Original Article

Oral health concerns with sweetened medicaments: Pediatricians' acuity

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Abstract

Background: Administration of sweetened medicaments poses many oral health related problems in children due to the lack of awareness among the pediatricians regarding their ill effects. **Purpose:** To assess pediatricians' awareness and attitudes toward the use of liquid pediatric medicines and their relationship with dental caries and erosion. **Materials and Methods:** A cross-sectional descriptive study was conducted among the pediatricians residing in Nellore city. Data were obtained from 55 pediatricians using questionnaires. **Results:** Among the respondents, 95.6% prescribed liquid medicaments, 51.1% expressed that they may be associated with dental effects, 60% were not aware regarding the sweetness of medicaments, whereas majority of them (77.8%) opined that children complained regarding the taste, 73.3% stated that sugar substitutes were used as sweetening agents, 70.9% believed that they were not acidic, 68.9% did not recommend brushing after intake of medicines, 90% failed to deliver oral health instructions, and 54.5% believed that lack of oral hygiene was a contributing factor for development of dental caries. **Conclusion:** Majority of the respondents prescribed liquid medicaments and were unaware regarding the sweetening agents and acidity, which cause ill effects on the dental hard tissues. Most of them neither recommended nor delivered oral hygiene instructions (OHI) after prescribing sweetened liquid medicaments. Hence, OHI should be delivered to enhance the oral health related quality of life in children.

Key words: *Dental caries, erosion, liquid medications, pediatricians, sugar substitutes*

INTRODUCTION

Oral health is essential for children's general health, growth, and development. Dental caries is the most common and prevalent infectious disease in the oral cavity. It is a dynamic disease involving the calcified tissues of the teeth and requires the presence of bacterial plaque, a dietary fermentable carbohydrate-like sugar which results in acid production and subsequent demineralization of the tooth surface. As the concentration of organic acids increases in the inner layer of plaque on the tooth surface, pH drop occurs causing demineralization of tooth structure.[1]

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Compliance of liquid medicines can be enhanced by addition of sucrose, which improves palatability of the liquid medicines. But administration of sweetened liquid medicines for prolonged periods in children increases the risk for development of caries and gingivitis.[2,3] This concern is ignored normally because the primary medical problem covers up the less-noticeable aspects of the child's health. Under such conditions, parents' chief focus is the medical problem. Poor oral hygiene can be anticipated, because the child's routine is altered.

Concerning the systemic health status of the children, the pediatricians most commonly prescribe

medicaments in different forms like syrups and oral drops, without knowing the constituents of these medicaments. Some of the constituents have deleterious or ill effects on the child's teeth due to formation of dental caries which manifests itself from mild to severe forms. As comprehensive health care providers, we should consider both the systemic and oral health of the child. Increased intake of medicines prescribed in both developed and developing countries exposes more number of children to medication caries, which can be deliberated as a public health problem.[1] This paper aims at assessing the awareness regarding the medications that the pediatricians prescribe and their ill effects on the oral health of the child, which directly or indirectly affects the quality of life.

MATERIALS AND METHODS

A cross-sectional, descriptive study was conducted among the pediatricians residing in a city, after obtaining institutional ethical clearance. The questionnaire used was a combination of 13 open- and closed-ended questions on demography (3), awareness (5), and attitudes (5) of pediatricians. A total of 70 pediatricians were residing in the city, but the questionnaires were distributed to the professionals available (convenience sample = 60) at the time of study; only 55 questionnaires were returned and 5 were considered as drop-outs due to incomplete data. Data were collected and analyzed using SPSS 11.0. Results were expressed as absolute values and percentages. All the answers of the open questions were reviewed to identify categories for analyses. Appropriate tests were carried out when necessary and were considered significant at $P < 0.05$ level.

RESULTS

Among 55 respondents aged between 28 and 55 years (Mean = 41.5), 80% were males. Regarding their medical practice, 77.8% were treating exclusively children and others were involved in general practice. Also, 53.3%, 33.3%, and 13.4% were into private practice, public service, and both, respectively; 95.6% prescribed liquid medicaments frequently and 4.4% prescribed them rarely.

Regarding awareness about the sweetness of pediatric liquid medicaments, 60% respondents claimed that they were not so sweet, 35.6% believed that they were very sweet, and 4.4% were not aware.

The factors which were considered relevant before choosing a liquid medicament in their daily practice were – medication feature (60%), child characteristics (22.2%), disease characteristics (15.6%), and socioeconomic factors (2.2%).

Different opinions were expressed by the pediatricians regarding the association between liquid medicaments and their dental effects; 51.1% and 31.1% stated that there may be or no association between them, respectively. Majority of the pediatricians (77.8%) opined that children complained regarding the taste of the medicament.

Pediatricians (73.3%) opined that the commonly used sweetening agent in liquid medicament was sugar substitute, 17.8% did not know which agent was commonly used, and glucose and lactose were considered by 4.4% each. Also, 70.9% of them pronounced that the medicines were not acidic and 68.9% of the pediatricians did not recommend brushing teeth after the intake of medicaments.

In spite of knowing that sucrose is the main ingredient among medicaments by 18.19% of pediatricians, 90% of them failed to deliver oral hygiene instructions (OHI; $P = 0.002$, significant) [Table 1].

There was a significant relationship ($P < 0.0001$) between the belief that these drugs are acidic (29.1%) and they can cause dental wear (51.1%) among them.

54.55% of pediatricians believed that lack of oral hygiene was a contributing factor for development of caries. But 6.7% did not give OHI [Table 2].

Table 1: Pediatricians' perception about the presence of sucrose in pediatric medicines and their recommendation of oral hygiene instructions

Sucrose	Oral hygiene instructions (%)		
	Yes	No	Total
Yes	1 (10.00)	9 (90.00)	10
No	15 (33.33)	30 (66.67)	45
Total	16 (29.10)	39 (70.90)	55

Table 2: Pediatricians' perception about lack of oral hygiene as a contributing factor to dental caries and their recommendation of oral hygiene instructions to their patients after prescription (%)

Lack of oral hygiene	Oral hygiene instructions	
	Yes	No
Yes	16	29.1
No	39	709

DISCUSSION

The detrimental effects of sugar-based liquid oral medicines on dental health were first documented by Roberts and Roberts in 1979,[2] but the term medication caries was not used till 1980. These preparations are of concern to medical professionals (pediatricians) when they are used abundantly and frequently, thereby providing a substrate for plaque microorganisms throughout the day.[4]

The pharmaceutical industry uses a large quantity of sugars, especially sucrose, in the formulation of cough drops, lozenges, vitamin preparations, antibiotic syrups, and others.[5] The term sugar includes all monosaccharides and disaccharides, the most common of which are glucose, fructose, sucrose, maltose, and lactose.[6] Sucrose is widely used due to its properties as a preservative, antioxidant, solvent, and thickening agent. It is also a low-cost, non-hygroscopic, easily processed substance, as well as a clinicians' helper in pediatric therapeutics, given that its pleasantly sweetish taste encourages medicine acceptance.[7] In the treatment of pediatric patients, physicians often have a difficult task ensuring the compliance of the patient to a particular treatment regimen. Hence, the use of pleasant-tasting oral liquid medicines has helped in the administration of these drugs for decades.[8]

Taste masking technologies incorporate sweeteners to improve the taste of the core material, which are further coated by liquids consisting of artificial sweeteners like sucralose, aspartame, and saccharin. These are used in combination with sugar alcohols like lactitol, maltitol, and sorbitol to reduce the after-taste perception of artificial sweeteners. Physiologically acceptable acids (e.g. citric acid) can be used along with sucralose to upturn the taste masking efficiency of the sweetener.[9]

Among the factors considered relevant to the prescription of medicines, disease characterstics and diagnosis of the disease were emphasized as the most important factors by the majority of the pediatricians. But in the present study, 60% of the pediatricians stated that medication features were considered before prescribing liquid medicaments.

Most of the pediatric liquid medications may contain inactive ingredients which can cause harmful effects to the teeth (e.g. dental caries or erosion). Among these components, the most common ones are fermentable sugars and acids.[10] Sugar is combined with other ingredients to give a more pleasant taste to the medications in order to increase acceptance and compliance of patients, especially children.

Previous studies have shown that sucrose was believed to be the main sweetener of various pediatric liquid medications.[11] In contrast, the present study showed that 73.3% of the pediatricians reported that other ingredients were added to these medications. Previous studies found that the amount of sucrose is usually high in syrups.[12-14] The factors to be considered for determining the drug's cariogenic potential are its sucrose content, acidic nature, and the individual's salivary flow rate and buffer capacity.[15]

The sucrose content was significantly lower in drugs that were prescribed for intake of three to four times daily than in those that were prescribed for once-daily intake. The cariogenic risk is further increased when only one dose is taken at night, which is a period of decreased salivary flow.[16,17] Saliva is an important caries-protective factor and the presence of sugar in the oral environment during night for long periods can intensify the cariogenic potential of the drug.

In the present study, 70.9% of the pediatricians pronounced that pediatric medicines were not acidic. Acidic medicines taste good, so patient compliance is enhanced, but they may produce side effects on the teeth when used for children with chronic diseases. A previous study stated that an acidic medication may reduce enamel hardness and influence the enamel roughness, characterizing its erosive potential.[18] Furthermore, an *in vivo* investigation also observed that frequent intake of medications may constitute a possible etiological or aggravating factor for severe dental erosion.[19] The frequent use of acidic medications that come in direct contact with teeth has been identified as an etiological factor in dental erosion not only for adults but also for children and adolescents. Higher erosive potential of these drugs can be attributed to the existence of acid components in their formulations, low endogenous pH, high titrable acidity, and absence or little amount of calcium, fluoride, and phosphate ions. In the present study, many of the pediatricians expressed that pediatric medicines can cause dental wear (51.1%) and only few (29.1%) of them believed that these drugs are acidic. Chewable tablets have a higher tendency for erosive potential due to their prolonged direct contact with the tooth surfaces. The attitudes of the pediatricians regarding prescription practices can be altered by empowering them with knowledge and education regarding medications which cause dental erosion.

Considering the cariogenic and erosive potential of sweetened and acidic medications which are prescribed to children, it is important that health professionals, especially pediatricians and pediatric dentists, should be engaged in educating parents to ensure adequate oral clearance after each dose of medication as a primary step for minimizing the risk of dental caries.

In the present study, 68.9% of pediatricians did not recommend brushing after intake of medication. This finding is concurrent with the previous studies which stated that most of the pediatricians did not give oral health instructions to be followed after intake of medicines. Another study found that most of the interviewed guardians stated that they never received instructions from pediatricians regarding OHI after medicine intake.[10]

The oral hygiene practices should include toothpaste with fluoride for preventing or controlling dental caries.[17,20,21] Duggal *et al*.[20] stated that even though the ingestion of sucrose at 12% may occur up to five times a day, significant loss of hard tissue does not occur if the patient's oral hygiene includes toothpaste with fluoride twice a day. However, if toothpaste with fluoride is not used, substantial demineralization is observed in individuals who are exposed to carbohydrates three times a day. In support of this data, a white spot lesion was evident on enamel surfaces when it was exposed to a regimen of 20% sucrose four times a day.

Children living in cities with fluoridated water supply are at higher risk for caries development on taking sweetened medicines frequently, if additional preventive measures are not used. Hence, it is important that children and parents should be aware of the need to brush their teeth after taking each dose of medicine, to take medicines at meal times rather than between meals, and to avoid taking medicines before going to bed and the need for fluoride application.[13,16,22]

The factors that should be considered to determine a drug's cariogenic potential are its sugar content, frequency, dose, and pattern of use.[23] Also, individual characteristics like salivary flow rate and buffer capacity should be considered. The liquid medications are usually viscous syrups that penetrate and adhere into fissures and interproximal areas, which are inaccessible for brushing. Children should be encouraged to rinse their mouths with water after taking liquid medications. Most parents are not aware that several foods, beverages, and pediatric medications in the form of syrups or granules have dissolved sugar in them, and associate caries only with consumption of candies and cookies.[24]

It is important that health professionals, particularly pediatricians and child health care providers, be aware of the risk of oral health imbalance during the continuous use of pediatric medicines. Oral hygiene must be insisted for all children under medication. The use of non-cariogenic substances in medicines or sugar-free medicines must be suggested whenever possible. Pediatric dentists should be engaged in educating parents to ensure adequate oral clearance after each dose of medication as a primary step for minimizing the risk of dental caries and erosion of dental structures related to long-term and, sometimes, unsupervised regimens with sugar-containing liquid oral medications.

The oral health of children can be promoted by following certain recommendations like taking the medicine in tablet form; brushing with toothpaste or chewing sugar-free gum after taking the medicine; home and dental-office fluoride applications; whenever possible, taking medicines at meal-times rather than between meals; avoiding consumption of the medicine before bed; and seeking regular preventive dental care. Awareness of the dangers posed by these medications should be promoted among prescribers, pharmacists, manufacturers, regulatory authorities, and the public, in order to bring about increased availability and use of sugar-free liquid medicines.

A number of medications frequently used by children, especially for a long term, may cause a significant risk of dental caries. A considerable number of liquid preparations which may be prescribed for children on a long-term basis are still available in a sugar vehicle.[3,25] Liquid oral medications taken for duration of 8 months or more are a risk factor for increased levels of caries.

The present study indicates a paradigm shift regarding the understanding of constituents in the sweetened medicaments. Initially, the awareness was focused on sucrose, but the present study showed that the contemporary pediatricians are aware of the sugar substitutes, which pose little concerns on the oral health.

Public health policies must be implemented in all countries to reduce the sugar content, where medicines are used on a long-term basis by children and adolescents, and therefore decrease the incidence of dental caries.[13] Prescription practices may vary in different countries, but the basic ingredients are nearly similar in many countries.

Adequate information should be provided regarding oral health in medical schools, residency and post-graduate programs, and in continuing education programs by adding a module on the preventive aspects of oral health program. Thus, all the medical professionals including pediatricians may be able to play an important role in improving the oral health of children.

Solicited diaries can be requested by a researcher, usually with a specific focus on the drug details, including name, type, dose, frequency, and mode of administration, during any health-associated interventions. Prospective studies can be conducted by using these diaries, which can provide evidence linking the medicaments used and their ill effects on the oral health status of children.

CONCLUSION

As the medications prescribed to children are commonly available as drops and syrups in sweetened forms, it is important that health professionals, particularly pediatricians and pediatric dentists, should be aware regarding the oral health imbalance during the continuous use of these medicines. Children under medication should be motivated to practice oral hygiene measures. Whenever possible, the use of non-cariogenic substances in medicines or the use of sugar-free medicines should be advised. Considering the cariogenic and erosive potential of sweetened and acidic medications prescribed to children, we should be engaged in educating pediatricians to ensure adequate oral clearance after each dose of medication as a primary step for minimizing the risk of dental caries and erosion of dental structures in children.

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