Short Communication

Prevalence of Dentinal Hypersensitivity and Dental Erosion among Competitive Swimmers, Kerala, India

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Abstract

Background: Professional swimmers face a hidden occupational hazard due to improper maintenance of pool. Ill maintained pools can lead to erosive effects on dental health and thus needs to be evaluated. **Methodology:** Fifty-six competitive swimmers from two training centers were contacted and surveyed for swimming exposure and oral health. A visual analog scale was used to rate the tooth sensitivity. Dental erosion and dental caries were recorded according to WHO oral health assessment criteria (2013). The dentinal hypersensitivity experience was assessed using the dentine hypersensitivity experience questionnaire - 15 (DHEQ-15). Data were analyzed using Chi-square test and multivariate analysis. **Results:** The prevalence of dentinal hypersensitivity and dental erosion was found to be 69.6% and 48.2%, respectively. The common surfaces affected by dental erosion were palatal surfaces of maxillary anterior, followed by lingual surfaces of mandibular anterior. There was a direct association between duration of the stay in pool and dental erosion. The DHEQ-15 questionnaire revealed that more than 80% of the participants never felt these sensations had any serious long-term effects on oral health. **Conclusions:** Oral health professional must understand dental erosion among competitive swimmers as an occupational oral health hazard and provide early counseling and necessary invasive and noninvasive care.

Keywords: Dentin sensitivity, oral health, swimming, swimming pools, tooth erosion

Introduction

Swimming is one of the most popular sports with multiple physical and mental health benefits. Chlorination of swimming pools helps to oxidize matter and kill microorganisms. The recommended pH range of chlorine in pool water is 7.4–7.6, below which it might lead to irritation of eyes and mucous membranes. Improperly maintained pools may lead to acute diffuse otitis externa (swimmer's ear) and asthma.[1,2]

Competitive swimmers, who often swim for a longer time, expose their teeth to large amounts of chemically treated water. Organic deposits due to breakdown of salivary proteins are noted on swimmer's teeth as a result of a higher pH due to addition of antimicrobial agents.[3]

Tooth wear such as tooth erosion has drawn increasing attention as a risk factor for tooth loss. Erosion is the progressive loss of tooth surface by acid from a nonbacterial source. The causes of erosion can be intrinsic as seen in gastroesophageal reflex, dietary erosion, and extrinsic such as environmental and occupational factors; such occupational factors may lead to erosion and thus hypersensitivity in professional swimmers.[4]

Among professional swimmers, the most common dental noncarious destructive lesion is dental erosion.[5] Pathogenic mechanism of dental erosion is based on the dissociation of hydroxyapatite and on impaired mineralization of the dental hard tissue due to long and frequent effect of acids. For the erosion to progress, the solution pH level has to be below 5.5 for enamel and below 6.0 for dentine.[6] Early diagnosis of dental erosion is difficult but critical to implement preventative measures and preserve tooth tissue. The paucity of diagnostic devices for the assessment of dental erosion leads to difficulties in early diagnosis. Clinical signs and carefully elicited history including patient's occupation are critical for early detection

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and deciding treatment options.[7] Clinical features of dental erosive lesions include broad concavities within smooth tooth enamel or loss of enamel surfaces with dentine exposure.[8]

The oral and systemic effects of swimming in ill-maintained pools have been studied in multiple high-income countries,[9-11] but the status with respect to low- and middle-income countries is yet to be uncovered; this dearth of knowledge about the prevalence of erosion among competitive swimmers in India could be traced using a professional swimming establishment with interregional trainees.

The objective of the current study is to find the prevalence of dentinal hypersensitivity and associated oral health symptoms among competitive swimmers in Kottayam district of Kerala, India.

Methodology

A cross sectional study was conducted among competitive swimmers from two training centers at Kottayam, India. A pilot study was conducted, and the sample size was calculated as 48. Swimmers with <1 year of training were excluded. Written consent was obtained from each participant before their examination, and the study was approved by an institutional review board.

Data were collected from each participant regarding their years of swimming, average duration of training per day, and consumption of acidic beverages. Caries and dental erosion status were recorded using the WHO Oral Health Assessment Criteria (2013).[12] Participants completed the dentine hypersensitivity experience questionnaire-15 (DHEQ-15)[13] with five domains: restrictions, coping, social, emotions, and identity.

A portable dental unit equipped with light (Transport II portable dental unit-Aspetico Inc, WA, USA) and compressed air was used for clinical oral examination. A single examiner conducted the oral inspection on all the tooth surfaces using mouth mirror and #23 explorer to clinically identify dental erosion. Dentinal hypersensitivity was measured using a visual analogue scale.[14] A stream of air was blown onto the teeth surfaces using an air–water syringe, and the level of sensation was recorded on the scale.

The data were analyzed usingStatistical software package SPSS (version 16.0; SPSS Inc., USA). Chi-square test and multivariate analysis were applied to find any association, and statistical significance was considered if $P \leq 0.05$. Chi-square analysis was done to find any association between dental erosion and swimmers experience in years, duration of swimming, dental caries, dentinal hypersensitivity, and frequency of consumption of fizzy drinks. Those variables for which a significant association was found were further analyzed to generate a multivariate model, and adjusted odds ratios were estimated.

Results

A total of 56 competitive swimmers with a mean age of 15 ± 2.8 years consisting of higher proportion of males (62.5%) participated in this study. Dentinal hypersensitivity was experienced among 69.6% and dental erosion among 48.2% participants. The prevalence of dental caries was found to be 39.3%. Among the participants having dentinal hypersensitivity, 61.5% were noted to have dental erosion.

Table 1 shows the associated factors for dental erosion among competitive swimmers. There was no gender predilection for dental erosion ($P > 0.05$). With increase in years of swimming experience, the prevalence of dental erosion increased from 26% to 69%. In this study, swimmers spent an average of 2 h in each training session. An increase in dental erosion was found among those who spent more than 2 h during a training session, although 61% had a habit of consuming acidic beverage, no association was found between the frequency of consumption of fizzy drinks and dental erosion. The odds of developing dental erosion were found to be 5.3 times among swimmers who have more than 3 years of swimming experience.

Table 2 shows the participant responses to the DHEQ-15. Among the participants with dentinal hypersensitivity, 41.2% agreed that they have had problems while eating cold foods like ice cream. Less than 40% reported these sensations to be very annoying to them. More than 44% of the participants with hypersensitivity disagreed to have any associated emotional problems; also, more than 80% did no't think these sensations were of health concern even though these sensations were not holding them back from visiting a dentist.

Discussion

Dental erosion is the loss of tooth surface due to the chemical

Table 1: Associated factors for dental erosion among competitive swimmers

	Erosion present (%)	Crude OR	Adjusted OR
Gender			
Males	21 (60)	0.5	NA
Females	9 (42.9)		
Years of swimming (years)			
≤3	7 (25.9)	6.35*	5.31*
>3	20 (69)		
Hypersensitivity			
Absent	3 (17.6)	7.67*	6.67*
Present	24 (61.5)		
Duration of swimming (h)			
≤2	10 (34.5)	3.23*	0.93
>2	17 (63)		
Consumption of fizzy drinks			
Present	10 (44.5)	1.2	NA
Absent	17 (50)		
Dental caries			
Present	11 (40.7)	1.8	NA
Absent	16 (55.2)		

*P<0.05. NA: Not applicable, OR: Odds ratio

Table 2: Dentinal hypersensitivity experience questionnaire-15

The DHEQ			
Questions number	**Questions**	**Percentage**	**Response**
	Restrictions		
1	Restrictions having sensations in my teeth takes a lot of the pleasure out of eating and drinking	29.4	Agree a little
2	It takes a long time to finish some foods and drinks because of sensations in my teeth	38.2	Disagree
3	There have been times when I have had problems eating ice cream because of these sensations	41.2	Agree
	Coping		
4	I have to change the way I eat or drink certain things	35.3	Agree
5	I have to be careful how I breathe on a cold day	35.3	Disagree a little
6	When eating some foods I have made sure they do not touch certain teeth	47.1	Agree
7	Because of the sensations, I take longer than others to finish a meal	32.4	Agree
	Social		
8	I have to be careful what I eat when I am with others because of the sensations in my teeth	52.9	Disagree
9	Going to the dentist is hard for me because I know it is going to be painful as a result of sensations in my teeth	73.5	Disagree
	Emotions		
10	I have been anxious that something I eat or drink might cause sensations in my teeth	44.1	Disagree
11	The sensations in my teeth have been irritating	32.4	Strongly agree
12	The sensations in my teeth have been annoying	26.5	Disagree a little
	Identity		
13	Having these sensations in my teeth makes me feel old	82.4	Disagree
14	Having these sensations in my teeth makes me feel damaged	82.4	Disagree
15	Having these sensations in my teeth makes me feel though I am unhealthy	85.3	Disagree

DHEQ: Dentine hypersensitivity experience questionnaire

etching which results in dissolution of the hard tissue. The presence of acidic external environment, which is not bacterial in origin, can result in dentin sensitivity. Tooth wear in a young patient would be seen as pathological rather than physiological problem.[15]

The prevalence of dentinal hypersensitivity and dental erosion among the competitive swimmers in the present study is 69.6% and 48.2% respectively. These values are higher compared to a similar study conducted by Buczkowska-Radlińska *et al*.[10] in Poland Zebrauskas *et al*.[11] in Lithuania reported higher prevalence of dental erosion among competitve swimmers aged 18–25 years(50%) compared to 12 - 17 years (25%). Further, this present study showed an increase in prevalence of dental erosion with the swimmer's experience. Eroded anterior tooth in swimmers is characterized by increased incisal translucency, incisal chipping, and in moderate to severe cases, cupping out of the incisal edges.[8]

Majority complained that the hypersensitivity aggravated on consuming citrus or cold foods, with most common site of discomfort being maxillary and mandibular anterior region as shown in Figure 1. There was no probable link noted between dentinal hypersensitivity in relation to dental caries and consumption of fizzy drinks along with a significant relationship elucidated between dental erosion and dentinal hypersensitivity ($P < 0.05$); this suggests the hypersensitivity among this population could be a good indicator of dental erosion.

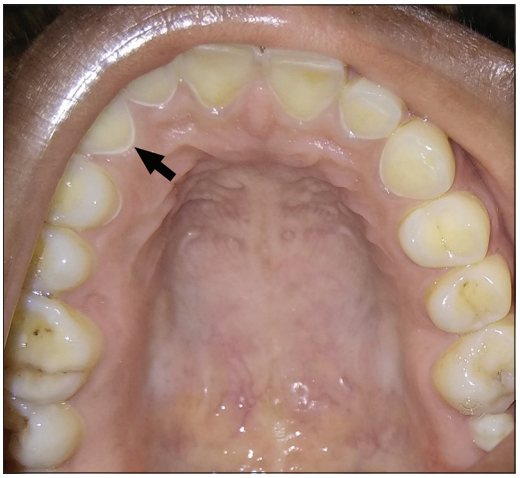

Figure 1: Dental erosion on palatal surface of maxillary upper anteriors

Dental erosion was noted to be more frequent on palatal surface of maxillary anterior followed by mandibular anteriors, similar to the findings reported by Buczkowska-Radlińska *et al*.[10] Majority of swimmers who were experiencing dentinal hypersensitivity restricted certain food items such as citrus fruits and ice creams, as with the study population in a research conducted by Bekes *et al*. in Germany.[16]

More than 80% of these swimmers did not perceive dentinal hypersensitivity as a health problem and demand any treatment.

The low demand for dental services was noted by 75% of participants in a study by Gillam *et al*.[17]

This study reports a prevalence of dental erosion 5 times higher compared to another study conducted among school children of similar age in India[18]. This raises a tangible public health concern regarding oral health among the young competitive swimmers.

Consumption of sports drink is an added exposure to dental erosion among athletes. However, no significant relationship has been established between consumption of soft drinks and dental erosion;[19] the present study also failed to establish any such relationship.

Dental caries and dental erosion share some common risk factors; furthermore, the acidic environment which leads to erosion is found to encourage the growth of *Streptococcus mutans*.[20,21] Multivariate analysis revealed no significant relationship in this study.

Conclusions

Professional maintenance of swimming pools with emphasis on balancing the pH of pool water is vital to avoid health risks for swimmers. Oral health professionals need to understand this oral health hazard and provide early counseling

It is impossible to avoid potentially erosive agents from contact with the tooth during a lifetime; therefore, the emphasis should be on early diagnosis and prevention. Awareness about the harmful effects of overchlorinating the pool water among employees must be improved. Oral health professionals can play a key role in promoting customized mouth guards among professional swimmers. Enamel repair commences within 2 h of an acidic exposure. Brushing teeth immediately after swimming can be harmful as the surface of the teeth is softened by the acidic chlorine. Rinsing of oral cavity with water, baking soda, or fluoride mouthwash after each swimming practice and usage of soft tooth brush must be encouraged among competitive swimmers.

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Conflicts of interest

There are no conflicts of interest.

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