






Clinical and behavioral conditions in the oral health of volleyball and soccer athletes: a cross-sectional study

Jullian Josnei de Souza¹ , Juliana Squizzato Leite¹ , Ricardo Bahls² , Rodrigo Stanislawczuk Grande^{3,4} , Fabio Andre Santos⁴ 

¹ Department of Dentistry, Ponta Grossa State University, PR, Brazil.

² Private practice, Ponta Grossa, PR, Brazil.

³ Department of Dentistry, Campos Gerais Higher Education Center (CESCAGE), Ponta Grossa – PR, Brazil.

⁴ Department of Dentistry, Ponta Grossa State University, PR, Brazil.

Corresponding author:

Fábio André Santos
Department of Dentistry, Ponta Grossa State University, PR, Brazil;
Ave. Carlos Cavalcanti, n.4748,
ZipCode: 84030-900
Ponta Grossa, PR, Brazil
e-mail: fasantos@uepg.br

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Aim: In this cross-sectional study, we evaluated the oral hygiene habits, oral health conditions, and the perception about the influence of oral health conditions on the physical performance of youth and professional volleyball and soccer athletes.

Methods: A total of 96 male athletes participated: 48 volleyball players (25 youth and 23 professional players); and 48 soccer players, of whom 22 were youth, and 26 were professional players. We analyzed the oral hygiene and oral health condition (daily toothbrush, flossing, mouthwash, dental plaque, orthodontic treatment, dental/facial trauma, temporomandibular dysfunction, malocclusion, and the athletes' perception about the influence of oral health conditions on the physical performance (yes or no)). Comparisons were made between the youth and professional athletes for each sport (volleyball and soccer). According to each variable, we applied the Chi-square, Fisher's Exact, and Mann-Whitney tests. **Results:** For soccer athletes, we found significant differences between youth and professionals for: flossing ($p=0.014$), orthodontic treatment ($p=0.028$), dental/facial trauma ($p=0.041$), and the athletes' perception about oral health and physical performance ($p<0.001$). Considering the category (youth and professional) regardless of the type of sport, we found significant differences for dental plaque ($p=0.024$) and dental/facial trauma ($p=0.005$). According to the sport (volleyball and soccer), independent of the category, we found significant differences for daily brushing, dental/facial trauma ($p=0.005$), and the athletes' perception about oral health and physical performance ($p=0.006$). **Conclusion:** We concluded that the surveyed athletes had good oral health and believed that oral health can influence sports performance.

Keywords: Oral Health. Athletic performance. Sports.



Introduction

Oral health has an impact on the general health, well-being, and quality of life of athletes. Most of the studies that have evaluated the relationship between oral health and sports have focused on the risk of orofacial trauma and its prevention¹⁻⁴. However, poor oral health can contribute negatively to the quality of life, increase systemic inflammation, and result in psychosocial impacts such as difficulties with eating, sleeping, and socialization⁵⁻⁷. Self-reported evidence from athletes suggests that poor oral health negatively affects their training and performance⁸.

Factors that can compromise an athlete's oral health include orofacial trauma, infections resulting from poor oral hygiene, including caries, and periodontal disease; dental erosion; malocclusion and temporomandibular dysfunction^{6,9,10}.

Poor oral health affects professional athletes from both developed and developing countries. The causes are related to nutritional challenges (intake of carbohydrates and acid sports drinks); the impairment of host immune response due to dehydration, xerostomia, intensive training; poor health behaviors and knowledge about oral health; and the lack of effective, preventive health promotion/support^{5,6}.

The objectives of this study were to evaluate oral hygiene habits, oral health conditions, and the perception about the influence of oral health conditions on the physical performance of youth and professional volleyball and soccer athletes.

Materials and Methods

In this cross-sectional study, the total number was 117 male athletes (66 professionals and 51 young athletes) from volleyball (Caramuru Vôlei, Brazilian Men's Volleyball Super League – Season 2020/21) and soccer (Operário Ferroviário Esporte Clube, Brazilian Soccer League Serie B – Season 2020/21). This study was approved by the research ethics committee (Protocol #2.888.375).

The athletes were evaluated over a period of 18 months (September 2018 to March 2020); the oral conditions were assessed by anamnesis (main complaint and previous medical and dental history) and extra- and intraoral physical examination. Two trained examiners (JJS and JSL) performed all anamnesis and the oral physical examinations. The training exercises involved two sections (theoretical and practical training) discussing the parameters with another investigator (FAS).

The anamnesis consisted of the main complaint and current medical and dental history. We also inquired about the frequency of daily toothbrushing, the use of dental floss and mouthwash, and trauma (dental/facial), as well as the athletes' perception about the influence of oral health conditions on physical performance, which was evaluated in a dichotomous way (yes or no).

Dental plaque was assessed dichotomously, considering whether plaque was present (or not) on four tooth sites; the percentage of the positive site was calculated per subject¹¹.

We analyzed changes in the temporomandibular joint (TMJ), considering the onset, intensity, duration, location of pain and changes over time, relief factors, and treatment

reports. Patients with previous reports of chronic temporomandibular dysfunction (TMD) also underwent behavioral and psychosocial developmental assessment^{12,13}.

Malocclusion was determined using Angle's molar classification and was classified as Class I; Class II, division 1; Class II, division 2; and Class III⁹. Class I athletes did not present malocclusion and Class II and III athletes were grouped into athletes with malocclusion. The athletes were evaluated if they needed orthodontic treatment or were already being treated.

Statistical analysis

We initially performed a descriptive analysis of the data, presenting the absolute and relative values of the evaluated parameters. Comparisons were made between each sport (volleyball and soccer) for youth and professional athletes (independent variables). We applied the Chi-square test for the qualitative nominal dependent variables (toothbrushing, flossing, mouthwash, trauma, oral health conditions and sports performance, TMD, malocclusion, and orthodontic treatment). If the lowest expected frequency in any cell was less than 5, we applied the Fisher's Exact test. The percentages of dental plaque and age (dependent variables) did not show normal distribution (Kolmogorov-Smirnov test, $p > 0.05$), and therefore the statistical analysis was performed using the Mann-Whitney test. The level of significance was 5% (IBM® SPSS® 21.0 Statistics, IBM Corp., Armonk, NY, USA).

Results

However, 96 athletes participated in this study (82% of the population): youth volleyball players, $n = 25$; professional volleyball players, $n = 23$; youth soccer players, $n = 22$; and professional soccer players, $n = 26$. The average age of the athletes was 16.7 ± 0.7 and 25.3 ± 3.3 years for the youth and professional athletes respectively. A number of 21 athletes (17 professionals and 4 young athletes) were not included in the study. The main reasons for the non-inclusion in the study were the non-attendance to dental appointments due to training routine, participation in official competitions, and change of sports team.

Considering the soccer players (youth and professional), the result for flossing, orthodontic treatment, dental/facial trauma, and athletes' perception about the influence of oral health on the sports performance showed significant differences (Table 1).

Table 1. Oral hygiene habits, oral health conditions and athletes' perception about the influence of oral health conditions on the physical performance of youth (Y) and professional (P) volleyball and soccer athletes (Ponta Grossa, Paraná, Brazil, 2018 to 2020).

Parameters	Volleyball athletes		P value	Soccer athletes		P value
	Y (n=25)	P (n=23)		Y (n=22)	P (n=26)	
Daily Toothbrush (%)						
≤2x/day	0 (0)	2 (9)	0.224 ^{ns} (^{††})	3 (14)	7 (27)	0.307 ^{ns} (^{††})
≥3x/day	25 (100)	21 (91)		19 (86)	19 (73)	
Flossing (%)						
No	8 (32)	12 (52)	0.157 ^{ns} ([†])	17 (77)	11 (42)	0.014 ^s ([†])
Yes	17 (68)	11 (48)		5 (23)	15 (58)	

Continue

Continuation

Mouthwash (%)						
No	13 (52)	16 (70)	0.214 ^{ns} (†)	18 (82)	18 (69)	0.316 ^{ns} (†)
Yes	12 (48)	7 (30)		4 (18)	8 (31)	
Dental plaque (%)						
Mean ± SD	30 ± 23	35 ± 20	0.158 ^{ns} (‡)	26 ± 19	37 ± 23	0.101 ^{ns} (‡)
Median (IQR)	21 (11–48)	25 (18–50)		18 (11–43)	42 (14–58)	
Orthodontic treatment (%)						
No	14 (56)	18 (78)	0.102 ^{ns} (†)	17 (77)	12 (46)	0.028 ^s (†)
Yes	11 (44)	5 (22)		5 (23)	14 (54)	
Trauma dental/facial (%)						
No	18 (78)	24 (96)	0.091 ^{ns} (++)	18 (82)	14 (54)	0.041 ^s (†)
Yes	5 (22)	1 (4)		4 (18)	12 (46)	
TMD (%)						
No	21 (84)	17 (74)	0.487 ^{ns} (++)	21 (96)	20 (77)	0.106 ^{ns} (++)
Yes	4 (16)	6 (26)		1 (4)	6 (23)	
Malocclusion (%)						
No	21 (84)	18 (78)	0.719 ^{ns} (++)	19 (86)	18 (69)	0.159 ^{ns} (†)
Yes	4 (16)	5 (22)		3 (14)	8 (31)	
Athletes' perception about the influence of oral health on the sports performance (%)						
No	4 (16)	8 (35)	0.133 ^{ns} (†)	18 (82)	7 (27)	<0.001 ^s (†)
Yes	21 (84)	15 (65)		4 (18)	19 (73)	

†Chi-Squared Test

††Fisher's Exact Test

‡Mann-Whitney test

SD. Standard deviation

IQR. interquartile range

^s significant^{ns} not significant

According to category (youth and professional), we found significant differences for dental plaque and dental/facial trauma. When we compare the two sports independent of the category, we found significant differences for daily brushing, dental/facial trauma, and the athletes' perception about the influence of oral health on the sports performance (Table 2).

Table 2. Frequency of toothbrushing and oral health conditions category: youth (Y) and professional (P) athletes, and sport: volleyball (V) and soccer (S). (Ponta Grossa, Paraná, Brazil, 2018 to 2020).

Parameters	Category		P value	Sport		P value
	Y (n=47)	P (n=49)		V (n=48)	S (n=48)	
Daily Toothbrush (%)						
≤2x/day	3 (6)	9 (18)	0.076 ^{ns} (†)	2 (4)	10 (21)	0.014 ^s (†)
≥3x/day	44(94)	40 (82)		46 (96)	38 (79)	

Continue

Continuation

Flossing (%)						
No	25 (53)	23 (47)	0.540 ^{ns} (†)	20 (42)	28 (58)	0.102 ^{ns} (†)
Yes	22 (47)	26 (53)		28 (58)	20 (42)	
Mouthwash (%)						
No	31 (66)	34 (69)	0.719 ^{ns} (†)	29 (60)	36 (75)	0.127 ^{ns} (†)
Yes	16 (34)	15 (31)		19 (40)	12 (25)	
Dental plaque (%)						
Mean ± SD	28 ± 21	36 ± 22	0.024 ^s (‡)	32 ± 21	32 ± 22	0.977 ^{ns} (‡)
Median (IQR)	18 (11–46)	25 (18–57)		23 (14–50)	25 (14–55)	
Orthodontic treatment (%)						
No	31 (66)	30 (61)	0.630 ^{ns} (†)	32 (67)	29 (60)	0.525 ^{ns} (†)
Yes	16 (34)	19 (39)		16 (33)	19 (40)	
Trauma dental/facial (%)						
No	42 (89)	32 (65)	0.005 ^s (†)	42 (88)	32 (67)	0.015 ^s (†)
Yes	5 (11)	17 (35)		6 (12)	16 (33)	
TMD (%)						
No	42 (89)	37 (75)	0.076 ^{ns} (†)	38 (79)	41 (85)	0.423 ^{ns} (†)
Yes	5 (11)	12 (25)		10 (21)	7 (15)	
Malocclusion (%)						
No	40 (85)	36 (73)	0.160 ^{ns} (†)	39 (81)	37 (77)	0.615 ^{ns} (†)
Yes	7 (15)	13 (27)		9 (19)	11 (23)	
Athletes' perception about the influence of oral health on the sports performance (%)						
No	22 (47)	15 (31)	0.103 ^{ns} (†)	12 (25)	25 (52)	0.006 ^s (†)
Yes	25 (53)	34 (69)		36 (75)	23 (48)	

†Chi-Squared Test

‡Mann-Whitney test

SD. Standard deviation

IQR. interquartile range

^s significant^{ns} not significant

Discussion

The daily frequency of toothbrushing was higher for volleyball athletes compared to soccer athletes. Youth soccer athletes had the lowest percentage of individuals who reported using dental floss in comparison with professional soccer players. This result may have been due to the fact that becoming a professional soccer player in Brazil is often a project which involves the whole of the athlete's family, possibly to the detriment of the athlete's formal education¹⁴. Brazil still has a high level of social inequality; in 2014 the Gini index for Brazil was 0.518 (0 = no inequality, and 1 = maximum inequality), indicating a high degree of social inequality (IPEA, <http://www.ipeadata.gov.br>). Similar situations have been observed in other developing countries, where parents see sports as the best option for young people to escape from poverty¹⁵. We should consider that poor socioeconomic conditions such as limited income and lower education levels are associated with poor oral health¹⁶. We should consider that

soccer is a very popular sport in Brazil and becomes more attractive for adolescents from low social class¹⁴.

Regarding the issue of flossing, we did not find differences between youth and professional athletes (category) and sport (volleyball and soccer). We observed the same results considering the mouthwash use. These results could be explained by the fact that the athletes are continually monitored by their team's medical staff. Our results showed that professional athletes had a higher percentage (significant difference) of visible dental plaque in comparison with youth athletes. Literature shows males aged 15-18 have the worst patterns of oral hygiene, probably due a greater tendency to neglect oral hygiene during the teenage years¹⁷. Our results can be explained by the intense training routine and psychophysical stress during professional athletes' competitions⁷.

Orthodontic treatment was reported more frequently by the youth volleyball and professional soccer athletes. We found statistical difference considering orthodontic treatment between youth and professional soccer players. The majority of the soccer athletes came from low-income families; consequently, it was only when they reached a professional level that they were able to pay for dental treatment. Occlusal problems may be associated with mouth breathing, TMD, digestive problems, as well as contributing to the occurrence of dental trauma^{3,9}, therefore negatively impacting on sport performance¹⁰. Consequently, orthodontic treatment can contribute to an improvement in sport performance.

We observed a normal pattern in relation to TMJ, and there was no significant difference between the groups regarding malocclusion. The clinical features of TMD are found in about 25% of the population; they include symptoms such as crackling, muscle and TMJ pain, muscle fatigue, opening limitations, and headaches¹². Stress can be a factor that influences TMJ; however, there was no significant difference between the youth athletes and the professional athletes. Stress can accentuate and perpetuate pre-existing dysfunction, due to excessive tension in the joints or muscles involved in biting or the grinding of teeth during sports¹³. The causes of this dysfunction are multifactorial; however, direct trauma to the jaw due to sports is one of the main factors. Severe mandibular shock caused during sports may also result in macro-trauma, causing disc deformities and dislocations, as well as ligament distension¹³. In less aggressive shocks, symptoms may disappear quickly, while more severe injuries can cause permanent changes in function^{2,8}. For this reason, athletes from so-called contact sports, such as hockey, soccer, basketball, and rugby, who commonly suffer shocks and impacts, have a higher incidence of the signs and symptoms of TMD¹.

Our study showed that the professional athletes reported having had more orofacial trauma than the youth athletes. Orofacial trauma was most frequent for the soccer players. In addition, professional soccer players presented more dental/facial trauma than youth athletes (significant difference). Soccer is a sport in which there is direct physical contact between athletes; consequently, there may be a higher incidence of trauma when compared to volleyball²⁻⁴.

Differences in the reported athletes' perception about the influence of oral health conditions on the physical performance were detected between the groups, especially

between the sports (volleyball and soccer), and youth and professional soccer athletes. The differences in the perceptions of the volleyball and soccer players may have been related to socio-educational differences between the two groups. Youth soccer athletes generally seek to invest in their careers to become professionals; however, they tend to put educational priorities in second place once they have difficulties in reconciling the daily routines of athletes with school activities¹⁴. In our study, 69% of the professional athletes reported that oral health can interfere with sports performance. In a study of elite Olympic athletes, 33-66% reported that oral health could interfere with sports performance⁸. Professional athletes demonstrate a better understanding of the relationship between oral diseases and sports performance. Professional athletes often have dentists on their medical staff who are responsible for orientation and the promotion of oral health. We should also consider that professional athletes always seek to improve their sports performance, which is why they value oral health and its impact on such performance.

Our study presents some limitations, such as the population involved in which all the soccer athletes came from one team (Brazilian Soccer League Serie B) and one volleyball club (Brazilian men's volleyball Super League). Both clubs are located in the southern region of Brazil, involving only male athletes. Considering these characteristics of the population included, the results need to be interpreted with caution, since there may be differences considering first division clubs and volleyball teams with higher investment in basic categories and salary income. As future perspectives, we recommend additional studies including other sports from different regions of the country.

We concluded that most of the surveyed athletes had good oral health and believe that oral health can influence sports performance. The use of mouthguards should be recommended in physical contact sports to reduce the risk of orofacial trauma. In order to improve oral hygiene conditions, and knowledge about health, sports teams should include dentists in their medical staff for both youth and professional athletes.

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Conflict of interest

The authors have no conflict of interest to declare.

Consent for publication

All authors have approved the final version and its publication.

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