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Viviane Santos da Silva Pierro [1], Lucianne Cople Maia [1]*, Thiago Isidro Vieira [1], Monique Santana Candreva [1], Michele Villardi [2] and Lucio Mendes Cabral [2]

[1]Department of Pediatric Dentistry and Orthodontics, School of Dentistry, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil
[2]Department of Medicaments, Pharmacy School, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

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Introduction

Dental erosion has been demanding increasing attention a er caries reduction in many societies [1]. It can be de ned “as chronic loss of dental hard tissue that is chemically etched away from the tooth surface by acid and/or chelation without bacterial involvement” [2,3]. It is assumed that the main etiological factors are acids of intrinsic

medicines analyzed.

Materials and Methods

e pediatric syrup medicines chosen for this study (Dimetapp®, Wyeth, Sao Paulo, Brazil and Claritin®, Schering-Plough, Vila Olímpia, Brazil) were selected based on a previous study [12], which has pointed out these medicines as presenting the worst results with regard to pH and titratable acidity taken together. Control solutions of citric acid with similar baseline pH values to those of the medicines tested were also evaluated.

e pH measurements throughout the study were made using a pH electrode connected to a digital pH-meter (Quimis Q-400HM, Diadema, Brazil). e electrode was calibrated at the start of each session using standard bu ers of pH 4.1 and 6.86. Five milliliters of the newly opened medicines and controls, which were at room temperature, were placed in a beaker and stirred using a non-heating magnetic stirrer until a stable reading was obtained. All measurements were obtained in triplicate and three bottles from each pediatric syrup medicine presenting di erent serial numbers were analyzed.

Further ve milliliters from each bottle of syrup medicine and both control solutions of citric acid were diluted with water (pH 6.48 ± 0.12) in a proportion of 1:0.5 and 1:1, and pH of these dilutions were measured as described earlier.

e titratable acidity was determined in triplicate by using the same pH-meter. To detect the end point of each medicine and control (both in undiluted and diluted forms), ve milliliters of each substance were titrated with 0.05 M sodium hydroxide (NaOH) solution, using

[10]. From measurements of hardness and by SEM and pro lometric analysis of bovine teeth and tests of the dissolution of hydroxyapatite in vitro, another study [24] veri ed that citric acid was more erosive than malic acid, being a potent erosive agent because of its ability to chelate calcium in hydroxyapatite, thus increasing enamel's rate of dissolution on exposure to the acid. In the present study, both control solutions were citric acid with similar baseline pH values to those of the medicines tested. e acid's choice was based on the medicines' labels, which denoted the presence of citric acid in the medicines' formulation. Our results con rmed the ability of citric acid to resist pH changes because of controls' high values of titratable acidity. When compared to the medicines tested, control solutions of citric acid presented titratable acidic values three to fourfold greater than medicines' values.

Other factors related with the ingested substances themselves could also modify erosion patterns, such as the general chemical composition of the solutions, which may modify the degree of enamel dissolution [25]. Ions like calcium, phosphate and uoride have a protective e ect against erosion [23]. erefore, previous studies have proposed the reduction of the erosive potential of beverages by modifying the amount and type of acid used in beverage formulations and/or supplementing with calcium and phosphate [14-16,24].

Nevertheless, product re-formulation can be di cult to be proposed because additives could promote further e ects on other ingredients in the drinks [14]. erefore, an alternative to products' modi cation could be products' dilution as tested by previous researchers [17] in a study that aimed to examine the e ect of dilution on the potential erosive properties of some diluting drinks. eir results showed that only titratable acidity fell considerably as the drink was progressively diluted, and little e ect was observed on pH values. However, these results were based on high dilution rates (concentrations ranged from undiluted to one part drink in 100,000 parts water), which were not applicable to the usual consumption of these drinks. On the other hand, our ndings demonstrated that dilution in uenced neither pH nor titratable acidity, but it is important to point out that our study intended to verify the e ect of dilution on the erosive potential of highly acidic pediatric syrup medicines and, therefore, the proposed dilution rates could not be more than twice the volume prescribed (which corresponds to a dilution rate of 1:1) because of the probable di culty of children in drinking medicines' volumes greater than these.

e etiology of dental erosion can also be in uenced by biological and behavioral factors. According to a previous study [23], "unusual eating, drinking and swallowing habits, for example holding an acid beverage in the mouth before swallowing, increase the contact time of an acid substance with the teeth and thus increase the risk of erosion" [23]. It is also true for acidic syrup medicines when used with a high frequency of ingestion and consumption at bedtime, considering that oral clearance is compromised during sleep [8-9,13]. In this context, both pediatric syrup medicines tested in this study could increase the risk of tooth erosion for their consumers. Besides being highly acidic, Claritin® is an antihistamine and one of its side e ects is the reduction of salivary ow rates, which impairs the protective e ect of saliva against erosion. With regard to Dimetapp®, it presented pH values and titratable acidic values even worse than Claritin's and its label information recommends its use up to 6 times per day.

Eroded enamel is more susceptible to wear by tooth-brushing and to toothpaste abrasion [26,27]. erefore, it is not advisable to brush the teeth immediately a er consuming acidic foods or drinks because it could result in tooth abrasion. Instead, a delay in tooth-brushing would allow the remineralizing action of saliva on the eroded enamel [27].

Conclusion

Within the limitations of this study, the dilution rates tested did not improve the pH and titratable acidity of the acidic pediatric syrup medicines analyzed. erefore, as dilution did not reduce the erosive properties of syrup medicines tested considering our results, recommendation on immediate water rinse and delayed tooth-brushing a er syrup medicines' ingestion could be proposed at the time of prescription. Further studies evaluating alternative preventive strategies for dental erosion due to these highly acidic syrup medicines should be conducted.

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