Oral mucosal lesions in children from 0 to 12 years old: ten years’ experience

Alessandra Majorana, MD,a Elena Bardellini, DDS,a Pierangela Flocchini, DDS,a Francesca Amadori, DDS,a Giulio Conti, b and Guglielmo Campus, DDS, PhD, c Brescia, Milan, and Sassari, Italy
UNIVERSITY OF BRESCIA, UNIVERSITY OF MILAN, AND UNIVERSITY OF SASSARI

Objective. The exact prevalence of oral lesions in childhood is not well known. We sought to define the prevalence of oral mucosal lesions in a large group of children.

Study design. A retrospective cross-sectional study was performed using clinical charts from January 1997 to December 2007. Data collected included age, gender, and pathologic diagnosis.

Results. In total, 10,128 children (0-12 years old) were enrolled. Clinical diagnostic criteria proposed by the World Health Organization were followed. The frequency of children presenting oral mucosal lesions was 28.9%, and no differences related to gender were observed. The most frequent lesions recorded were oral candidiasis (28.4%), geographic tongue and other tongue lesions (18.5%), traumatic lesions (17.8%), recurrent aphthous ulcerations (14.8%), herpes simplex virus type 1 infections (9.3%), and erythema multiforme (0.9%). Children suffering from chronic diseases had a higher frequency of oral lesions compared with healthy children (chi-square: \( P < .01 \)).


There are relatively few reports in the literature regarding oral mucosal conditions in children.1-10 The most common oral disease, caries, is studied the most, and cancer therapy–related mucosal disorders are also commonly described.1-16 Furthermore, the exact prevalence of oral mucosal lesions in healthy children is controversial due to a lack of standardized methods, different diagnostic criteria, and the description of very few lesions in each survey.1-10 The lack of epidemiologic data in this matter may lead to diseases of the soft tissues of the oral cavity being overlooked.17 Despite World Health Organization recommendations, the epidemiologic literature about children and adolescents in this field is quite limited.18 Moreover, the signs and symptoms of oral mucosal disorders in childhood can change with aging and are often different from common adult oral pathologies. These differences should be recognized by clinicians, and are aided by epidemiologic studies that document the frequency of oral lesions in children. Therefore, the aim of this study was to evaluate the prevalence of oral mucosal anomalies in children 0-12 years of age.

MATERIALS AND METHODS

Selection of the sample

A retrospective cross-sectional study was designed using clinical charts from the Department of Paediatric Dentistry of the Dental Clinic of the University of Brescia from January 1997 to December 2007. The case records of all patients were reviewed for the presence of oral soft tissue abnormalities, and relevant retrospective data were extracted systematically. Data collected included age, gender, site, and pathologic diagnosis. A total of 10,128 children (0-12 years of age) were enrolled. Parents or caregivers of all patients were interviewed regarding chief symptoms, history of current illness, medical history, and dental history. The patients were divided into 2 groups: children with systemic diseases and healthy children.

Examination and data recording

Clinical diagnostic criteria proposed by the World Health Organization were followed;19 patients were examined under standardized conditions, with artificial light, disposable retractors, and a mirror. Lesions caused by decay and endodontic and inflammatory periodontal lesions were excluded. If needed, clinical diagnoses were confirmed by laboratory tests, such as blood tests, swabs, or biopsy.

A team of 4 examiners was instructed and calibrated to detect oral lesions in young patients in 1997 before the beginning of the study. The calibration exercises were repeated every 24 months, and during the 10-year
period, a total of 6 examiners took part in the study and 2 examiners (A.M. and E.B.) participated in its entirety. All clinical data (including medical history, use of medications, and presence of oral habits) were recorded on a form designed for this study. The parents of the children were informed about the survey and gave informed consent. The study was approved by the Ethics Committee at the University of Brescia (registration no. 2006/24).

Data analysis

All data were entered into a database in Microsoft Excel 2004 for Macintosh. Analysis was performed using the statistical software Stata 9.0 for Mac. Descriptive statistics and bivariate analysis were performed using the chi-squared test. Fisher test was used when appropriate. Results were considered to be statistically significant when \( P < .05 \).

RESULTS

A total of 10,128 children (mean age 6.5 ± 0.3 yrs) were examined: 5,874 (58.0%) boys and 4,254 (42.0%) girls. Oral mucosal lesions were detected in 2,918 (28.9%) children. The age and gender distributions of the sample are displayed in Fig. 1. Seventeen different types of oral mucosal lesions were diagnosed (Table I). The most common lesions were oral candidiasis (n = 829; 28.4%), traumatic lesions (n = 519; 17.8%), recurrent aphthous stomatitis (n = 476; 14.8%), geographic tongue (n = 290; 10.9%), oral herpes simplex virus type 1 (HSV-1) recurrent infection (n = 271; 9.3%), primary herpetic gingivostomatitis (n = 132; 4.5%), and erythema multiforme (n = 26; 0.9%).

Traumatic intraoral soft tissue lesions were commonly caused by injuries, such as from habits (morsicatio buccarum, cheek and lip biting, etc.), unsuitable fillings, orthodontic devices, burns from foods, caustic materials for dental care, and traumatic events. No differences among oral mucosal lesion types relating to gender and age were observed.

Patients were divided into 2 main groups: children with systemic diseases (n = 1,772; 60.7%) and healthy children (n = 1,146; 39.3%). Systemic diseases were distributed as follows: asthma (9.0%), cardiopathies (7.0%), nephropathies (2.0%), diabetes (9.0%), primary (12.0%) and secondary immunodeficiencies (7.0%), celiac disease (10.0%), hemolytic disease (23.0%), organ transplantation (6.0%), genetic syndrome (5.0%), and encephalopathies (10.0%). Among the primary immunodeficiencies, we saw combined T- and B-cell immunodeficiencies such as T−/B− severe combined immunodeficiency (SCID), T−/B− SCID, Omenn syndrome, and well defined syndromes, such as Wiskott-Aldrich, DiGeorge, and Hyper-IgE. Secondary immunodeficiencies were caused by human immunodeficiency virus (HIV) infection. Among the hematologic diseases seen, leukemia represented 78.2% of cases.

The frequency of oral mucosal lesions was significantly higher (\( \chi^2 = 173.03; P < .01 \)) in the group of children suffering from systemic disease compared with healthy children (Table II). Several disorders, including oral candidiasis (odds ratio [OR] 2.31, 95% confidence interval [CI] 2.00-2.68), recurrent aphthous ulcerations (OR 1.75, 95% CI 1.45-2.11), cheilitis (OR 6.43, 95% CI 2.90-14.95), geographic tongue or other tongue lesions (OR 2.23, 95% CI 1.86-2.69), and other lesions, i.e., gingival overgrowth (OR 1.65, 95% CI 1.10-2.48), were significantly higher in patients affected by chronic diseases. In contrast, the presence of traumatic lesions was higher in healthy children (OR 0.66, 95% CI 0.56-0.80).

The percentage distribution of oral mucosal lesions in patients with systemic diseases is shown in Fig. 2. Oral candidiasis was the most common lesion in patients who had a history of diabetes, asthma, or transplantation. Lesions of the tongue were most frequent in children with encephalopathies (40.6%), as were traumatic lesions (42.8%). The prevalence of recurrent mucosal ulcerations was high in patients affected by leukemia or immunodeficiency (33.5% and 31.8%, respectively).

DISCUSSION

This survey was a retrospective cross-sectional study designed to evaluate the prevalence of oral mucosal lesions in 10,128 children aged 0-12 years attending the Department of Pediatric Dentistry at the University of Brescia (Italy). Cross-sectional studies are important in estimating the prevalence of a disease in the population and in identifying high-risk populations. The main strengths of the present survey are the high number of
This study found that oral mucosal lesions were present in almost one-third of the total children examined. Similar prevalence rates have been reported from the United States, Europe, Brazil, and Latin America. However, several studies have reported a lower percentage. This wide range in prevalence...
could be linked to several factors, such as different sociodemographic characteristics of the sample, different analysis methods, or other diagnostic criteria.

Seventeen different types of oral mucosal lesions were detected in the present study. The most prevalent mucosal lesions found were candidiasis, traumatic lesions, geographic tongue, recurrent aphthous stomatitis, primary herpetic gingivostomatitis, oral recurrent HSV-1 infection, and erythema multiforme. Not surprisingly, a significantly higher prevalence ($P < .01$) of oral lesions was detected in children suffering from systemic diseases. However, age and gender did not influence the frequency of oral lesions observed in these children.

**Oral candidiasis**

Oral candidiasis was more likely to occur in children with systemic diseases, owing to local and systemic predisposing factors (immunodeficiencies, diabetes, endocrine disturbances, antibiotic therapies, corticosteroids therapies, malignancy, xerostomia, and poor oral hygiene).21-23 In particular, diabetes had a strong association with candidiasis, detected in three-fourths of diabetic children. Impaired function of the polymorphonuclear leukocytes and vascular changes, coupled with xerostomia and poor oral hygiene, have been suggested as risk factors of candidiasis, particularly in diabetic patients with poor glucose control.24,25 Moreover, the high prevalence of oral candidiasis recorded in children suffering from asthma might be due to the adverse effect of drug therapies such as topical or inhaled corticosteroids. These drugs are able to cause local immunosuppression, thus modifying oral microflora.26-28 Furthermore, the use of $\beta_2$ agonists might induce a decrease in salivary secretion, facilitating the growth of Candida albicans. The prevalence of oral candidiasis was also increased in children undergoing organ transplantation, which was likely induced by immunosuppression drugs29,30 and altered oral hygiene. Among patients affected by hematologic diseases, leukemia represented three-fourths of cases and contributed to oral candidiasis from severe immunosuppression and neutropenia.31,32 Among all immunodeficiencies, candidiasis was especially prevalent in HIV-positive children. These children likely experienced oral candidiasis because of poor adherence or nonadherence to therapy, possible failing therapy or a nonreconstituted cell-mediated immunity.33,34

In healthy subjects, the percentage of oral candidiasis reported in the literature varies from 0.80% to 3.7% of school-age children.5 In the present study, candidiasis rates were higher (8.57%), possibly because newborns and breastfeeding children were included. Candidiasis was often seen in children who used pacifiers or had recently taken antibiotics.

**Oral HSV-1 infections**

Oral HSV-1 infections were detected in 6.9% of children, regardless of the systemic health status. The similar prevalence in each health group was surprising, especially because immunodeficiency, leukemia, and organ transplantation were conditions common to the systemic disease group. One possible explanation is that the virus is widespread in this pediatric population35,36 and the cross-sectional design failed to discriminate potential differences. Furthermore, the cross-sectional design did not assess duration of lesions, which may have differed between groups.

**Recurrent aphthous stomatitis**

Recurrent aphthous stomatitis (RAS) was more common in children affected by systemic disease than in healthy children, as has been previously reported.20,37-39 RAS is the most common oral ulcerative disease, affecting 10%-20% of the population. Here, RAS was most prevalent in children affected by immunodeficiency, nutritional deficiencies, malabsorption, and celiac disease. This is consistent with the premise that epithelial homeostasis, good nutrient status, and proper immune surveillance contribute to the prevention of RAS.2-9

**Traumatic lesion**

In the present survey, significant differences were not observed between healthy and systemically affected children regarding the prevalence of traumatic lesions. This is not surprising, because soft tissue lesions caused by incorrect habits such as cheek biting, morsicatio buccarum, tongue or lip sucking, object (i.e., pens, toys) biting, or by local injuries (orthodontic devices, sharp fillings, fractured teeth) are common in both groups. Also, well documented in the literature are the presence of traumatic lesions in patients with encephalopathies (e.g., epilepsy, neurologic diseases, or behavioral problems) as seen in this study.1-6,40

**Geographic tongue**

The literature reports great variation in the prevalence of geographic tongue, and a weak correlation to general health conditions has been described.1-6,41 Several authors have reported a higher prevalence in young children (0-6 years of age), and hypothesized that non-genetic multifactorial factors are contributory.3-9 We found that a high prevalence of this lesion had a positive association with the presence of chronic diseases, suggesting that underlying pathophysiologic abnormal-
ities or the drugs these children take may account for this disorder.

**Erythema multiforme**

Erythema multiforme is a hypersensitive reaction triggered by precipitating factors usually infectious organisms (e.g., HSV infection) or by drugs. Other triggering factors can include malignancy, radiotherapy, and autoimmune diseases. Despite the potential for these factors to be more prevalent in the chronic disease group, the prevalence of erythema multiforme was only ~0.4%-0.5% in both groups, indicating that it is a rather infrequent condition that requires multiple factors to come together to trigger its evolution.

**Limitations and conclusion**

Although this study provides helpful information, there are several weaknesses. One is that the detection of the lesions was dependent on the knowledge and recognition of lesions by multiple examiners in the pediatric clinic, although calibration was performed every 24 months. Another weakness is that the oral mucosal lesions were diagnosed after only a single examination of each patient, possibly underestimating the prevalence of recurrent alterations, such as RAS or HSV infection. Furthermore, the number and duration of lesions were not recorded, nor were the medications administered, which could have contributed directly or indirectly to lesion development. Despite these limitations, the results of this survey should be useful in indirectly to lesion development. Despite these limitations, the results of this survey should be useful in providing more information about oral mucosal anomalies and the factors associated with them in children. In turn, clinicians should be aware of the diversity of mucosal anomalies present in children.

**REFERENCES**


Reprint requests:
Dr. Guglielmo Campus
Dental Institute
University of Sassari
Viale San Pietro 43/C
I-25123 Brescia
Italy
gcampus@uniss.it