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Original Article

Factors Associated with Gingivitis in Children with Developmental Disabilities

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Abstract

Objective: To investigate factors associated with gingivitis in children aged one to 13 years with developmental disabilities. **Material and Methods:** A total of 408 dental records were used to recover the data. Gingivitis was measured based on the Modified Gingival Index. Other variables were also analysed: gender, age, International Classification of Diseases (ICD) code, mouth breathing, history of gastroesophageal reflux, use of psychotropic drugs, reports of dry mouth, history of asthma, use of medications to treat asthma, oral hygiene, dental caries, and filled or missing teeth in deciduous or permanent dentition. For the purposes of this analysis, the individuals were categorized as with and without gingivitis. Variables with a p-value < 0.25 in the bivariate analysis were incorporated into the logistic regression models (ICD, reflux, oral hygiene, primary tooth decay or filling, mouth breathing, dry mouth and use of psychotropic drugs). **Results:** We found a 14.67% prevalence of gingivitis. Individuals with mouth breathing had a 2.574-fold (95% CI: (1.113-5.950) greater chance of exhibiting gingivitis. Individuals with moderate oral hygiene had a 2.763-fold (95% CI: 1.066 to 7.160) greater chance of exhibiting gingivitis, and individuals with poor oral hygiene had a 15.029-fold (95% CI: 3.705-60.965) greater chance of exhibiting gingivitis than those with good oral hygiene. **Conclusion:** Moderate or poor oral hygiene and mouth breathing are factors associated with gingivitis in a group of patients with developmental disabilities at a dental service in Belo Horizonte.

Keywords: Dental Care for Disabled; Gingivitis; Cerebral Palsy.

Introduction

Gingivitis is the predominant form of periodontal disease in children and adolescents, and it is the second most important and prevalent oral disease in children [1]. In Brazil, the prevalence of gingival bleeding increases from the age of 12 years to adulthood and decreases in the elderly, considering the increase in tooth loss in this age group. Approximately one-quarter of adolescents aged 12 years and one-third of individuals aged 15-19 years old have gingivitis [2].

Moderate or severe gingivitis has been found almost universally, with the degree and extent increasing with age and the degree of mental and physical impairment [3]. Among individuals with disabilities, the presence of gingival changes is related to the consumption of paste-like food, difficulties with self-cleaning (because of impairments of the tongue movements and the muscles involved in swallowing) and difficulty maintaining efficient cleaning by the individuals or their caregivers [4]. Moreover, medication use may be associated with gingivitis [5]. Gingivitis in this group ranges from 68.3% to 94.73% in Brazil [6], 61.3% in India [3] and 93.6% in Saudi Arabia [7].

Gingivitis is associated with mouth breathing and dry mouth [8], oral hygiene [9, 10]. age [11], dental caries [5,12], the use of medication, [12] different diagnoses of cerebral palsy [4], asthma and the medications used to treat it [13], and male gender [5].

Knowledge regarding the factors associated with gingivitis among individuals with developmental disabilities can assist in broadening the understanding of this condition and establishing treatment options that are more suitable for this group of patients. Thus, the purpose of the present study was to investigate factors associated with gingivitis in children (aged one to 13 years) with developmental disabilities who were treated at a reference service for patients with special needs in the city of Belo Horizonte, Brazil. This service is provided at the dental clinic of the Minas Rehabilitation Association (Associação Mineira de Reabilitação-AMR), which works in partnership with the School of Dentistry, Federal University of Minas Gerais (Universidade Federal de Minas Gerais- UFMG).

Material and Methods

Ethical Considerations

This study was approved by the ethics committee on human research of UFMG under number ETIC 219/03.

Sample Selection

This was an observational study based on the analysis of all records of individuals aged 1 to 13 years old with developmental disabilities who underwent treatment or dental maintenance (n=408) from 1998 to 2014. This was a consecutive sample. Individuals who died, who dropped out of treatment and rehabilitation or were older than 13 years were excluded from the study. The total number of patients with developmental disabilities who were treated at the dental service during this period was 1121. All the variables were measured on the first day of dental treatment except the

medical diagnosis (patient diagnosis -ICD G80/other code), which was determined during neurological treatment.

The medical records were collected by students under the strict supervision of the same teacher/researcher from the UFMG Dental School throughout the whole study period.

Visual Clinical Examination

Gingival status was determined using the Modified Gingival Index, and the contour and gingival colour were considered normal (0) or mildly to severely inflamed (1) [10,14]. The studied covariates were gender, history of asthma, mouth breathing, dry mouth, use of centrally acting medication, use of medications to treat asthma, tooth decay in primary and permanent teeth, filled primary and permanent teeth, gastroesophageal reflux, oral hygiene and age in years. Finally, the patient's diagnosis according to the International Classification of Diseases (ICD) code was collected and dichotomized into either G80 Cerebral Palsy or other diagnoses.

The presence of mouth breathing was recorded from direct observation of the patient and the parents' reports. Oral hygiene was recorded as "good", "fair" or "poor" [15].

Statistical Analysis

The statistical analysis included descriptive analysis with ratio calculation and multiple logistic regression. The crude OR (95% CI) for each covariate was estimated. Variables with $p < 0.25$ were included in the final model to estimate the adjusted OR (95% CI), which was calculated using the forward stepwise method. Only the variables that had p values < 0.05 were kept in the multiple logistic regression model. All statistical analyses were performed using the program SPSS version 19.0 (SPSS, Inc., Chicago, IL, USA).

Results

Sample Characteristics

Information on gingivitis was available in 368 (Response rate = 90.19%) out of 408 charts of the analysed children aged one to 13 years. A gingivitis prevalence rate of 14.67% was found. The distribution of the patients by age is presented in Table 1.

The patients' diagnoses were as follows: G800 (spastic quadriplegic cerebral palsy), G801 (spastic diplegic cerebral palsy), G802 (spastic hemiplegic cerebral palsy), G811 (spastic hemiplegia), G824 (spastic tetraplegia), F82 (specific developmental disorder of motor function), G540 (brachial plexus disorders), G71 (primary disorders of muscles), M401 (other secondary kyphosis), P271 (bronchopulmonary dysplasia), P143 (other brachial plexus injuries), Q052 (lumbar spina bifida with hydrocephalus), Q053 (sacral spina bifida with hydrocephalus), Q057 (lumbar spina bifida without hydrocephalus), Q059 (spina bifida unspecified), Q90 (Down syndrome), R628 (other lack of expected normal physiological development) and R629 (lack of expected normal physiological development, unspecified). In most cases, the caregivers were responsible for providing oral hygiene or finishing

tooth brushing because of the children's high degree of motor impairment, as indicated by their medical diagnoses.

Table 1. Distribution of 408 children with developmental disabilities by age.

Age	Number of individuals
1 year	97 (23.77%)
2 years	82 (20.01%)
3 years	58 (14.21%)
4 years	49 (12.00%)
5 years	38 (9,31%)
6 years	26 (6.37%)
7 years	18 (4.41%)
8 years	11 (2.69%)
9 years	11 (2.69%)
10 years	4 (0.98%)
11 years	5 (1.22%)
12 years	5 (1.22%)
13 years	4 (0.98%)

In the bivariate analysis, the variables ICD code, reflux, hygiene, primary tooth decayed or filled, mouth breathing, dry mouth and central-acting medication use were included in the logistic regression model because they presented p values < 0.25 (Table 2). The Hosmer-Lemeshow test demonstrated that the model was suitable (0.363). Oral care ($p < 0.001$) and oral breathing ($p = 0.027$) were included in the final model (Table 2).

Table 2. Associations between gingivitis and independent variables.

Variable		Without inflammation	With inflammation	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (years)				1.056 (0.957-1.165)	0.282		
Gender	Male	178	31	1.030 (0.574-1.846)	0.921		
	Female	136	23	1			
CID G80	No	44	3	0.422 (0.123-1.444)	0.169		
	Yes	192	31	1			
Psychotropic drugs	No	166	20	0.511 (0.281-0.931)	0.028		
	Yes	140	33	1			
Asthma	No	252	43	0.967 (0.272-3.441)			
	Yes	17	3	1	0.959		
Use of drugs to treat asthma	No	278	50	1.679 (0.492-5.732)			
	Yes	28	3	1	0.408		
Gastroesophageal reflux	No	280	42	0.464 (0.218-0.985)	0.045		
	Yes	34	11	1			
Mouth breathing	No	171	19	1		1	
	Yes	140	34	2.183 (1.195-4.000)	0,011	2.574 (1.113-5.950)	0.027
Xerostomia	No	275	40	0.403 (0.197-0.824)	0.013		
	Yes	36	13	1			
Oral Hygiene	Good	250	30	1		1	
	Moderate	46	13	0.084 (0.030-0.237)	0.000	2.763 (1.066-7.160)	0.036
	Poor	7	10	0.198 (0.063-0.622)	0.006	15.029 (3.705-60.965)	<0.001
Decayed deciduous teeth	No	233	35	1			
	Yes	77	18	1.127 (1.001-1.269)	0.048		
Filled deciduous	No	291	50	1	0.109		

teeth	Yes	16	3	1.166 (0.966-1.406)	
Decayed permanent teeth	No	62	12	*	0.998
	Yes	8	0		
Filled permanent teeth	No	63	11	1	
	Yes	4	1	1.091 (0.162-7.368)	0.928

*Considering the distribution of data, it was not possible to measure OR.

Discussion

Oral hygiene and mouth breathing were independently associated with gingivitis in the children analysed in this study.

The results showed that gingivitis is associated with poor oral hygiene, as demonstrated in previous studies [9,10], and that there is a biological gradient for the oral hygiene variable in individuals with developmental disabilities similar to that for dental caries [17]. Another study did not show this association [7]. Gingivitis is an early stage of chronic periodontitis, and its incidence is decreased by plaque control measures such as tooth brushing and the use of floss and toothpaste [3,11]. Therefore, emphasizing oral hygiene habits among patients and their caregivers has become a major goal of this service not only to control gingivitis and dental caries but mainly to increase the quality of life of these patients.

Gingivitis was also associated with mouth breathing, as demonstrated in a previous study. This effect appears to be closely linked to decreased salivary flow (and its protective effects on soft tissue), which evaporates more quickly in the case of mouth breathing [8,16]. Other authors have not found this association [5].

We expected that gastroesophageal reflux disease, tooth decay [5,12], cerebral palsy [3,4,7,18], asthma and drugs for its treatment [13], xerostomia [8], and male gender [5] would be associated with gingivitis, but these associations were not found in our study.

In relation to age, previous studies showed that younger children have less gingivitis than older children [11,18], which was also not proven in our study.

We expected that the use of psychotropic drugs would be associated with gingivitis [12]. The use of phenytoin, an anticonvulsant significantly associated with gingival hyperplasia [20], was not detected in this population. Phenobarbital and valproic acid, which were used by a large part of this sample, were previously associated with gingival hyperplasia [4]. However, in this study, the use of anticonvulsant drugs was not associated with gingivitis. A previous study carried out in Brazil also found no associations between the use of anticonvulsants and gingival and periodontal disorders [6].

In the prevalence analysis, the result was very similar to the results of a study carried out in Piracicaba (Brazil) with 5-year-old children (16.6%) [5], a previous study in Belo Horizonte with children ranging in age from 5-6 years (18.19%) [21], a study of children aged from 4-12 years (19.2%) with severe mental disabilities in the Netherlands [22] and study of Nigerian children aged 8.5 years on average (19.7%) [23]. Several studies of individuals with cerebral palsy reported a higher prevalence of gingivitis than that reported in this study [3,7,18]. In terms of the general

Brazilian population, the national oral health survey indicated that at 12 years old, 27.1% of Brazilians have gingival bleeding [2].

This study has some limitations. The first one relates to how the dependent variable was collected. The use of a visual examination without probing may have compromised the results, and the number of patients with gingivitis indicated by the records was likely lower than the actual number, as reported in a previous study based on gingival bleeding after brushing according to the Bass method [22]. The Modified Gingival Index was successfully used in a previous study of cerebral palsy patients [10]. Moreover, it is important to note that it is very difficult to perform reliable periodontal probing because there is no patient cooperation. Even experienced dentists had difficulties gaining access to the patients' mouths. In this case, probing could not be performed in all patients. The use of a probe was considered problematic or even potentially traumatic for the participating children with severe mental disabilities, especially as some of the children had never visited a dentist [22]. Indices measuring a bleeding component can be used in clinical trials with success [24], but non-invasive and invasive gingival indices include both objective and subjective aspects, and the scientific evidence does not support the statement that invasive indices are truly objective. Therefore, using a visual index to assess gingivitis can be an alternative to an invasive index [25].

The second limitation relates to the sample. The lower degree of gingivitis diagnosed may be explained by the percentage of younger individuals in the study sample (23.77% with 1 year and 20.01% with 2 years). The eruption of primary teeth in these individuals was incomplete. Consequently, the probability of finding infected sites was reduced. The group of subjects evaluated participated in an integrated rehabilitation service assisted by various health professionals who emphasize basic hygiene aspects to promote general health. This multidisciplinary approach might have influenced the low prevalence of gingivitis and the associated factors, such as oral hygiene. Collaboration between the health staff and the dental team is essential to promote not only oral health but holistic care for children with disabilities [22].

The third limitation is that these secondary data were obtained from medical records and the gingivitis diagnoses were made by students under a professor's supervision as a teaching/learning activity that took place during a dental course. Although it is recognized that it is not possible to have total control over secondary data obtained from outpatient and hospital records, such data can be of great help for understanding the health/disease process in a population. However, the collection of data from these records was guided by the same professional (a senior professor of School of Dentistry) at this dental service throughout the study period. Finally, cross-sectional studies do not allow the establishment of causal relationships between independent variables and the response variable [26].

This study shows the importance of allowing the health care team to apply more efficient strategies for monitoring patients and their caregivers and for encouraging the dental team to improve oral hygiene to control gingivitis and its consequences. Regarding oral breathing, joint

efforts between the dental and multidisciplinary health teams should be taken to promote oral health and positively affect quality of life.

Conclusion

Moderate or poor oral hygiene and mouth breathing are factors associated with gingivitis in patients with developmental disabilities seen at a dental service in Belo Horizonte, Brazil.

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