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# A cross-sectional assessment of knowledge, attitude, and practice of dentists regarding acute herpetic gingivostomatitis in children

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**ABSTRACT.** Acute herpetic gingivostomatitis (AHGS) is the oral manifestation of HVS-1 primary infection. Despite being a self-limiting infection, AHGS can progress to severe complications. Dentists should be prepared to correctly diagnose and treat the disease. Therefore, the purpose of this study is to assess knowledge, attitude, and practice (KAP) of dentists regarding acute herpetic gingivostomatitis (AHGS) among children. A cross-sectional and descriptive study was carried out through a KAP Survey of 416 Brazilian dentists. Descriptive analyzes with absolute and relative frequencies were performed and possible associations between socio-demographic variables with the KAP questions were investigated using Chi-square and Fisher's exact tests (significance level 5%). Results revealed high knowledge scores among 68% of the dentists. The worst knowledge scores were found for AHGS complications. High scores were only associated with degree of education ($p<0.005$). For the treatment of AHGS, the responses were variable and signaled possible overtreatment in practice. Therapeutic possibilities beyond acyclovir are still lacking. This study highlights the importance of providing continuous education and integrating the practice of oral pathology into the practice of dentistry. It can help to increase knowledge, avoid overtreatment, and stimulate decision-making by the dentist in cases of complications.

**Keywords**: Herpetic gingivostomatitis; oral herpes simplex; dental health survey; surveys and questionnaires; pediatric dentistry; oral medicine.

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## Introduction

Approximately 80 herpesvirus types have already been cataloged. Herpes simplex virus (HVS) type 1 is mainly related to intraoral and pharyngeal manifestations (Stoopler, 2005). Infections are common and, although they usually have a mild to moderate course, major complications can occur in some cases, especially in children (Stoopler, 2005). Disease development before 6 months of age is rare due to protection from maternal anti-HVS antibodies (Fatahzadeh & Schwartz, 2007), but approximately one-third of children contract a primary HVS-1 infection by 5 years of age (Kolokotronis & Doumas, 2006) since the disease is very contagious(de Suremain, 2019).

Acute herpetic gingivostomatitis (AHGS) is the oral manifestation of HVS-1 primary infection and normally affects children between 6 months and 5 years of age, being rare in adults. Most primary infections are subclinical or cause pharyngitis, confusing with other upper airway infections. However, symptomatic cases are not uncommon(Balasubramaniam et al., 2014). AHGS can manifest in a more severe way, with abrupt onset of signs and symptoms that include fever, lymphadenopathy, irritability, nausea, and vomiting (Amir et al., 1999; Petti & Lodi, 2019). About two days after the prodromal phase, vesicles spread throughout the mobile and adherent mucosa and rupture into painful ulcerations (Petti & Lodi, 2019). In all cases, there is gingival erythema and edema. Perioral lesions are also common. Patients may have sialorrhea and halitosis, in addition to pain and dysphagia, which restrict eating and hygiene (Fatahzadeh & Schwartz, 2007; Petti & Lodi, 2019).

Despite being a self-limiting infection, with remission between 5 and 14 days, AHGS can progress to complications such as severe dehydration, herpetic keratoconjunctivitis, esophagitis, pneumonia, bacteremia, and meningitis. Herpes simplex encephalitis (HSE) is an emergency that also requires a high index

of suspicion for diagnosis. Dehydration is the most common complication and occurs due to intense pain when ingesting liquids and food, requiring intravenous fluids to correct electrolytes (Thomas, 2007). Adherence of the lips preventing mouth opening has already been reported (Arduino & Porter, 2007).

Basically, AHGS requires supportive treatment, aiming to reduce symptoms and avoid complications. Rest and hydration, hygiene, mouthwashes with 0.12% chlorhexidine, topical anesthetics, antipyretics, and lip balms are recommended (Faden, 2006); Arduino & Porter, 2007; Fatahzadeh & Schwartz, 2007). In addition, studies show that acyclovir can reduce the duration of infection when administered during the prodromal phase (Goldman, 2016; La Selva et al., 2020). Antimicrobial photodynamic therapy (aPDT) has also been reported to alleviate symptoms and shorten the period of infection (Chole & Domb, 1979).

Differentiating AHGS from other diseases can be challenging. Chickenpox, herpangina, aphthous stomatitis, Stevens-Johnson syndrome and hand-foot-mouth disease can confuse the diagnosis. Knowledge of differences in location, endemic outbreaks, grouping of lesions, age of the patient and lesions in other areas of the body help in the diagnosis (Amir et al., 1999; Eysenbach, 2004). However, delays or misdiagnoses are frequent, leading to inappropriate treatment. Children and parents often go to various doctors and dentists for symptom relief. Due to a lack of knowledge, clinicians often indicate the use of systemic antibiotics or even corticosteroids and antifungals. Some cases progress to serious complications and morbidity, with avoidable hospital admissions.

As HVS has many clinical presentations, clinicians must maintain a high index of suspicion of HVS infections and be prepared to offer appropriate treatment (Kolokotronis & Doumas, 2006). However, the difficulty in diagnosing and treating AHGS is a reality. Studies that assess the clinician's ability to recognize, diagnose and treat the disease may show flaws in undergraduate and graduate education, in the training of health professionals regarding the differential diagnosis of infectious diseases or even in the understanding that the mouth is a frequent niche of manifestations of systemic diseases. These studies can help to promote professional training actions. The aim of this study is to assess the knowledge, attitude, and practice (KAP) of Brazilian dentists regarding AHGS among children. Also, the literature regarding treatment and complications of the disease is updated.

## Material and methods

After approval by the Ethics Committee in Research with Human Beings (Maringá State University - CAAE 37079920.5.0000.0104), this study was developed in accordance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES statement) (Eysenbach, 2004). All participants signed an informed consent form.

### Study design

This is a cross-sectional, analytical study, developed using a knowledge, attitude and practice (KAP) survey (Cleland, 1973; Ratcliffe, 1976; Green, 2001), conducted between October 1, 2020 and January 31, 2021. Prior to the implementation of this KAP survey model, the questionnaire design, validation, pilot study, and strategies to enroll dentists for maximal participation were discussed. The main instrument to collect data was an online questionnaire using Google forms (Google, California, USA), which is available at: https://forms.gle/rG7sCk3qrEAq3wKv8. Upon clicking on the link, the first page assured the confidentiality of data, informed the participants of the study objectives, and stated that the study participation was purely voluntary. Only one researcher (ACPLS) had access to the data and no identification or personal details were required (apart from the registration e-mail). The participants had complete freedom either to decline or answer the questionnaire. In this page, the participant was also informed of the total number of questions and the approximate time to answer them.

All data will be permanently deleted once the results are published.

### Sample

Brazilian dentists were included. Submission was considered only when the 'send' button was clicked at the end of the questionnaire and all questions had to be answered (inclusion criteria). The participant could answer the questionnaire only once, and the control was carried out through the registration e-mail.

Both convenience (researchers themselves contacted dentists to participate in the study) and snowball sampling (the participating dentists were asked to forward the questionnaire to their colleagues) were used so that maximal participation could be ensured.

To determine the representativeness of the sample, a confidence interval of 95% and a margin of error of 5% were estimated. The calculation considered the population of 239,214 dentists in Brazil, according to the Federal Council of Dentistry(n.d.) on August 6, 2020, resulting in a minimum of 384 participants.

### Pilot questionnaire

A pilot study was done on 38 dentists (10% of the final sample) to validate the questionnaire, testing its applicability and responsiveness. The criteria evaluated were clarity, objectivity, and comprehensibility of the questions (Silva et al., 2018). In addition, the volunteers evaluated whether the first questions would be able to answer the following ones to avoid bias. These responses were excluded from the main analysis.

### Questionnaire

The structure of the questionnaire followed the recommendations of Silva et al. (2018), adapted to the KAP model (Cleland, 1973; Green, 2001). The questionnaire had two sessions, totaling 20 closed-ended questions. The first session with demographic data consisted of seven questions about gender, age, practice time, education degree, practice-based specialties, state of origin (Brazil has 26 states and a Federal District) and place of work (university, public or private service). In the second session (KAP), the three dimensions were addressed (knowledge, practice, attitude) through multiple choice questions or multiple options with check boxes (Khan et al., 2014).

The questions in the knowledge section (K1-K8) were divided into four strands: clinical characteristics (K1-K3), etiopathogenesis (K4-K6), diagnosis (K7), and complications of AHGS (K8). Each question had 5 to 7 possible answers, one of which was *'I don't know'* and only one was correct. The attitude dimension had two questions (A1-A2) related to the difficulty in diagnosing AHGS and the possible barriers to the good practice of dental care in patients with the disease. There were no right or wrong answers, but alternatives that best represented the participant's opinion. The practical dimension encompassed three questions (P1-P3) related to the action or experiences of the participants regarding the diagnosis and treatment of AHGS. All questions were designed by two DDS, MSc, PhD in Oral Medicine (EST) and Pediatric Dentistry (GCS).

The questionnaire was distributed personally via a quick response (QR) code as well as posted on various social media platforms like Instagram and WhatsApp. Participants could not review or change an answer after submission.

### Data analysis

The collected data were stored on the Google Forms platform and then organized and tabulated in Google Sheets, being password protected and accessed only by the main researcher. Then, the spreadsheets were imported into the SPSS 22.0 statistical software (IBM, Armonk, New York, USA). Descriptive analyzes with absolute and relative frequencies were performed. The association between sociodemographic variables and the other questions was also verified using the Chi-square and Fisher's exact tests, considering a significance of 5%.

An 8-point scoring system was developed to assess the knowledge levels of the dentists. Total knowledge level was calculated based on each dentist's response. Each correct response was given a score of '1' and incorrect response a score of '0' (Sezgin & ŞirinoĞlu Çapan, 2020).

## Results

A total of 422 responses were obtained, of which 6 were excluded because they were duplicated or tripled (final n = 416). There were no responses from just one federative unit of Brazil (Amapá), and most of the participants were from states with greater demographic concentration, such as São Paulo (n=76; 18.2%) and Rio de Janeiro (n = 47; 8.8%).

The demographic characteristics of the participants are shown in Table I. There were 316 women (75.9%) and 100 male (24.03%), and the age ranged between 20 and 65 years (± 33.24% years), of which 53.8% (n = 224) were under 30 years old and 48.6% (n = 202) had 5 years or less of practice. 37% (n = 154) had the Doctor of Dental Surgery degree (DDS), 36% (n = 150) were specialists, 18% (n = 75) and 9% (n = 37) had a master's and doctoral/postdoctoral degree, respectively. A greater number of responses were obtained by specialists in pediatric dentistry (n = 42; 10.2%), public health (n = 41; 10%), orthodontics (n = 40; 9.7%) and endodontics (n = 38; 9.2%). Approximately 19% (n = 79) of participants had two or more specialties. 43% (n = 179) worked in private practice and 17% (n = 71) in public services.

Poor and high knowledge scores were observed among 3% (n = 12) and 68% (n = 283) of the dentists, respectively. 73% (n = 304) correctly answered the question about the clinical aspect of AHGS, 82% (n = 341) correctly answered about the most affected age group (between 6 months and 5 years old) and 87% (n = 362) correctly answered about the prodromal phase (fever, lymphadenopathy, nausea, vomiting, and irritability).

Regarding the etiopathogenesis, most participants (n = 391; 94%) agreed that the etiological factor is a virus; however, many believed that HVS is also the cause of herpes zoster, recurrent aphthous stomatitis and hand-foot-and-mouth disease (Figure 1). Most participants correctly stated that the diagnosis of AHGS is established through clinical examination (n = 370; 89%), some considered exfoliative cytology (n = 21; 5%) and few said they did not know (n = 4; 1%).

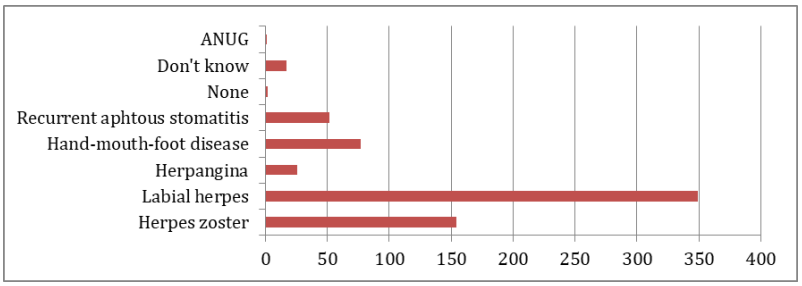


**Figure 1**. Answers to the question: 'Which of these diseases is caused by the same etiologic factor as AHGS?'.

As for the possible complications of AHGS, 41% (n = 170) marked the correct option (*self-inoculation resulting in finger and eye infection, meningitis, encephalitis, severe dehydration*), while 28.4% (n = 118) selected only the answer *autoinoculation*. A considerable number of participants did not know (n = 60; 14.5%) or did not believe (n = 38; 9.2%) that AHGS could progress to major complications (Figure 2).

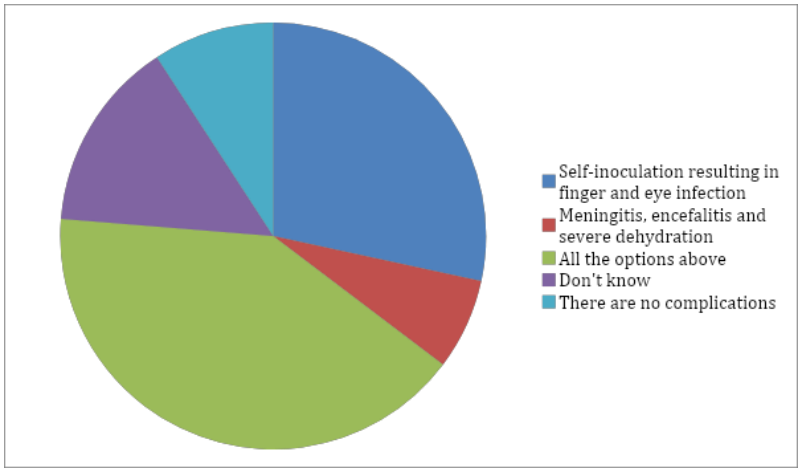


**Figure 2.** Knowledge about possible complications resulting from AHGS.

In general, good practices were observed in relation to treatment, and included oral analgesics (n = 255; 61.4%), oral acyclovir (n = 170; 41%), and low-level laser therapy / aPDT (n = 162; 38.9%). Topical anesthetics (n = 103; 24.8%) and chlorhexidine gluconate 0.12% oral rinse (n = 102; 24.6%) were also mentioned. Some participants considered the use of antifungals (n = 32; 7.6%) and antibiotics (n = 19; 4.5%). Alternative therapies such as Bach® flower remedies and sodium bicarbonate oral rinse were poorly selected options. 3.8% (n = 16) do not prescribe any type of treatment, while 14.7% (n = 61) prefer to refer the patient to another professional (Figure 3).

More than half of the volunteers (n = 222; 53.3%) reported difficulties in diagnosing oral pathologies and pointed to the lack of contact with the area in theory (n = 112; 27%) and in practice (n = 154; 37%) as justifications.

Relating the sociodemographic variables with the performance of the participants, the only variable with a statistically significant difference was the education degree. The group with master's and doctoral/postdoctoral degree performed better when compared to DDS and specialists ($p < 0.005$).

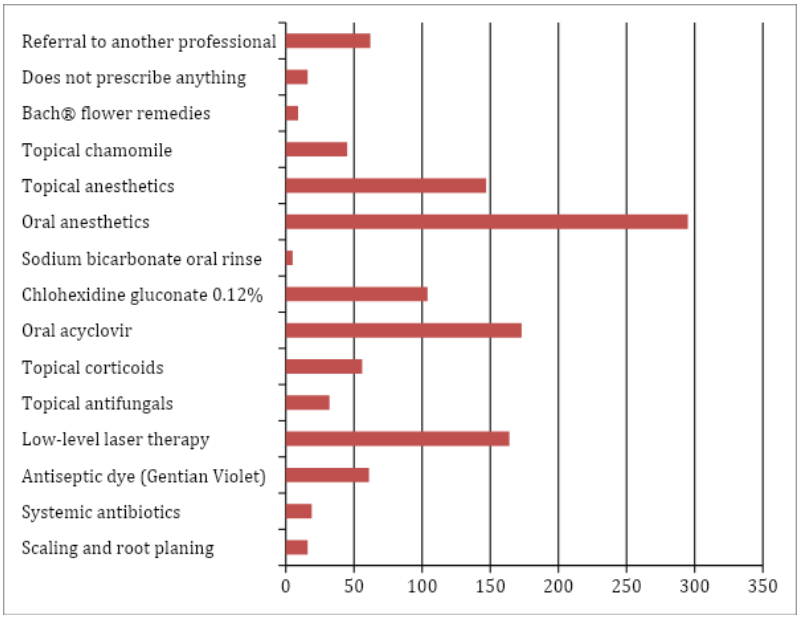


**Figure 3**. Responses to treatment options for AHGS.

## Discussion

Although high knowledge scores were observed in 68% of dentists, the worst performances were found when AHGS complications were addressed. They were not able to identify all the possible complications of the disease, and many did not know or did not believe that such complications exist. Although complications are not common, they can be serious. De Suremain et al. (2019), analyzed hospitalizations associated with AHGS in a North American hospital between 2004 and 2010 and found that the main causes were fever and electrolyte imbalance (a consequence of dehydration). Dehydration is one of the main causes of morbidity and mortality worldwide (Thomas, 2007). Misdiagnosis and inadequate treatment can result in electrolyte imbalance, acidosis, cardiovascular instability, renal failure, lethargy, and death (Steiner et al., 2004). This reinforces the importance of recognizing the signs of dehydration for decision-making by the dentist.

With mild dehydration, it is only necessary to advise on the intake of liquids and food (Black et al., 2003; Colletti et al., 2010). A child with moderate dehydration may experience tiredness and irritation. Heart and respiratory rates may be slightly increased, blood pressure low, sunken fontanelles, dry mucous membranes, few tears, cold extremities, and little urine. In addition, there is an increase in capillary refill time (calculated by pressing the index finger for 15 seconds, and then timing the return to the initial color) and reduced skin turgor (the skin on the abdomen is pulled up for a few seconds and does not return to its original state) (Black et al., 2003; Colletti et al.,2010). In severe dehydration, apathy, lethargy, and unconsciousness are to be expected. Tachycardia, increased respiratory rate, very weak pulse, low blood pressure, dry mucous membranes, absence of tears and very reduced urine are signs that help in the diagnosis. The child also has cyanotic extremities, increased capillary refill time or no reflux, and reduced skin turgor (Black et al., 2003; Colletti et al.,2010), and should be immediately referred to emergency care (Santillanes & Rose, 2018). Cases of moderate dehydration can be treated with oral replacement, without the need for hospitalization (Santillanes & Rose, 2018). The child should receive between 50 $mLkg^{-1}$ and 100 $mLkg^{-1}$ of oral rehydration solution in the first 2 to 4 hours to correct the fluid deficit (Black et al., 2003; Santillanes & Rose, 2018).

It is also critical that the dentist monitor the patient's progress and refer to medical attention when there are signs of finger and eye infection, meningitis, and encephalitis. Although herpes simplex encephalitis is uncommon (Whitley, 2015), Ito et al. (2000) reported a case of a 3-year-old patient diagnosed with acute disseminated encephalomyelitis after AHGS. The retrospective study by Huang et al. (2020) evaluated 282 children with AHGS admitted to a hospital in Taiwan, of which four had central nervous system dysfunction, with epileptic and hallucinatory symptoms.

As for the treatment of AHGS, the responses in the present study were very variable. The impasse on the issue concerning the treatment of the disease can be explained by the absence of randomized clinical trials and literature reviews on therapeutic possibilities beyond acyclovir. Prescription of antifungals, antibiotics, dental prophylaxis and scaling or root planning have been reported, raising the possibility of routine overtreatment.

It is known that the indiscriminate use of antibiotics was associated with resistance (Ramachandran et al., 2019; Huang et al., 2020; Bardellini et al., 2022) and efforts have been made to stop the abusive use. Especially in children, the use of topical anesthetics to reduce pain and dysphagia should be cautious, due to the possibility of intoxication (Curtis et al., 2007; Teoh & Moses, 2020). Methemoglobinemia (MetHb), a blood disorder in which an abnormal amount of methemoglobin is produced, has also been reported because of the use of topical anesthetics (Balicer & Kitai, 2004). In addition, these medications can interfere with the gag reflex (Markman, 2009; Memarpour et al., 2015). The use of off-label therapies (such as Bach® flower remedies, antiseptic dye (Gentian violet), sodium bicarbonate oral rinse, and others) has been mentioned, although there is no scientific evidence to support it.

Symptom relief is based on pain control through oral analgesics, in addition to fluid and food intake to prevent dehydration until the infection disappears (Goldman, 2016). Although acyclovir is a well-established antiviral drug, its oral use is effective against HVS-1 if administered in the prodromal phase of the disease (Kiderman et al., 2002; Nasser et al., 2008; Goldman, 2016). However, at this stage it is common for parents and doctors to mistake the symptoms of AHGS with other common childhood illnesses, delaying the administration of the drug. Although efforts have focused on finding the best way to administer acyclovir (Whitley, 2015), there are no studies that determine the appropriate therapy for children with AHGS (Goldman, 2016). Based on a single randomized trial, antiviral treatment should only be started within the first 72 hours of symptom onset if there is substantial pain or dehydration (Goldman, 2016). What is evident is that despite the high incidence and viral load of the disease, little research has been carried out to determine the value of antiviral therapy in these cases (Goldman, 2016).

Even though there are no specific clinical studies relating AHGS and aPDT, this treatment option was quite selected by the participants of the present study (38.9%). This antimicrobial modality involves the use of laser and a photosensitizer with a specific wavelength (Namvar et al., 2019) in which microorganisms such as bacteria, fungi, viruses and protozoa can be killed through the production of single oxygen species (Gursoy et al., 2013). Some *in vitro* (Namvar et al., 2019) and *in vivo* (Marotti et al., 2009; La Selva et al., 2020) studies have shown its effectiveness in the treatment of herpes simplex labialis. Advantages include prevention of virus reactivation, absence of microbial resistance and side effects, in addition to the laser photobiomodulation effect to reduce symptoms (Kolenko et al., 2021). A similar effectiveness of aPDT in the management of AHGS is assumed, depending on the child's compliance to treatment.

More than half of the participants claimed difficulty in diagnosing oral lesions. The main reason given was the lack of constant contact with the subject in theory and in practice. This corroborates findings from a similar study that assessed the knowledge, attitude, and practices of Iranian dentists about oral cancer (Razavi et al., 2013). The authors found that the level of knowledge was related to the number of patients seen in the practical experience of the interviewees (Razavi et al., 2013). Another study (Ergun et al., 2009) analyzed the knowledge of Turkish dentists regarding lesions in the oral mucosa and the participants also reported difficulty in diagnosis, justifying that the knowledge acquired at undergraduate and graduate levels would be insufficient. However, the authors emphasized the availability of courses, symposia, and conferences on oral lesions, raising the possibility of participants' lack of interest in the subject (Ergun et al., 2009), which was pointed out by some dentists (3.12%) in the present study.

In the present study, the only variable with a statistically significant difference regarding the level of knowledge was the education degree, which were directly proportional, indicating the important role of continuing education in the training of professionals in diagnosing and treating oral lesions, a situation pointed out by several studies (Ergun et al., 2009; Razavi et al., 2013; Golikeri et al., 2019).

We are aware that our results may not reflect the real scenario regarding the level of knowledge about AHGS in Brazil. Convenience and snowball sampling largely restricted access to the questionnaire for newly graduated dentists or those working at universities. Despite the limitations of studies with online questionnaires, which include unlimited time for responses that may be verified in other sources or are not faithful, several precautions were taken to reduce bias, such as reviewing all responses to exclude duplications or triplets. In addition, preventive measures were taken to avoid previous questions from answering subsequent questions and from allowing participants to revise or change an answer after submission.

Although high knowledge scores were observed among 68% of the dentists, many responded that the etiological factor of AHGS is the same as for other viruses, such as hand-foot-and-mouth disease, herpangina and Herpes-zoster. Also, poor scores were found when AHGS complications were addressed, and this study

made it clear how the treatment of the disease is still not well established. The main impediment to good practice was the lack of experience in oral medicine both in theory and in practice. We speculate whether parents and patients do not seek doctors, pediatricians or even hospitals instead of dental clinics, indicating that dentists are not the reference in cases of oral lesions and a timid presence of oral medicine in the professional qualification of these professionals.

We emphasize that Brazil has continental dimensions and has the largest number of dentists in the world. This perhaps allows our findings to extrapolate to the world stage. The study highlighted the importance of providing systematic training in oral lesions and integrating the practice of oral medicine into the routine practice of dentistry. Doing so can help to increase knowledge, avoid overtreatment, and stimulate decision-making by the dentist in cases of complications.

## Conclusion

Brazilian dentists showed a good level of knowledge about AHGS in children; however, they still have difficulty in treating the disease. The higher the degree, the higher were participants' correct answers rates.

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