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Prevalence of oral trauma in Para-Pan American Games athletes

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Abstract–The aim of this cross-sectional epidemiological survey was to assess the prevalence of oral trauma in athletes representing 25 countries competing at the most recent Para-Pan American Games (III PARAPAN) held in Rio de Janeiro, Brazil. The study was approved by the appropriate institutional review board. The examiners participated in standardization and calibration training sessions before the field phase began. Invitations were sent to >1200 participating athletes competing in eight sports and to the Medical Committee of the Para-Pan American Sports Organization before and during the III PARAPAN. A convenience sample of 120 athletes was recruited. After signing an informed consent, all athletes answered a questionnaire. Data were collected at the clinical examination and recorded in a specific trauma form. The mean age of the athletes was 32.5 years. Males comprised 79.2% of the sample; females 20.8%. The prevalence of oral trauma among the athletes was 47.5% ($N = 57$). However, only 15 athletes reported that these traumatic injuries were sports-related. The sport with the highest prevalence of oral trauma was judo (75%); the least was volleyball with no reported traumatic injuries. The most common traumatic injury was enamel fracture (27.4%). The teeth most affected were the maxillary permanent central incisors ($N = 19$), followed by the maxillary premolars ($N = 8$). On the basis of the results of this study of oral trauma among athletes examined at the III PARAPAN, a recommendation for enhanced educational efforts and the use of properly fitted mouthguards to prevent traumatic injuries among high-performance athletes with disabilities seems warranted.

The Paralympic Games originated as sports competition for athletes with disabilities. The first Paralympics were held in Rome in 1960, in conjunction with the Summer Olympic Games. Currently, Paralympics offers elite sports events for international athletes from six different disability groups. The Para-Pan American Games (PARAPAN) evolved from the Paralympics. The first PARAPAN was held in Mexico City, and the third edition (III PARAPAN) took place in Rio de Janeiro, Brazil, following the completion of the XV Pan American Games. Nearly 1200 athletes representing 25 countries from the Americas competed in eight sports.

A paucity of current literature exists related to the oral health of high-performance athletes competing in the Paralympics. The risk of oral trauma may vary depending on the type of contact in different sports venues. In particular, people with disabilities may be at even greater risk of oral trauma. There are few studies that determine the risk of trauma for each sport or the use of mouthguards. The few studies that do exist are limited to describing acute conditions and accidents involving athletes during sporting events. Little epidemiological trauma information related to athletes with disabilities is available.

Traumatic injuries are accidents that frequently require expeditious emergency dental management. Dental trauma in adults most frequently involves fractures of the crowns of the maxillary anterior permanent teeth, influencing function and esthetics (1). The etiology of oral trauma is related to a variety of causal factors such as falls, physical aggression, sports, car accidents, and epileptic seizures (1, 2). Epidemiological studies in this population therefore are of extreme importance (3).

One such study involved Special Olympics, Special Smiles which included 713 Special Olympic athletes during the summer games held in New Jersey, USA. Of the 713 athletes with disabilities such as mental retardation, 11.9% had experienced previous dental trauma and 17.8% wore a protective mouthguard (4).

In another investigation, dental trauma was evaluated in students at a special school for people with cerebral palsy (5). The 68 individuals who participated in that study ranged in age from 7 to 21 years with a mean age of 12.6 years. Of those who participated, 57% had signs of trauma to the permanent teeth. The

teeth most affected were the maxillary permanent central incisors. The most common traumatic injuries were fractures of enamel and dentin (62%; 5).

The objective of this study was to conduct a cross-sectional epidemiological survey of oral trauma in a convenience sample of athletes with disabilities participating in the III Para-Pan American Games 2007 held in Rio de Janeiro, Brazil.

Material and methods

This study was approved by the Research Ethics Committee of the Pedro Ernesto University Hospital of the University of the State of Rio de Janeiro, Brazil, and was administered by three examiners. The protocol was derived from a previous study conducted during the XV Pan American Games (6). The examiners included one periodontist and two general dentists who were calibrated for intra- and inter-judge reliability using kappa values obtained through the statistical program SPSS version 8.0 (SPSS Inc., Chicago, IL, USA). The intra- and inter-kappa values varied between 0.0902–0.0987 and 0.0859–0.0875, respectively.

Prior to the games, the project was presented and informational leaflets distributed at a meeting of the Medical Committee of the Para-Pan American Games. The informational leaflets subsequently were sent by the Organizing Committee of the Para-Pan American Games in Rio to all athletes in residence at the Para-Pan American village. In addition, during the games, two announcements were placed in the village newsletter, which was distributed to all athletes. Moreover, personal recruitment was conducted in the international zone and outside the village restaurant, as these were high-volume traffic areas for athletes from all countries participating in the games.

Athletes who agreed to participate in the study signed an informed consent and completed a questionnaire, available in English, Portuguese, or Spanish, with help of one of the examiners. Questionnaires identified the following information from participants: name, country of birth, age, date of birth, sex, type of sport, and whether or not the athlete previously had sustained a traumatic injury, and whether they had used a mouthguard.

After completing the questionnaire, participants received a clinical intra-oral examination by one of the previously trained and calibrated dentists. The examinations were conducted using appropriate infection control measures. All intra-oral examinations were conducted in a dental chair with standard light source and air jet. Traumatic injuries were categorized according to the Ellis classification system (7).

Differences between proportions were calculated using the chi-square test, and the alpha level was set at 0.05. Data were presented as means, with standard deviations, and 95% confidence intervals were calculated.

Results

Over 1200 athletes were registered for the games. The overall gender ratio was four males to one female athlete. A convenience sample of 120 athletes agreed to participate in the study. The overall gender distribution of the sample included 95/120 (79.2%) males; 25/120 (20.8%) females. The athletes ranged in age from 13 to 58 years.

Table 1. Distribution of athletes participating in the study by sport

Sport	No. of examined athletes	No. of athletes with oral trauma	No. of athletes with sports-related oral trauma
Track and field	50	26	4
Basketball	6	3	2
Soccer	12	4	2
Judo	4	4	3
Weightlifting	20	10	1
Swimming	11	4	2
Table tennis	8	4	1
Volleyball	9	2	0
Total	120	57	15

Table 2. Proportion of examined athletes to athletes with sports-related dental trauma

Sport	No. of athletes with sports-related oral trauma	No. of examined athletes	%
Track and field	4	50	8.0
Judo	3	4	75.0
Soccer	2	12	16.7
Swimming	2	11	18.2
Basketball	2	6	33.3
Weightlifting	1	20	5.0
Table tennis	1	8	12.5
Volleyball	0	9	0
Total	15	120	-

The distribution of athletes participating in this study by sport is presented in Table 1. A total of 57/120 athletes reported prior traumatic injury, resulting in a prevalence of oral trauma of 47.5% (95% CI ±8.93). Only 15/57 (26.3%) indicated that the traumatic injury was associated with practicing for or competing in their respective sport.

The range in age of the athletes who reportedly had sustained a prior traumatic injury was 13–58 years; mean age was 32.5 years. By gender, 80.7% were male and 20.3% female, which was determined not to be a statistically significant difference ($P = 0.580$).

The distribution of traumatic injuries by sport demonstrates that judo was the sport with proportionately the highest percentage (75%, 95% CI ±42.44) of oral trauma. Athletes in track and field (8%, 95% CI ± 7.38) and in weightlifting (5%, 95% CI ±9.55) had a low prevalence of oral trauma. None of the volleyball players in this study reported previous oral trauma (Table 2 and Fig. 1).

Fifty-seven athletes reported 62 prior traumatic injuries (Table 3). Twenty-one of the 62 traumatic injuries

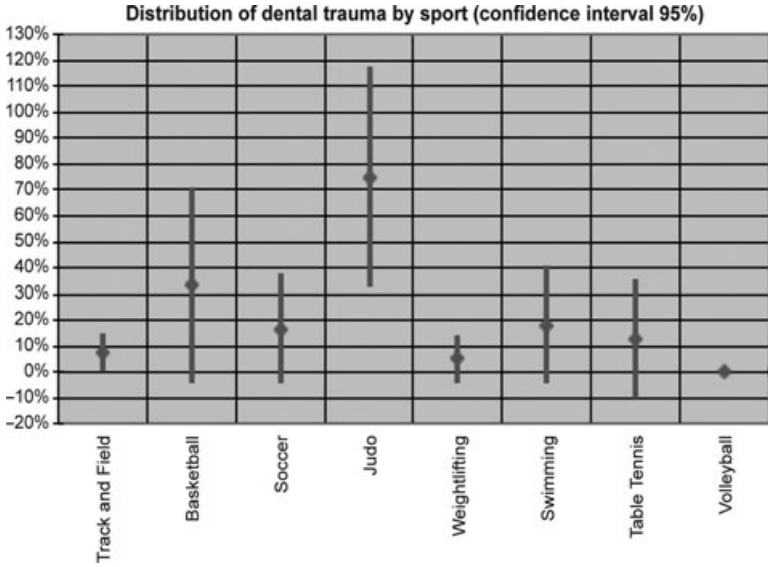

Fig. 1. Distribution of oral trauma by sport (confidence interval 95%).

Table 3. Distribution of dental trauma by type of injury

Type of traumatic injury	Total traumatic injuries	%	Traumatic injuries caused by sports only	%
Enamel	17	27.4	4	19.1
Enamel+dentin	13	20.9	1	4.7
Enamel+dentin +pulp	9	14.5	3	14.3
Avulsion	5	8.1	4	19.1
Soft tissue	6	9.7	3	14.3
Unverified	12	19.4	6	28.5
Total	62	100	21	100

Table 4. Distribution of dental trauma by tooth

Teeth	No. of dental trauma
Maxillary central incisors	19
Maxillary lateral incisors	6
Maxillary canine	1
Maxillary premolars	8
Maxillary first molar	1
Maxillary Total	35
Mandibular central incisor	1
Mandibular lateral incisors	2
Mandibular canine	1
Mandibular premolars	2
Mandibular first molar	3
Mandibular Total	9

reportedly occurred during practicing for or competing in their respective sports. The type of traumatic injury with the highest prevalence was enamel only fracture (N = 17/62; 27.4%, 95% CI ±11.1). Of the teeth with enamel only fractures, four of the 21 traumatic injuries (19.1%, 95% CI ±6.11) reportedly occurred during practicing for or competing in their respective sports.

In this study, athletes with visual disabilities had a higher prevalence of sports-related traumatic injuries (N = 13/21; 61.9%), followed by athletes with physical disabilities (N = 6/21; 28.6%) and athletes with neurological disabilities (N = 2/21; 9.5%).

The distribution of trauma by tooth appears in Table 4. In this study, the teeth most affected were the maxillary permanent central incisors (N = 19), followed by the maxillary premolars (N = 8).

Discussion/conclusion

Various systems have been in use to categorize traumatic injuries (7). The classification by Ellis was used in this study. Previous studies on the prevalence of traumatic injuries demonstrate variation in results due in part to the different methodologies used (8). Most epidemiological studies of oral trauma used retrospective questionnaires (9–11). In the current study, a questionnaire was used followed by a clinical examination.

Caution should be exercised in the interpretation of self-reported data from retrospective epidemiological studies. In some instances, overestimates may be self-reported, while in other instances, previous traumatic injuries may not be recalled by the subject, particularly those that did not require dental intervention. Further, in prospective studies, traumatic injuries would be registered if the patient sought dental treatment, but perhaps not for less severe enamel fractures (12). Thus, for some patients, the consequences of oral trauma may not be observable nor can they be classified according to the history provided by the patient (7).

In some previous studies, the prevalence of trauma in permanent teeth ranged from 14.2% to 29.6% (13–16). In the current study, nearly one-half (47.5%) of subjects overall had sustained a prior traumatic injury. However, when these data were analyzed based on sports-related oral trauma only, a prevalence of 12.5%

(15/120) was determined. In this group of athletes from the III PARAPAN, the occurrence of traumatic injuries related to participation in sports was less than from other causes. This finding is consistent with a previous study of trauma in children with cerebral palsy who had more traumatic injuries associated with situations other than sport. In that study, an oral trauma prevalence of 57% was reported and attributed to the subjects' disability (5).

While some previous studies reported no statistically significant gender differences for oral trauma (13, 15–17), other authors found that males were more prone to oral trauma than females (8, 13, 18, 19). In this study, while males demonstrated a higher frequency of oral trauma (80.7%) than females (20.3%), this difference was not determined to be statistically significant based on gender. It is important to notice that the male population was overrepresented in this sample, which may explain these results.

In the current study, the teeth most frequently affected were the maxillary permanent central incisors ($N = 19/44$), accounting for 43.1% of the affected teeth. This finding is consistent with several previously reported studies (5, 8, 12, 13, 15, 17, 18, 20, 21).

In addition, the current study is consistent with previous reports published related to types of fractures. In this study, enamel fractures were reported in 27.4% of the subjects, which is comparable to other studies that reported a range of 21.6–75.5% (12, 15, 16, 19, 22). Other traumatic injuries were reported frequently as follows: enamel and dentin fractures (20.9%); fracture of enamel, dentin, and pulp (14.5%); avulsion (8.1%). When considering only sport-related trauma in the current sample enamel fractures and avulsions occurred at the same frequency of 19.1% ($N = 4/21$). In contrast, children with cerebral palsy most commonly demonstrated enamel and dentin fractures in 62% of the cases (5).

There were a small number of sports-related traumatic injuries in this sample (15 athletes reported 21 traumatic injuries). On the basis of current findings of traumatic injuries in this study, the sport with the highest frequency of traumatic injuries was judo (75%); however, the sample was quite small. In addition, the sports that were less affected were as follows: track and field (8%); weightlifting (5%); and volleyball (0%). Future studies that focus on traumatic injuries in these specific sports seem warranted.

The high incidence of traumatic injuries in sports at all levels justifies the need for more education regarding traumatic injury prevention for athletes. Included among the recommended interventions is the use of properly fitted athletic mouthguards to protect the hard and soft tissues (23). While the protective capabilities of mouthguards related to mild traumatic brain injury and postconcussion neurocognitive performance have not been established definitively, the use of mouthguards remains essential in the prevention of hard and soft tissue oral trauma (24).

The use of a mouthguard is not required by most sports federations. Athletes, especially amateurs, often avoid using them (25). Various reasons have been given for the nonuse of a mouthguard, including esthetics, speaking, breathing, stability, dry mouth, and nausea (25). Many of these complaints are the result of poor-quality mouthguards used by the majority of athletes. These complaints can often be overcome by the use of a custom-fabricated mouthguard (26). Also, the fabrication of the mouthguard should take into consideration the actual sport involved, such as in basketball, the instrument is another player's elbow, in field hockey a stick or in soccer another player's head. Some sports may require mouthguards on both arches to handle kicks.

Only two athletes of the 120 examined had worn a mouthguard (both were boil and bite). There remains a need for enhanced education on prevention of sports-related oral trauma among high-performance athletes with disabilities such as those who compete in the Para-Pan American Games through a wider acceptance of high-quality athletic mouthguards.

Custom-made mouthguards should be strongly recommended for visually impaired athletes who presented higher incidence of sports-related traumatic injuries in the present study and are at much higher risk for dental trauma.

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Conflict of interest

None of the authors have a conflict of interest to report.

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