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# Bruxism and type of breathing as factors associated with oral herpes lesion in Brazilian para-athletes

Carmen Lucia Mueller Storrer<sup>1</sup> | Eugenio Esteves Costa<sup>2</sup> | Rafaela Scariot<sup>3</sup> |  
 Maria Fernanda Pivetta Petinati<sup>2</sup> | Ciro Winckler<sup>4</sup> | Tatiana Miranda Deliberador<sup>2</sup> |  
 Erika Calvano Kuchler<sup>5,6</sup> | João Armando Brancher<sup>2</sup>

<sup>1</sup> Faculdade São Leopoldo Mandic –  
 Unidade Curitiba, Curitiba, Paraná, Brazil

<sup>2</sup> School of Health Sciences, Universidade  
 Positivo, Curitiba, Paraná, Brazil

<sup>3</sup> Universidade Federal do Paraná,  
 Curitiba, Paraná, Brazil

<sup>4</sup> Sport Science Department, Brazilian  
 Paralympic Committee, São Paulo,  
 Brazil

<sup>5</sup> Human Movement Sciences  
 Department, Universidade Federal de São  
 Paulo, Santos, Brazil

<sup>6</sup> Department of Pediatric Dentistry,  
 School of Dentistry of Ribeirão  
 Preto Universidade de São Paulo, São  
 Paulo, Brazil

## Correspondence

Carmen Lucia Mueller Storrer, Rua Dep-  
 utado Heitor Alencar Furtado, 3600,  
 Curitiba, Paraná, Brazil.

Email: [carmen.storrer@gmail.com](mailto:carmen.storrer@gmail.com)

## Abstract

**Aims:** The present study investigated if recurrent manifestation of oral herpes lesions is associated with other factors and impacts the oral health-related quality of life in para-athletes.

**Methods and results:** The studied population was composed of a convenience sample of 370 Brazilian para-athletes. All included individuals answered questionnaires and were submitted to an oral examination. A self-reported questionnaire addressed demographic and oral health data, including the recurrent manifestation of oral herpes lesions. The Oral Health Impact Profile was also applied in its reduced version with 14 questions (OHIP-14). The population was categorized according to results from previous competitions into a high-performance level, medium-performance level, and regional-performance level. Chi-square or Fisher's exact tests, odds ratio calculation, logistic regression analysis, and *t*-tests were performed ( $\alpha = 5\%$ ). Sixty (16.2%) para-athletes reported recurrent manifestations of oral herpes lesions. Para-athletes with sleep bruxism ( $p = .007$ ) and awake bruxism ( $p = .048$ ) had a higher chance of reporting oral herpes lesions. Type of breathing was also associated with oral herpes lesions ( $p = .031$ ). The OHIP-14 mean distribution among the groups was not statistically significant ( $p > .05$ ).

**Conclusion:** Bruxism and type of breathing were associated with self-reported oral herpes lesions in Brazilian para-athletes.

## KEYWORDS

bruxism, herpes simplex virus type 1, oral health, para-athletes, quality of life, sports

## 1 | INTRODUCTION

The concept of oral health has been modified and expanded over the past few years. Now, the World Health Organization considers the inclusion of social well-being,

not only the absence of disease when evaluating oral health (WHO).<sup>1</sup> Poor oral health influences social well-being and is strongly associated with poor systemic health and decreased quality of life (QoL).<sup>2</sup> Thus, oral health problems, such as caries lesions, periodontal diseases, root

canal therapies, dental trauma, and the need for dental extractions can significantly affect QoL.<sup>3,4</sup> In high-performance athletes, oral health conditions can affect performance.<sup>5</sup> In fact, oral health problems are frequent in athletes with disabilities. Two important cross-sectional studies performed with thousands of para-athletes showed that the most common oral health problems with major impact on oral profile in this population were untreated dental caries, missing teeth, gingival diseases.<sup>6–9</sup> It was also concluded that the majority of para-athletes needs urgent dental treatment.<sup>9</sup>

Oral herpes is one such condition that can impact QoL. Oral herpes lesions are usually 1–2 mm blisters that rapidly breakdown and are caused by infections of the herpes simplex virus type I (HSV-1 few). After the primary infection, which is normally asymptomatic, the herpes lesion may periodically be reactivated. The recurrent herpetic infection usually occurs on the lips and produces symptoms such as paresthesia, tenderness, pain, fever, gingivostomatitis, and burning sensation.<sup>10</sup> These oral lesions are relatively common before and during sports competitions,<sup>11,12</sup> and are probably triggered by stress, exposure to ultraviolet rays, and immunosuppression.<sup>11,13,14</sup> Although recurrent oral herpes has been widely studied,<sup>12,15,16</sup> data about the prevalence of the recurrent oral herpes lesions among para-athletes and its association with QoL in para-athletes are still unexplored in this group.<sup>17,18</sup> Therefore, studies evaluating these aspects should be performed in para-athletes.

Oral health-related quality of life (OHRQoL) questionnaires are powerful tools to predict psychological issues and estimate the impact of oral health in the individual's QoL in general.<sup>19</sup> One of these questionnaires, the Oral Health Impact Profile (OHIP-14), is a short-form questionnaire, developed and validated by Slade (1997),<sup>21</sup> that evaluates the impact of oral health on daily activities, measuring the perception of the influence of oral health on social sphere and overall QoL.<sup>22</sup> It is widely used in epidemiological studies.<sup>23</sup> Therefore, in the present study we hypothesize that some factors such as bruxism and type of breathing are involved in the higher risk of recurrent manifestation of oral herpes lesions in para-athletes. We also hypothesized that the recurrent manifestation of oral herpes lesions impacts the OHRQoL in para-athletes.

## 2 | MATERIALS AND METHODS

### 2.1 | Ethical aspects and study population

This study was approved by the local Ethical Committee according to resolution 196/96 of the Health National

Council, register #3.261.377. Only individuals who signed their informed consent were included in this project.

The studied population was composed of a convenience sample of Brazilian para-athletes. Two hundred seventy-two para-athletes were recruited during the selective stage for the Para-Pan American Games that occurred in Curitiba-PR in April 2019, and 97 para-athletes were recruited in the Brazilian Paralympic Training Center located in São Paulo-SP in June 2019. The final response rate was 95.4% and all the para-athletes that answered the questionnaires were submitted to an oral examination.

The null hypotheses of this study were (a) recurrent manifestation of oral herpes lesions are not associated with other conditions in para-athletes; (b) recurrent manifestation of oral herpes lesions does not impact the OHRQoL in para-athletes.

### 2.2 | Sampling and data collection

The screening procedure consisted of a self-reported questionnaire in Portuguese that was previously tested in a pilot project. The self-reported questionnaire addressed age, gender, ethnicity, level of para-athlete performance (regional, medium, or high, based on results of previous competitions) of wheelchair-bound athletes, previous sport-related injuries, including facial trauma, oral health habits, and recurrent manifestation of oral herpes lesions. All individuals that were not sure about their answers were excluded from the survey.

The para-athletes were divided according to results of previous competitions into three categories: (i) high-performance level; (ii) medium-performance level; and (iii) regional-performance level. To assess the impact oral health has on the quality of life of athletes, the Oral Health Impact Profile questionnaire was used in its reduced version with 14 questions (OHIP-14).<sup>21</sup> This questionnaire contains 14 questions grouped into seven domains, which measure functional limitation (D1), physical disability (D2), psychological discomfort (D3), physical incapacity (D4), psychological disability (D5), social disability (D6), and social disadvantage (D7). Responses are given according to a scale coded as 0 - never, 1 - rarely, 2 - sometimes, 3 - often, and 4 - always. The higher the value attributed by the respondent, the worse the self-perceived impact.<sup>20</sup>

### 2.3 | Clinical examination

The oral examination was carried out by previously calibrated dentists in a room. The athletes were seated in chairs in front of a window to obtain the maximum natural lighting.

The presence of bruxism was based on a previous study and included bruxism, sleep bruxism, and awake bruxism.<sup>24</sup> The questionnaire also included information regarding the habit of clenching or grinding teeth. The presence of bruxism was therefore confirmed by observing signs and symptoms related to bruxism during clinical examination, such as dental wear facets and fractures of restorations, or dental impressions on the cheek mucosa and tongue and by the individual's self-report. Breathing type, nasal, buccal, or both, was evaluated through the questionnaire and clinical exam. Lip seal was categorized at rest as sealed or as an absence of lip seal when the incisors were exposed.

## 2.4 | Statistical analysis

The para-athletes were divided into two groups according to the presence and absence of reported recurrent manifestation of oral herpes lesions. Chi-square or Fisher's exact tests and odds ratio calculation were performed to evaluate the frequency of the characteristic distributions according to the groups. Then a logistic regression model was used to estimate the adjusted odds ratio for reported recurrent manifestation of oral herpes lesions. *t*-Test was used to compare age and to evaluate the association between the recurrent manifestation of oral herpes lesion and OHIP-14. An established alpha of 5% was used for all comparisons.

## 3 | RESULTS

A total of 370 para-athletes were included. Their ages ranged from 14 to 79 years; 121 (32.7%) were females, while 249 (67.3%) were males. Eighty-seven (29.5%) subjects were wheelchair-bound athletes. One hundred forty-eight (41.5%) subjects reported previous sport-related injuries, and 142 (38.4%) athletes were bruxers.

Table 1 presents the characteristic distributions according to the groups with and without oral herpes. Sixty (16.2%) subjects reported recurrent oral herpes lesions. Sleep bruxism was more common in athletes with recurrent oral herpes lesions, with a statistical significance difference ( $p = .007$ ). Awake bruxism was also more common in athletes with recurrent oral herpes lesions ( $p = .048$ ). The type of breathing was also associated with reported recurrent oral herpes lesion ( $p = .031$ ).

Figure 1 shows the overall OHIP-14 distribution according to the group that reports recurrent oral herpes lesion and the control group. There was no statistically significant difference ( $p = .388$ ). Table 2 shows the means and standard deviations (SD) of the domains according to the

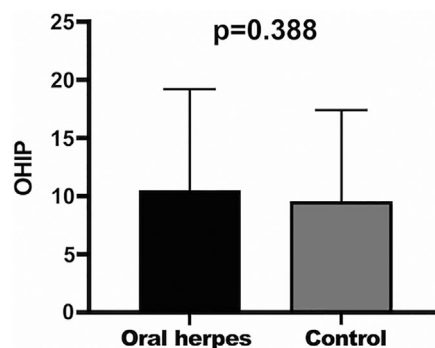


FIGURE 1 Oral Health Impact Profile (OHIP) according to the groups: "recurrent oral herpes lesion" and "control"

groups. None of the domains were associated with recurrent manifestation of oral herpes lesions ( $p > .05$ ).

## 4 | DISCUSSION

It is not new information that oral herpes episodes can occur before, during, or after physical and psychosocial stress,<sup>25</sup> as it is related to stress and anxiety.<sup>26</sup> So, we hypothesized that para-athletes in preparation for international competitions, the population that has a higher predisposition for the occurrence of the oral lesions, have the lesions negatively affect their QoL. In this sense, this study provides a unique set of data that describe the self-report of oral herpes lesion manifestation among para-athletes from Brazil during the training phases and in the qualifying competitions for international sports events. In this population, 16.2% of the para-athletes reported recurrent manifestations of oral herpes lesions that were associated with bruxism, both awake and asleep, and buccal and nasal breathing.

A recent systematic review and meta-analysis<sup>19</sup> indicated that HSV-1 infection is widely prevalent in Latin America once nearly 90% of adults are infected, which is higher than the global population (67%)<sup>20</sup> and, among athletes, is responsible for the most frequently reported outbreak of skin.<sup>11</sup> Besides, infection burden, such as recurrent oral herpes lesion, is relatively common before and during sports competitions among high-performance athletes, triggered by constant stress and anxiety, exposition to ultraviolet rays, episodes of immunosuppression, and direct skin-to-skin contact.<sup>27,28</sup>

Some studies demonstrated the impact that exercise can have on the immune system. Physical training with moderate intensity has been shown to improve various immune markers,<sup>17,28,29</sup> although exercises practiced by high-performance athletes have been associated with suppressed mucosal and cellular immunity, latent viral

**TABLE 1** Characteristic distribution according to the groups with and without manifestation of reported recurrent oral herpes lesions

Characteristic	Recurrent oral herpes lesion		Univariate analysis		Multivariate analysis OR [95% CI]
	No	Yes	p-Value	OR [95% CI]	
Age					
Mean (SD)	31.1 (SD = 10.60)	29.9 (SD = 10.30)	.453 <sup>a</sup>	–	–
Gender, n (%)					
Male	208 (32.9%)	41 (31.70%)	.851 <sup>b</sup>	0.94 [0.51–1.71]	0.98 [0.63–1.53]
Female	102 (67.10%)	19 (68.30%)			
Level of para-athlete performance					
Regional	132 (42.60%)	24 (40.70%)		Reference	Reference
Medium	74 (23.90%)	21 (35.60%)	.178 <sup>b</sup>	1.53 [0.83–3.03]	1.77 [0.81–3.13]
High	104 (33.50%)	14 (23.70%)	.404 <sup>b</sup>	0.74 [0.35–1.47]	0.89 [0.48–1.51]
Sports-related injuries					
No	173 (58.20%)	36 (60.00%)	.801 <sup>b</sup>	1.06 [0.52–1.63]	1.02 [0.25–1.34]
Yes	124 (41.80%)	24 (40.00%)			
Wheelchair-bound athletes					
Yes	72 (28.70%)	15 (34.10%)	.468 <sup>b</sup>	0.97 [0.65–2.54]	0.89 [0.48–1.98]
No	179 (71.30%)	29 (65.90%)			
Breathing type					
Nasal	201 (66.80%)	33 (55.90%)	<b>.031</b> <sup>a,b</sup>	Reference	
Buccal	45 (14.90%)	7 (11.90%)		0.94 [0.43–2.53]	0.78 [0.65–1.89]
Both	55 (18.30%)	19 (32.20%)		2.12 [1.28–2.89]	2.02 [1.11–2.91]
Bruxism					
No	198 (63.90%)	30 (50.00%)	<b>.043</b> <sup>b</sup>	2.02 [1.00–3.10]	1.67 [1.13–2.91]
Yes	112 (36.10%)	30 (50.00%)			
Sleep bruxism					
No	245 (80.30%)	38 (64.40%)	<b>.007</b> <sup>b</sup>	2.25 [1.23–4.12]	1.98 [1.33–3.89]
Yes	60 (19.70%)	21 (35.60%)			
Awake bruxism					
No	208 (68.20%)	26 (44.10%)	<b>.048</b> <sup>b</sup>	1.68 [1.00–2.98]	1.79 [1.09–2.81]
Yes	97 (31.80%)	33 (55.90%)			
Lip seal					
No	51 (21.50%)	51 (85.00%)	.252 <sup>b</sup>	1.55 [0.72–3.35]	1.62 [0.81–3.05]
Yes	237 (78.50%)	9 (15.00%)			

Note: Bold means statistically significant difference ( $p < .05$ ).

Abbreviations: CI, confidence interval; OR, odds ratio; SD, standard deviation.

<sup>a</sup>t-Test was used; difference was observed between nasal breathing and both types of breathing.

<sup>b</sup>Chi-square test was used.

infection, and increased symptoms of upper respiratory tract infections, predisposing to oral herpes.<sup>30</sup> In our study design, we chose to dichotomize para-athletes in three different groups based on the performance of each individual: regional-performance level, medium-performance level, and high-performance level, and the reported recurrence of oral herpes lesion was not statistically different among these groups.

Considering the important role that oral health plays in QoL, it has been stated that the OHIP-14 measures the extent to which oral conditions affect an individual's

behavior and complement the clinical assessment of oral health.<sup>4</sup> Our study did not observe a statistical difference in the OHQoL accessed by OHIP-14 subscales between para-athletes who reported or who did not report oral herpes. This could be due to the small sample size of para-athletes who reported oral herpes in our population, or by the fact that they were not presenting the lesion on the day that questionnaire was applied. Another possibility is that the stressful life events triggered by competition increases the susceptibility to illness and oral herpes manifestation in the after weeks of the event. The stress and anxiety of

**TABLE 2** Oral health on quality of life (OHIP-14) according to the groups

OHIP-14 items	xzDomain	Recurrent oral herpes lesion, mean (SD)		p-Value
		Yes	No	
1	Functional limitation	1.13 (1.53)	1.08 (1.45)	.812
2	Physical pain	1.93 (2.04)	1.61 (1.70)	.220
3	Psychological discomfort	2.70 (2.39)	2.38 (2.29)	.326
4	Physical disability	1.08 (1.52)	0.94 (1.48)	.513
5	Psychological disability	1.93 (2.17)	1.51 (1.73)	.109
6	Social disability	1.18 (1.65)	1.46 (1.74)	.273
7	Handicap	0.65 (1.30)	0.64 (1.20)	.960

Abbreviation: SD, standard deviation.

*t*-Test was used.

para-athletes and their association with oral herpes manifestation and OHQoL should be investigated in future studies.

Besides OHQoL, our study also aimed to evaluate factors associated with oral herpes in para-athletes, and an interesting association with bruxism was observed. Oral herpes lesions were associated with bruxism, sleep bruxism, and awake bruxism. Sleep bruxism is characterized by grinding or clenching of the teeth during sleep that is triggered by environmental and genetic factors. The most common environmental factors associated with bruxism are anxiety, stress, and poor sleep quality<sup>31</sup>—factors also associated with oral herpes recurrence. Awake bruxism is a masticatory muscle activity that occurs during wakefulness and is characterized by repetitive or sustained tooth contact and/or by bracing or thrusting of the mandible.<sup>32</sup> Both conditions have the characteristics that might be associated with some specific symptoms of anxiety disorders, such as stress sensitivity. Para-athletes who have both bruxism episodes, sleep bruxism and awake bruxism, have a higher chance to report oral herpes. Both sleep bruxism and awake bruxism are associated with important psycho-emotional aspects and can affect the QoL, although no domain of OHQoL has been associated with oral herpes. According to Peake et al. (2017),<sup>30</sup> chronic sleep disturbance is feasibly associated with inflammation and disintegration of cadenced immune variables,<sup>33,34</sup> but surprisingly little is known about how bruxism influences the immune responses.

Primary individual infections with HSV-1 occur through direct contact with body fluids, especially saliva. The virus infects the oral mucosa through a specific interaction between virus and cell surface receptors and initiates the

replication process. Afterward, it invades nerve endings and is transported to neuronal cell bodies where it remains latent. The trigeminal ganglion is the main site where the virus remains.<sup>35</sup> The stimuli that determine the virus remains in its latent or reactivating state are still unclear but some systemic or local agents trigger virus activation like fever, emotional stress, fatigue, lip exposition to ultraviolet light or cold, and local lip trauma.<sup>10</sup> Now, our findings demonstrated that type of breathing is associated with oral herpes lesions, and those para-athletes who presented both types of breathing, mouth and nasal, have a higher chance to have recurrent oral herpes lesions. Despite the physiopathological mechanism that leads to the episodes of herpes lesions, we may hypothesize that in the same way changing mouth and nasal breaths could trigger the lesions. Maybe that is why lips are not efficiently humidified when the individual opens his mouth to breathe. But this is also contradictory because in individuals who breathe only through the mouth the prevalence of injuries is small. So, we can assume that mouth and nasal breathing, together, is one more factor that should be added to the list of triggering factors for oral herpes lesions. To the best of our knowledge, this is the first study that revealed this association.

Finally, our study did not demonstrate that para-athletes with oral herpes had a worse OHQoL; however, some other associations were observed. The knowledge regarding the factors associated with oral herpes might allow strategies to reduce the recurrence of this lesion in athletes. Despite this study provided the same evidence of an association between bruxism, type of breathing, and oral herpes, the limitation of this study was the absence of lesions at the time of the interview, so the collected responses were based only on self-report by the para-athletes. In conclusion, awake and sleep bruxism and type of breathing, described as buccal and nasal breathing, were associated with self-reported oral herpes lesion in Brazilian para-athletes.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ETHICS STATEMENT

This study was approved by the local Ethical Committee according to resolution 196/96 of the Health National Council, register #3.261.377.

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