Frequency and distribution of gingival bleeding in a population of para-athletes competing at the III Para-Pan-American Games in Rio de Janeiro 2007

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Abstract

Aim: Prevalence of gingivitis is high in most populations and physical impairments may jeopardise oral hygiene skills, leading to gingival bleeding. This aimed to evaluate the frequency and distribution of gingival bleeding among para-athletes.

Design: A cross-sectional randomised study. Invitations were sent to over 1,300 para-participants of the III Para-Pan-American Games. A modified version of the Eastman Interdental Bleeding Index (EIBI) was adopted to assess gingival inflammation (Modified EIBI). Individuals were separated according to their physical impairments: GI– visually-impaired, with 2 subgroups: GI-a- with late-acquired-visual-impairment and GI-c- with either congenital or early-acquired-visual-impairment; G-II- with impaired upper-limbs; with 1 subgroup: G-II-t- with bilateral impairment or absent limbs; G-III, with lower limbs disabilities. The frequency and distribution of interdental bleeding were calculated and compared between groups.

Results: 121 individuals were examined, 95(78.51%) males, with mean age 32.6(sd±9.6). 29 individuals (23.97%) and 66 sites (3.03%) showed interdental bleeding. Frequencies were: G-I (8.12%±2.94); G-I-a (5.56%±2.45); G-I-c (10.7%±3.4); G-II (1.1%±0.4); G-II-t (0%); GIII (1.7%±0.7). Significant differences were found in G-I>G-III (p=0.0002); G-I-c>G-I-a (p=0.042). Males showed higher frequency of bleeding (3.6%±1.7) than females (0.8%±0.5%), p<0.01.

Conclusions: Interdental bleeding is a common condition in this population with special needs and is influenced by different physical impairments. The EIBI is a valuable tool for screening large populations and can be easily used for assessing gingival health conditions among athletes with physical disabilities. The modified-EIBI is also a valuable tool for screening large populations at major sports events, and can be easily used to assess gingival health conditions among individuals with special needs.

Key words: Disabilities, gingival bleeding, para-Pan-American games, special needs
Introduction

The Paralympics Games trace their origins to the work of Dr Ludwig Guttmann at the National Spinal Injuries Unit at Stoke Mandeville Hospital in Buckinghamshire, associating sports as part of the treatment of paraplegic patients. Competitions were prepared to coincide with the Opening Ceremony of the London Games in July 1948, becoming an annual event. From 1960 onwards, attempts were made to hold every fourth Games in the Olympic host city, and since 1988 the Paralympics were brought to the central arena of the Olympics, both literally and figuratively. New sports were embraced, a wider range of disabilities were included, and these helped to give credence to the belief that access to sport is available to all. (Jackson and Fredrickson, 1997; Gold et al., 2007).

Nowadays, the Para-Pan-American Games gather professional athletes from the American Continent every four years. The games are awarded by the Organización Desportiva Pan Americana (ODEPA), to a host city. This city is responsible for creating an Organizing Committee to take charge of all the aspects of the competitions, including the preparation of the appropriate medical assistance.

Rio de Janeiro held the III Para-Pan-American Games in 2007, embracing 10 different sports. The Brazilian Olympic Committee (COB), in accordance with the ODEPA, organised the appropriate general and medical facilities for the athletes temporarily living at the Para-Pan-American Village, during the period of the games. It is important to emphasise that high performance athletes need to be healthy to be able to train and achieve their best performance when representing their countries during major sports events. Those competitions involve a long period of concentration and training, so an oral health problem can potentially jeopardise the performance of the athlete during the competitions, especially those taking place in a foreign country.

In a population of para-athletes, physical impairments, such as visual deficiency or arm-hand disabilities, may limit the hygiene skills and thus influence the quality of oral hygiene, leading to gingival inflammation and bleeding. Periodontal diseases are primarily inflammatory, and visual signs of bleeding are useful to evaluate the gingival status. Interdental gingival bleeding is a clear and objective parameter to show the presence of gingival inflammation.

Bleeding after stimulation has been considered a clinical sign indicating gingival inflammation and associated inflammatory lesions within the connective tissues of the interdental gingival region (Bouwsma et al., 1988). The clinical evaluation of interdental gingival status has been based upon bleeding tendency after stimulation with wooden interdental cleaners (Gjermo and Flotra, 1970). According to Albandar and Rams (2000), the prevalence of gingivitis is reported to be high in most populations. Although oral health conditions in disabled individuals have been reported earlier (Ohita et al.,1993; Pieper et al., 1996; White et al., 1998; Perlman 2000, Pezzementi and Fischer 2005), there are few studies describing the periodontal status of physically impaired athletes (para-athletes) during major sport events ( Feldman et al., 1997; Reid et al., 2003). Many studies have shown the association between periodontal inflammation and systemic health (Moutsopoulos and Madianos 2006; Wohlfel et al., 2009), although there is no consensus regarding the causal relationship between them. The detection of visual signs of inflammation in the oral cavity of this disadvantaged population should be taken into consideration when conducting oral health programmes before, or during, major sports events.

Whether or not physically impaired athletes are at higher risk for gingival inflammation is not known at the moment. Therefore, the current study was specifically undertaken to assess the periodontal status of para-athletes. The aim of this cross-sectional randomised study was to assess the frequency and distribution of interdental gingival bleeding in a population of athletes competing at the III Para-Pan-American Games.

Materials and method

The study population consisted of a sample of volunteer para-athletes participating in the competitions, held in Rio de Janeiro, in August of 2007. A total of approximately 1,300 para-athletes occupied the Para-Pan-American Village, for the event. Contestants came from 26 countries in the American Continent, including North America, Central America, Caribbean Islands, and South America. The study was approved by the Ethics Committee from the Rio de Janeiro State University Hospital (HUPE) and all participants signed an informed consent.

Printed invitations, written in the three official languages of the Games, Spanish, English and Portuguese, previously approved by the Brazilian Olympic Committee (COB), as well as by the Organización Desportiva Pan Americana (ODEPA), were distributed to the medical staff of each participant country, and also by internal mail to all the athletes, before and during the competitions.

In total, 121 individuals, who represent nearly 10% of the athletes, were recruited outside the polyclinic area, between the international zone and the restaurant entrance, where all athletes had to go for their meals. Written invitations were randomly distributed, and the athletes were included in the study if they agreed to be examined and signed the informed consent. Recruitment and examination happened during the short official period of the competitions (12-19 August 2007).

The facilities for the study (a one-chair dental office and a reception area), were located within the polyclinic.
The office installation and equipments used for the study were approved by the Rio de Janeiro Infection Control Committee (Sanitary Vigilance from Rio de Janeiro State) to ensure the safety of the participants.

Most of the athletes who volunteered for the study availed immediately of the invitation, while others preferred to wait for a convenient time. Assistance was provided to athletes with special needs, for example, wheelchair users or visually impaired individuals, in order to reach the examination area located within the polyclinic. A trained volunteer helped the athletes to complete the forms, according to the native language of each contestant, and also gave a brief explanation of the benefits and risks of the study. After signing the informed consent, each athlete was taken to the office for the clinical examination. All athletes who volunteered were included in the study, and their medical history was recorded on the examination form, in addition to their different physical disabilities. There were no athletes taking any medication that were thought to interfere with gingival bleeding, such as anticoagulants. None of the contestants reported to be smokers, or had had dental treatment (e.g. scaling and root planing) in the previous two months.

The maximum total time for each examination was approximately seven minutes. Examinations took place daily, from 9 a.m. to 7 p.m. All athletes were screened by the same trained practitioner, who was previously calibrated.

A modified version of the Eastman Interdental Bleeding Index (EIBI) (Canon and Polson, 1985) was used in this study to assess gingival bleeding. Initially, the buccal gingival surface of the upper arch was gently dried with an air-syringe, and a rounded tip wood toothpick was used to probe the buccal area of the interdental papillae of both sides of maxilla and mandible (right and left) of each athlete. All interdental sites located mesially to the second premolars, in both arches, were probed. A toothpick was gently inserted between the teeth, from a facial aspect, on a horizontal path of insertion, depressing the papillae by 1 or 2mm (avoiding the apical direction of the tip) and the presence or absence of bleeding within 15 seconds was recorded. Given that some teeth could be missing, it was possible to evaluate a maximum number of 18 interdental spaces for each athlete. Upon request, after the examination, a brief explanation about the gingival general condition was given to each athlete.

Depending on the different physical disabilities or malformations, the para-athletes were divided into four main groups (G-I, G-II, G-III, G-IV) and subgroups. G-I-a- with visual impairment acquired after the age of 2 years; G-I-c- with either congenital visual impairment, or acquired before the age of 2 years; G-II: athletes with impaired upper limbs (hands or arms), with one subgroup: G-II-t- athletes showing right and left impaired or absent limbs (totally disabled arm/hand athletes); G-III: athletes with lower limbs disabilities or malformation, some of whom were reliant on a wheelchair. This group represented individuals that did not have any disability involving hands, arms, or vision.

Two neurologically impaired female athletes were among the individuals recruited and examined. They were not included in any of the four main groups; however, their data were used when assessing differences between genders. The frequency of bleeding papillae per athlete was calculated, assessing each different group (number of interdental bleeding sites divided by the total number of athletes on each group). Frequency of bleeding (%) for each group was also calculated. Frequency and distribution of bleeding among this population were calculated using the number of interdental bleeding sites divided by the total number of athletes in each group. Comparisons between groups were made using comparative Z - Tests for proportions and Fisher’s Exact test (p<0.05).

Results

The main groups to which the 119 athletes in the different disability groups belonged were:

- G-I: 26 athletes with visual impairment with two subgroups:
  - G-I-a- 13 with visual impairment acquired after the age of 2 years;
  - G-I-c- 13 with either congenital visual impairment, or acquired before the age of 2 years;
- G-II: 10 athletes with impaired upper limbs (hands or arms), with one subgroup:
  - G-II-t- 4 athletes showing right and left impaired or absent limbs (totally disabled arm/hand athletes);
- G-III: 83 athletes with lower limbs disabilities or malformation, some of whom were reliant on a wheelchair. This group represented individuals that did not have any disability involving hands, arms, or vision.

The results from the calibration showed an intra-individual agreement of > 0.90. A total of 121 athletes (including two females with neurological impairments) were examined, mean age 32.6 (sd±9.6), most of them being males (78.5%).

Table 1 shows the frequency and distribution of bleeding papillae among para-athletes according to their physical impairment.
Table 1 Frequency and distribution of bleeding papillae among individuals in different groups according to their special needs

<table>
<thead>
<tr>
<th>Groups</th>
<th>N (%)</th>
<th>Age mean (sd)</th>
<th>Bleeding papillae per athlete mean (%; sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>121 (100)</td>
<td>32.61 (+9.62)</td>
<td>0.55 (3.03; ± 1.55)</td>
</tr>
<tr>
<td>Group I</td>
<td>26 (21.49)</td>
<td>26.35 (+5.90)</td>
<td>1.46 (8.12; ± 2.94)</td>
</tr>
<tr>
<td>GI – a</td>
<td>13 (13.22)</td>
<td>27.77 (+6.31)</td>
<td>1 (5.56; ± 2.45)</td>
</tr>
<tr>
<td>GI – c</td>
<td>13 (10.74)</td>
<td>24.92 (+5.31)</td>
<td>1.92 (10.68; ± 3.4)</td>
</tr>
<tr>
<td>Group II</td>
<td>10 (13.22)</td>
<td>31.80 (+10.65)</td>
<td>0.2 (1.11; ± 0.42)</td>
</tr>
<tr>
<td>GII – t</td>
<td>4 (3.31)</td>
<td>24.50 (+4.36)</td>
<td>0</td>
</tr>
<tr>
<td>Group III</td>
<td>83 (68.60)</td>
<td>34.55 (+9.76)</td>
<td>0.3 (1.67; ± 0.71)</td>
</tr>
<tr>
<td>Males</td>
<td>95 (78.51)</td>
<td>31.43 (+8.78)</td>
<td>0.65 (3.63; ± 1.72)</td>
</tr>
<tr>
<td>Females</td>
<td>26 (21.49)</td>
<td>36.92 (+11.39)</td>
<td>0.15 (0.85; ± 0.46)</td>
</tr>
</tbody>
</table>

(sd) – standard deviation; N – number of individuals. * - p<0.05; ¶ p<0.01; # p<0.002; * p<0.0002

Key:
G-I-a- with visual impairment acquired after the age of 2 years
G-I-c- with either congenital visual impairment, or acquired before the age of 2 years
G-II: athletes with impaired upper limbs (hands or arms), with 1 subgroup: G-II-t- athletes showing right and left impaired or absent limbs (totally disabled arm/hand athletes)
G-III: athletes with lower limbs disabilities or malformation, some of whom were reliant on a wheelchair.

From the total number of para-athletes (n=121), 2,178 interdental sites were inspected and 66 sites were positive for bleeding (3.0%); 29 athletes (24.0%) showed at least one bleeding site.

Individuals from Group I (visually-impaired athletes), showed a higher frequency of bleeding papillae, when compared to Group III (athletes with lower limbs disabilities or mal-formation; p<0.0002). When comparing the subgroups G-I-a (subjects that acquired the visual impairment after the age of 2 years old) and G-I-c (subjects that had either congenital or acquired visual impairment before the age of 2 years old), it was found that subjects from subgroup G-I-c, had poorer gingival health with a higher frequency of interdental bleeding sites (p = 0.04).

No significant statistical difference was found between Groups II (subjects with unilateral impairment of upper limbs – arm +/or hand) and Group III (p>0.05). Interestingly, para-athletes from G-II-t (bilateral impairment of upper limbs) showed no signs of bleeding. The population of male contestants showed a significantly higher frequency of bleeding papillae when compared to the females (p<0.01).

Discussion

This survey was based on an observational cross-sectional study of the interdental gingival status of para-athletes (showing physical impairments, physical disabilities, physical mal-formations, or amputees). Bleeding is an important parameter of gingival inflammation and many indices have been used based on colour changes and/or bleeding, for the identification of early gingivitis (Caton et al., 1988; Tinoco and Giemro, 1992; Newburn, 1996). However, interproximal papillae may not be easily evaluated for visual signs of early inflammation, although they can be a critical site for the periodontal pathology (Caton et al., 1988).

The ability to detect early inflammatory lesions in tissues from interdental sites can be a useful tool for the diagnosis of gingival health. Caton and Polson (1985) suggested that the Eastman Interdental Bleeding Index (EIBI) is a sensitive and reliable method to assess interdental bleeding. In this study, we used a modified version of this index to assess the interdental bleeding status of individuals with special needs, because it was a rapid and simple method to be used during major sports events. It is possible that the modified version of the Eastman Interdental Bleeding Index used in this study may have underestimated the gingival inflammation, since no data on the periodontal status of posterior teeth were collected.

Although many authors (White et al., 1998; Perlman 2000; Reid et al., 2003; Moutsopoulou and Madianos, 2006) assessed oral health status of Special Olympic athletes with mild to moderate intellectual impairment, cerebral palsy or other neurological impairment, there is a lack of studies assessing gingival health conditions among para-athletes (physically impaired athletes). To our knowledge, this is the first study of gingival status of para-athletes.

In this study, the athletes were divided in three main groups according to their disabilities: G-I and G-II athletes had a clear disadvantage in terms of performing oral health procedures due to their visual or upper limb impairments. The sub-classification of athletes in the G-I group was because some athletes reported that they had lost their vision relatively recently, while others had congenital visual impairment, or acquired it before the age of 2 years of age. It was decided to subdivide this group since there was a clear disadvantage for an individual who had learned to clean their teeth without seeing them, compared to individuals who were able to see them by the time they learned oral hygiene measures. The stratification in the G-II group was made because individuals showing right and left impaired, or absent upper limbs, had a clear disadvantage when compared to individuals with only one impaired, or absent upper limb, and who could still adapt to use the remaining upper limb. G-III individuals were athletes showing lower limb disabilities or malformation, but did not present any disability involving hands, arms, or vision. These individuals were used as a control group since they would apparently have no impairment in performing oral health procedures.

Feldman et al. (1997) assessed the feasibility of col-
lecting epidemiological data among 1,000 Special Olympics contestants with intellectual impairment. Results revealed that approximately 60% (n = 421) of these athletes had visual signs of gingivitis. The athletes participating in this study were assessed as having a much worse gingival health than the general population examined by the U.S. Department of Health and Human Services in 1986.

It is known that some systemic conditions such as blood disorders, diabetes, neutropenia, leukaemia, and oral conditions such as erosive lichen planus, pemphigus, pemphigoid, dermatitis herpetiformis, linear IgA disease, chronic ulcerative stomatitis, among others, might influence gingival bleeding. In this study, none of the participants reported or showed any of those conditions. None of the examined contestants reported the use of any drugs, such as anticoagulants, which may impact on the bleeding status.

In a variety of studies, researchers have attributed short-term oral health improvements, and low plaque levels, to the influence of the Hawthorne effect as an unintended consequence of research participation (Binney et al., 1996; Feil et al., 2002). Since the participants could have brushed their teeth and removed all visible plaque before coming to examination, it was decided to use gingival bleeding as a marker of inflammation, and indirect indicator of oral hygiene, as it was less affected by sudden oral health improvements.

In 1998, White et al. also investigated a group of special athletes focusing on their dental treatment needs. The study was based on an oral health screening protocol for assessing oral health status of contestants, participating in an annual Special Olympics event. The screening protocol included the use of a flashlight and tongue blade to visually inspect the entire mouth rather than assess individual teeth or surfaces. Results from 385 athletes in the San Francisco Bay area were published. From the total adult population screened, 47% of the individuals showed visual signs of gingivitis. Findings regarding missing teeth and untreated dental decay indicated that those athletes had a substantial unmet need for dental and preventive services. The authors pointed to the fact that visual-only assessment can lead to underestimation of data, when compared to other tactile, as well as visual, examination.

Forrest (1969) was the first to carry out a survey evaluating oral health conditions among high performance athletes during the competition period. This took place at the Mexico Olympics (1968) and it was found that athletes had a high DMF for most of the countries. However, information was collected from the dental records of participants who were seeking dental care, and this may have influenced the results. The collection of epidemiological data on oral health status based on dental records of contestants seeking dental care service can introduce an unwanted bias in the survey. In the present study, it is important to emphasise that dental care services were provided by a different designated team of practitioners working for a private company (ODONTOPREV, São Paulo, Brazil).

After the examination of the 121 recruited para-athletes, it was found that two female athletes examined showed no physical impairment but a neurological impairment (cerebral palsy). The data from these athletes was not used for comparisons between groups, and was only included in the statistical analysis when considering genders. The seven minute protocol adopted for the entire examination was welcomed by most of the athletes, considering the benefits of a quick check up on their gingival health condition. Time is a crucial factor when recruiting for epidemiological surveys in major sports events, in order to avoid delay for training programmes and opportunities during the competition period.

The difference between groups, G-I (visually-impaired athletes) and G-III (lower limb impairments) strongly suggests that visual impairment might jeopardise oral hygiene. When comparing the two subgroups of visually-impaired athletes, G-I-a (with acquired visual impairment after the age of 2 years) and G-I-c (with congenital impairments, or acquired before the age of 2 years), G-I-c showed a higher frequency of bleeding sites, than G-I-a. There was no statistical significant difference between G-II (unilateral upper limb impairment) and GIII (other disabilities but no visual or upper limbs impairments).

One possible explanation for this finding is that the high motivation found among those individuals helped them overcoming their disability. In general, the development of new skills was evident among those athletes participating in a major sport event, despite the limitations of the unilateral arm or hand impairment.

Interestingly, the four athletes of subgroup G-II-t (total impairment of upper limbs -arm/hand) showed no signs of bleeding. Despite the small sample size, which does not allow any conclusions, this observation strongly suggests that they might get assistance when cleaning their teeth. When assessing data from the entire population screened (n=121), comparison between genders points to a worse gingival condition of males. The population of male contestants showed a fourfold higher frequency of bleeding papillae when compared to the females, and the difference between groups was statistically significant. However, it is important to take into consideration that data on females gingival status could be underestimated due to the limited number of females examined (n=26).

In general, the number of male contestants in the III Para-Pan-American Games was approximately three times larger than the number of female contestants.

Customised, oral health programmes should be designed and offered to individuals at higher risk of gingival inflammation, such as visually- and congenitally-impaired athletes in major sports events. In particular, a
dental team specifically trained to assist this population with special needs should always be present at major sports events.

Conclusions

Gingival bleeding is a common condition in this population and is influenced by different physical impairments. The modified version of the Interdental Bleeding Index is a valuable tool for screening large populations at major sports events, and can be easily used to assess gingival health conditions among individuals with special needs.

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References


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