Oral health-related behaviours reported by elite and professional athletes

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Key points

- Oral diseases and athlete-reported negative performance impacts are common in elite and professional athletes.
- Advises dentists that elite athletes are willing to adopt oral health-related behaviours to mitigate the risks to oral health associated with sport.
- Dentists should be aware of the need for enhanced prevention for athletes.

Abstract

Background In elite sport, the protection of an athlete's health is a priority. However, research indicates a substantial prevalence of oral disease in elite and professional athletes. The challenges to oral health from participation in sport require investigation to identify effective strategies and mitigate risk.

Aim To explore athlete-reported oral health behaviours, risks and potential for behaviour change in a representative sample of elite athletes based in the UK.

Method This was a cross-sectional study. We provided oral health screening for 352 elite and professional athletes from June 2015 to September 2016; 344 athletes also completed a questionnaire.

Results The median age was 25 years (range 18–39) and 236 (67%) were male; 323 (94.2%) said they brush twice daily while 136 (40%) said their most recent dental attendance was within the previous six months. Ninety-seven (28%) would be assessed as high consumers of sugar in their regular diet. The use of sports nutrition products was common with 288 (80%) reporting the use of sports drinks during training or competition but were positive about behaviour changes.

Conclusion Despite reporting positive oral health-related behaviours, athletes have substantial amounts of oral disease. Athletes are willing to consider behaviour change related to daily plaque removal, increased fluoride availability and regular dental visits to improve oral health.

Listen to the author talk about the key findings in this paper in the associated video abstract. Available in the supplementary information online.

Introduction

In elite sport, protection of an athlete's health is a priority, however, dental caries, periodontal diseases and erosive tooth wear (ETW) remain prevalent.[1,2,3,4] Furthermore, athletes with poor oral health report negative impacts on wellbeing, quality of life, training and performance.[1,2,3,4] Severe events such as acute dental infections or orofacial trauma, leading to time lost from training and even competition, occur infrequently. However, chronic impacts which may not lead to time loss, but rather a reduction in the quality of training, are commonly reported, and at elite level may have important consequences.[4,5] Likely challenges to oral health in sport include increased risk of dental caries due to increased and/or inappropriate consumption of dietary carbohydrates within usual diet or sports nutrition products such as sports drinks, energy bars and gels.[6,7] These products are marketed with no accompanying guidance related to oral health. Sports drinks tend to be acidic, therefore may also contribute to ETW.[8] Lack of awareness or prioritisation may also be a factor in elite sport.[9] The risks of oral disease may be further increased due to alterations in saliva composition during exercise and immune suppression following intense effort.[10,11] Effective oral health promotion strategies may minimise performance impacts from poor oral health.[4] Although there is good evidence for oral health promotion and prevention outside of sport,[12] the challenges to oral health from sport and those related to implementation in this environment, confer unique characteristics that require investigation to identify effective strategies and mitigate risk.[13]

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Aims

The aim of this study was to explore athlete-reported oral health behaviours, risks to oral health and potential for behaviour change in a representative sample of elite athletes.

Methods

Study design

This was a cross-sectional study, conducted at UK elite athlete training centres between June 2015 and August 2016. We provided oral health screening for 256 athletes on podium potential/placement programmes for the 2016 Rio Olympics and 96 professional athletes (352 in total) across 11 sports which we categorised as 'endurance', 'strength and power' (events lasting less than two minutes) or 'mixed' (such as team sports). The methods and results are reported in a previous paper.[4] The athlete-reported data presented in this paper were collected with a self-administered questionnaire, and completed at the screening appointment.

Eligibility criteria

- Member of elite (Olympic or professional) training/development squad
- Aged 18 years or over
- Able to understand the consent process with the aid of a translator, if required
- Able to understand and complete the questionnaire with the aid of a translator if required.

Ethical approval was received from University College London research ethics committee (project ID 6388/001). Informed written consent was obtained. Participation in the study was entirely voluntary and with no obligation.

Table 1 Clinical indicators of oral health by group, sport category and sport

	Caries (ICDAS >3)	ETW (BEWE >7)	Periodontal condition (BPE 1 or 2)	Periodontal condition (BPE 3 or 4)
All (352)	173 (49.1%)	148 (42%)	272 (77.3%)	76 (21.6%)
Sport category				
Endurance (143)	55 (38.5%)	50 (35.0%)	112 (78.3%)	29 (20.3%)
Mixed/team (159)	89 (56.0%)	82 (51.6%)	124 (78%)	33 (20.8%)
Strength and power (50)	29 (58.0%)	16 (32.0%)	36 (78%)	14 (20.8%)
Sport				
Rowing (60)	20 (33.3%)	16 (26.7%)	47 (78.3%)	12 (20%)
Swimming (51)	19 (41.3%)	23 (50%)	28 (54.9%)	7 (13.7%)
Cycling (51)	25 (49.0%)	16 (26.7%)	34 (66.6%)	17 (33.3%)
Sailing (15)	8 (53.3%)	4 (27.7%)	12 (80%)	3 (20%)
Hockey (46)	21 (45.7%)	21 (45.7%)	33 (71.7%)	12 (26.1%)
Rugby (72)	44 (61.1%)	38 (52.8%)	57 (79.1%)	15 (20.8%)
Football (26)	16 (61.5%)	38 (52.8%)	22 (84.6%)	3 (11.5%)
Gymnastics (15)	8 (53.3%)	9 (60%)	13 (86.6%)	2 (13.3%)
Athletics (21)	12 (57.1%)	2 (9.5%)	16 (76.1%)	5 (23.8%)

Table 2 Knowledge/belief about factors that can damage oral health

Can cause damage to mouth, teeth or gums	No	Yes	Don't know
Cakes, biscuits, puddings, pastries	11 (3.2%)	318 (92.7%)	14 (4.1%)
Sweets/chocolate	1 (0.3%)	340 (99.1%)	2 (0.6%)
Fizzy drinks and/or squash	5 (1.5%)	334 (97.1%)	4 (1.2%)
Sports drinks	4 (1.2%)	327 (95.1%)	12 (3.5%)
Energy bars	19 (5.5%)	280 (81.4%)	43 (12.5%)
Energy gels	15 (4.4%)	303 (88.1%)	25 (7.3%)
Smoking tobacco	6 (1.7%)	323 (94.2%)	14 (4.1%)
Smokeless/chewing tobacco	12 (3.5%)	280 (81.4%)	51 (14.8%)
e-cigarettes with nicotine	18 (5.2%)	213 (61.9%)	112 (32.6%)
e-cigarettes without nicotine	26 (7.6%)	189 (54.9%)	127 (37.1%)

Athlete-reported oral health behaviours, risks to oral health and potential for behaviour change

The questionnaire was developed with input from our advisory group which included academics, athletes and dentists with an interest in sport. Items to explore self-reported oral health-related behaviours were based on those used in the Adult Dental Health Survey (ADHS) 2009.[14] They included: frequency of toothbrushing, use of additional oral hygiene methods, most recent dental attendance, type of service used, most important factor when making a dental appointment and previous dental advice received. Use of additional oral hygiene aids included electric toothbrush (ETB), fluoride mouthwash, interdental cleaning and sugar-free chewing gum (SFG). Risks to oral health included tobacco use and consumption of sugar in usual diet. The Scientific Advisory Committee on Nutrition (SACN) advises that the maximum free sugar consumption for the UK diet should be 5%.[15] Using the method described in ADHS 2009, athletes who indicated that they consumed a serving of cakes, sweets or soft drinks six or more times a week were categorised as high sugar consumers.[14] We also explored knowledge of risks to oral health of sports nutrition products (SNPs) and asked about athletes' use of SNPs before, during and after training and competition. Finally, we asked which behaviours athletes would consider adopting if it would improve their oral health. The research advisory group reviewed the questionnaire which was piloted before use.

Statistical analysis

We used a standard statistical package (IBM SPSS Statistics, version 22.0) for data analysis. Counts and percentages summarised the categorical data. This report was guided by the STROBE statement of observational studies.[16]

Results

Median age was 25 years (range 18–39) and 236 (67%) were male. The demographic characteristics of the group are presented in Supplementary Table 1. There were 50 (14.2%) athletes in the strength and power (S&P) category, 143 (40.6%) in the endurance category and 159 (45.2%) in the mixed category. Table 1 summarises the prevalence of oral disease in each category and sport. Questionnaire data were available for up to 344 athletes (50 [14.5%] S&P; 140 [40.7%] endurance; and 154 [44.8%] mixed). Eight questionnaires were not returned due to time constraints and some athletes omitted some response options.

Oral health behaviours

Overall, 323 (94.2%, 95% CI 91.8–96.7) reported brushing their teeth at least twice daily. Regarding use of additional methods for oral hygiene, 190 (55.9%, 95% CI 49.9–60.4) said they used an ETB, 148 (43.7%, 95% CI 37.9–48.3) said they used dental floss or interdental brushes, 139 (40.9%, 95% CI 35.4–45.6) said they used fluoride mouthwash and 120 (35.1%, 95% CI 30.32–40.3) reported using sugar-free chewing gum (SFG). Three hundred and twelve (90%, 95% CI 87.1–93.4) athletes reported drinking water on at least six days or more per week (Supplementary Tables 2, 3 and 4).

Risks to oral health

One (0.3%) athlete reported current use of smokeless tobacco. We categorised 97 (28.2%, 95% CI 23.7–33.2) of athletes as high consumers of sugar in their regular diet. Regarding the use of sports nutrition products, 288 (85.7%, 95% CI 81.5–89.1) of the 336 athletes who provided this information reported using sports drinks at least sometimes during training/competition, 198 (58.8%, 95% CI 53.4–63.9) used energy bars and 239 (70.3%, 95% CI 65.9–75.5) used energy gels (Supplementary Tables 5, 6 and 7).

Dental service considerations

We asked how recently athletes had attended a dentist. Fewer than half (136, 39.5%, 95% CI 34.5–44.8) of the athletes said they had attended for a dental visit within the previous six months. Three quarters (262, 76.2%, 95% CI 71.4–80.4) said they recalled receiving oral hygiene advice from a dental professional at some time and just over half (206, 59.9%, 95% CI 54.6–64.9) said they recalled receiving advice about diet. When asked what type of dental service they used for their most recent dental visit 141 (41%, 95% CI 35.9–46.3) said an NHS dentist, 147 (45.6%, 95% CI 40.5–50.9) said a private dentist and 34 (9.9%, 95% CI 7.13–13.52) said a private dental hygienist. Athletes were asked which single factor was the most important when arranging a dental appointment. However, 20 indicated more than one factor. Of the remaining 314, 195 (62.1%, 95% CI 56.6–67.3) said convenience, 85 (27.1%, 95% CI 22.5–32.3) reputation of the dentist and 34 (10.8%, 95% CI 6.9–13.2) cost (Supplementary Tables 8, 9, 10 and 11).

Oral health beliefs and potential for behaviour change

The majority of athletes recognised that smoking and sugary foods and drinks, including sports nutrition products, could damage oral health (Table 2). The potential for behaviour change options and athlete responses are listed in Table 3. With the exception of reducing snacking between meals, most athletes were positive about the potential for behaviour change.

Discussion

Key findings

This is the first study to investigate self-reported oral health behaviour and challenges to oral health in representative samples of elite and professional athletes from different sports. In general, athletes report favourable oral health behaviours including toothbrushing before bed and in the morning, but fewer than half had attended a dentist within the previous six months. Overall, we categorised 28.2% of athletes as high consumers of sugar in their regular diet; however, 58.8% reported using energy bars and 70.3% energy gels during training and competition, while fewer than half (46%) athletes said they could or probably could reduce snacking between meals. Although 85.7% reported using sports drinks at least sometimes during training/competition, 80.4% said they could or probably could reduce sugary drinks, including sports drinks, between meals. Athletes said that they would consider regular dental visits, use of additional oral hygiene aids and increasing fluoride availability to improve oral health.

Strengths and limitations of the data

The strength of this study is the number of participants and completeness of the sample screened in each sport. Conducting studies in elite sport is difficult due to the competing pressures for time on the athletes and their support teams. However, self-reported measures can be unreliable and only serve as a proxy measure for oral hygiene and dietary habits. The questionnaire was completed independently and anonymously for convenience and to limit responder bias. However, it provided limited information regarding whether the athletes used sports drinks, energy bars and gels on the advice of coaches and/or nutritionists, or if they used them in response to marketing/availability. Information on the content of the snacks consumed by athletes was also limited. Use of qualitative methods such as interviews or focus groups would have yielded a much greater depth of information but would have required a greater time commitment from the athletes, which was not possible during this study.

Table 3 Opportunities for behaviour change

Could do if I thought it would help keep my mouth teeth and gums healthy	No	With difficulty	Probably	Yes
Reduce snacking between meals (including energy bars/gels)	77 (22.4%)	107 (31.1%)	97 (28.2%)	60 (17.4%)
Reduce sugary drinks (including sports drinks) between meals	34 (9.9%)	33 (9.6%)	91 (26.5%)	183 (53.2%)
Brush teeth before sleeping	9 (2.6%)	1 (0.3%)	17 (4.9%)	315 (91.6%)
Only spit out toothpaste, don't rinse with water	26 (7.6%)	14 (4.1%)	59 (17.2%)	241 (70.1%)
Use fluoride mouthwash at a different time to brushing	13 (3.8%)	19 (5.5%)	88 (25.6%)	220 (64.7%)
Use dental floss/interdental brushes every day	8 (2.3%)	48 (13.7%)	109 (31.7%)	173 (50.6%)
Use sugar free chewing gum	42 (12.2%)	11 (3.5%)	88 (25.6%)	199 (57.6%)
Regular visits to a dentist/hygienist for advice and monitoring	5 (1.5%)	32 (9.3%)	108 (31.4%)	198 (57.6%)

Comparison with other studies

Few studies have investigated oral health behaviours and risks to oral health in this relatively young adult group.[17,18,19] A cautious comparison may be made with adults of a similar age in the general population in England, Wales and Northern Ireland.[19] Elite athletes report more favourable oral health behaviours; 94% compared to 74% say they brush morning and night and 43% compared to 18% say they use dental floss or interdental brushes. Only one athlete reported currently using smokeless tobacco (the proportion of smokers in the general population is around 28%) and 28.2% compared to 55% would be classed as high consumers of sugar in their general diet. The findings from this study support those from one study of Nigerian college athletes,[17] and another study limited to triathletes which concluded by recommending 'raising athletes' awareness of their specific increased risk for dental caries and erosion and demonstrating how to optimise their oral hygiene and advice'.[18]

Evidence-based interventions to improve oral health

We found differences in the prevalence of oral diseases between different sports. However, the document Delivering better oral health: an evidence-based toolkit (DBOH) recommends that everyone should be given the benefit of advice and support to change behaviour regarding their general and dental health, not just those thought to be 'at risk'.[12] Therefore, strategies identified in this paper are appropriate to all sports.

Reducing risks to oral health from lifestyle

Athletes reported high consumption of energy gels and bars during training and competition, despite believing that they can damage oral health. However, fewer than half felt they could reduce snacking. Hydration is an important consideration in sport[20] and most athletes reported using sports drinks; nonetheless, many felt that they could reduce their intake of sports drinks. The use of beverages and supplements containing sugars should be discouraged.[7] Many rowers regularly drink sugar-free squash, however this is not associated with increased caries or ETW in this group, and therefore could be a useful alternative to proprietary sports drinks for hydration. For post-event hydration, milk could be substituted for proprietary sports drinks, and plain water is adequate if combined with electrolyte and carbohydrate-containing foods such as those normally eaten during the recovery period.[7,21,22] Many athletes (83.2%) would consider the use of SFG but Delivering better oral health guidance does not recommend it as a preventive adjunct. There is, however, some evidence that it may have a potential role in caries prevention.[23] Athletes reported receiving oral hygiene advice and advice about diet from a dental professional at some time and dental professionals are well placed to identify potential lifestyle problems, such as eating disorders.[13] Sport nutrition is one of the cornerstones for athlete preparation and therefore well placed to deliver benefits across performance, general health, oral health and wellbeing. It would therefore make sense for strategies incorporating oral health to be jointly developed by registered sport nutritionists, oral health experts and other athlete support team members.[7]

Improving oral health through oral health screening and coaching

Oral health promotion in sport is most likely to be successful if it is embedded within overall athlete general health and performance promotion,[24] but most members of the athlete support team are not experts in this area and therefore specialist input is needed. Coaches, nutritionists and those who work with athletes should have robust training to ensure that athletes balance performance with their oral and general health. Dental recall intervals are based on risk and regular attendance for dental checks does not necessarily predict better oral health.[25,26] However, regular checks are important, not only to identify oral diseases at an early stage but also as an opportunity to enhance motivation towards a high standard of oral health.[27] Most athletes said they would attend for regular dental checks if it would improve their oral health, but convenience is an important consideration. Oral diseases such as caries, ETW and periodontal diseases do not present with pain in their early stages and athletes may delay a dental check or even treatment until they perceive that they have a problem. Athletes may not be brushing effectively, as most had evidence of gingival inflammation or risk factors present. Interdental cleaning using dental floss or other methods is important for optimum oral health.[12,28] Although less than half currently do this, most athletes said they would consider cleaning interdentally if it would improve oral health. However, practical instruction is required to improve oral hygiene skills. Our high recruitment rate of athletes underlines the importance of providing screening and simple oral health promotion/preventive advice at athletes' training centres, preferably combined with education and coaching in practical oral hygiene skills.

Opportunities to mitigate risk through increased fluoride availability

The most important behavioural factor affecting both caries and periodontal health is routinely performed oral hygiene with fluoride.[29] When normal strength fluoride toothpaste (1,000–1,450 ppm) is used, fluoride mouthwash used at a different time to brushing can be advised.[30] Many athletes said they could use a fluoride mouthwash, at a different time to brushing, therefore this could be an opportunity to increase fluoride availability but requires a new behaviour. Where caries risk is increased, higher strength prescription fluoride (2,800 ppm) is indicated.[31] Very high strength fluoride toothpaste (5,000 ppm) may also have a protective effect against erosion.[32] Nearly all athletes said they brushed in accordance with the widely recognised oral health advice of twice daily,[12] therefore using prescription strength fluoride toothpaste would increase fluoride availability without requiring change in current behaviour.

Enhancing oral health-related behaviour through behaviour change techniques

To date, there is no evidence to show which behaviour change technique (BCT) is best for enhancing health behaviours related to oral health.[33] However, the current dominant approach to understanding health behaviour is the COM-B model,[34] and it has been suggested that interventions based on this behaviour change theory may be successful.[35] Further research, including consultation with all stakeholders such as sports nutritionists, sport and exercise medicine practitioners, and dental professionals, is needed to ensure quality and relevance within elite athlete care.

Conclusion

Elite and professional athletes report more favourable oral health behaviours but still have similar levels of oral disease to the general population. Athletes say they would consider simple behaviour change including a reduction in the use of sports drinks, attendance for regular screening and the

adoption of additional oral hygiene methods. These findings help inform the design of interventions to improve/maintain oral health and reduce performance impacts.

Declaration of interests
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