 2016 Jan;50(1):41-4. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/26527674>. 10.1136/bjsports-2015-094953

bjsports-2015-094953 [pii].