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Erosivity Potential of Paediatric medicament on deciduous teeth: A systemic review

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Abstract

Dental erosion is well- recognized problem of younger population that has apparently increased in the last few decades. One of the reasons for the rapid increase in erosion is the widespread and long term use of Pediatric medicaments especially in the form of liquid suspension syrups. A number of recent studies have confirmed that the use of Pediatric liquid medicament demineralizes the enamel surface of primary tooth which leads to dental erosion. For this systemic review an electronic search through PubMed, Medline, and National medical library was made and a total of 1431 articles were retrieved from the year 2010 to 2020. Later the search strategy was focused on original research, in vitro studies, randomised control trials that results in 21 studies that are relevant to this review. 90% of the most commonly used pediatric liquid medicaments are erosive and cariogenic. Hence care must be taken while prescribing these sweetened medicaments in children. A direct co-relation was found between the use of pediatric medicaments (especially liquid suspensions) and dental erosion. Long term use of PLM causes demineralization of the enamel surface of primary teeth.

Keywords: Dental erosion, PLM, Pediatric liquid medicaments, caries, erosivity potential, pediatric medicines, systemic review, review

Introduction

Dental erosion is an irrevocable loss of tooth structure which doesn't involve microorganisms. It is a well-recognized problem that has apparently increased among the younger population in last few decades followed by dental caries.[1] At present there are a lot of intrinsic as well as extrinsic factors involved in erosion. Intrinsic factors include acidic gastric fluid coming into contact with the oral cavity, in patients suffering from bulimia, gastrointestinal reflux disease and extrinsic factors include the consumption of acidic foods (e.g. citrus, soft drinks, and salad dressings)[2] . Apart from the edibles one of the major extrinsic factor entailed in causing erosion nowadays is acidic drugs. The widespread use of commercially available pediatric medicaments has been reported as the most common source of erosion in children.[3] The medicaments are prepared with a lot of additives including sugars. It was used to mark the acidic taste of medicine making it more palatable and acceptable by the child patient. This also changes the plaque pH. Since enamel in primary teeth is porous, less prismatic and less calcified so it gets easily dissolved by the acids present in the pediatric remedies.[4] Past reports have shown that the frequency and duration of these medicaments has a dramatic effect on the prevalence of erosion and caries.[1] The use of liquid suspensions in medicaments is a daily occurrence for many children. The ill effect of these medicaments mostly goes unnoticed and later on progresses in permanent dentition.[5&6] So far, many studies have confirmed that PLM's results in erosion as well as caries in little one's but a systemic summaries of their methodologies and result are lacking.So the aim of this review is to summarize the data related to type of PLM that are causing erosion in pediatric patients.

Review methodology

A literature review was performed after conducting an electronic search through PubMed, Medline (from 2010-2020) and National medical library to identify studies related to the erosive effect of pediatric liquid medicaments.

Search strategy was to compile past research that is relevant to the use of PLM in children

Keywords used are: PLM, Pediatric liquid medicaments, dental erosion, erosivity of PLM.

Out of total 1431, 804 articles were found to be studying the erosivity potential of liquid medications.

The search result was further narrowed to original research, in vitro studies, randomised control trials, resulting in 21 studies relevant to research question.

Result

Our search identified 1431 articles from three sources namely- PubMEd (NCBI), Medline, National medical library respectively **(Illustration 1)** From the year 2010-2020. From this 21 articles were identified for full text review including original research, randomised control trial and in-vitro comparative studies. Rest 1410 publications were excluded, owing to reason of duplication, irrelevant, repeated and abstract review only.

From the above search strategy it was concluded that the use of pediatric medicaments leads to loss of enamel surface of primary teeth. Erosivity potential is present in pediatric medications especially the liquid suspensions of the medicaments.

Discussion

This systemic review identifies the causative factor behind dental erosion & dental caries in primary teeth that had become a major problem among the younger population. For this review an electronic search was made

to obtain data on the erosive potential of commonly used pediatric medicaments from the year 2010-2020 **(Illustration 1).**

The included studies in the current review provide information about the erosivity & cariogenicity potential of commonly used paediatric medications.

Dental erosion is an irreversible loss of dental hard tissue by a chemical process without bacterial involvement While dental caries is caused by cariogenic bacteria, which adhere to the tooth surface and are part of dental plaque biofilm.[13] Dental erosion is considered as a second major reason for tooth wear in children first being the dental caries. The logic behind the fact that caries and erosion are most commonly seen in primary dentition is that the primary teeth is porous, less prismatic and less calcified so it is easily dissolved by acids when compared with permanent teeth.[2]

Liquid suspensions are most commonly used in pediatric practice because they are readily accepted by the child due to the presence of increase amount of sugars & other additives that makes it more palatable & acceptable by the pediatric patient[1] . These additives are considered as inactive ingredient with high acidic pH which leads to demineralization of the primary enamel surface & cause sensitivity, unaesthetic appearance and many more.

The additives may add significantly to dental caries in the child patient.[4] In past years not much of importance was given to the possible erosivity & cariogenicity potential of pediatric medicaments so the present review highlights the scientific reports by various authors Izabel et al (2010), Arora et al (2012), Xavier et al (2013) , Nankar et al (2014), Scatena et al (2014), Tupali et al (2014), Saeed et al (2015), Kiran et al (2015), Lussi et al (2015), Kulkarni et al (2016), Valinoti et al (2016), Sowmya K et al (2016) Sudhir et al (2017), Vdihi Shah et al (2017), Deepthi M et al (2018) , Elham et el (2018), Yun gyeong et al (2019), Nangalia et al (2019), Thejeswar et al (2020), Siddiq H et al (2020) that have found association between dental erosion with the long term use of paediatric medicaments (Table 1)

Beside the studies analysing the erosive effect of pediatric medicaments some studies have demonstrated the cariogenic potential of these medicaments too (Table 2) like Izabel et al (2010), Xavier et al (2013), Nankar et al (2014), Saeed et al (2015), Valinoti C et al (2016), Sowmya K et al (2016), Deepthi M et al (2018) and Elham et al (2018).

The result of this review confirmed that long term use of liquid medications leads to loss of mineral content of tooth.

Conclusion

Nowadays, dental erosion is commonly encountered in children taking various paediatric medicament that may progress in permanent dentition if not properly diagnosed. This systemic review provide evidence for the erosivity and cariogenicity capacity of the long term use of common pediatric medications. For prevention of the same greater care should be taken while prescribing these medications. Parents and professionals should enhance their knowledge on the ill effect of the remedies which are used in our day to day practice.

Clinical Significance

Care must be taken while prescribing these formulations in pediatric patients. Alternate substitute must be recommended and awareness must be spread among parents like rinsing mouth right after medicament ingestion might deduce the ill-effects. Pediatric dentist play a key role in identifying these lesion at the earliest, finding the cause behind it and treating it with the best of abilities.

List of abbreviations

PLM: Paediatric liquid medicament

PLA: Paediatric liquid analgesics

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Legend Table and Figures

Table 1: Overview of studies related to Erosivity potential of Pediatric liquid medicaments

Year	Author	Aim of the Study	Conclusion	Medicament
2010	Izabel et al[7]	To evaluate the erosive and cariogenic potential of antihistaminic medicine	Antihistaminic medicine have high sugar content and has erosive and cariogenic potential	Dexamethasone, Loratadine, agasten, cetirtec, dexchlorphenarmine maleate
2012	Arora et al[8]	To evaluate erosive potential of sugar free & sugar containing pediatric medicine given regulary & long term to children	Pediatric sugar free medicines were not more erosive than sugar containing medicine	Paracetamol, ibuprofen, paracetamol + ibuprofen, amoxicillin, amoxiclav, metrogen
2013	Xavier et al[9]	To evaluate the erosive and cariogenicity potential of pediatric drugs: study of physiochemical parameters	Drug showed physiochemical characteristics indicative of a cariogenic and erosive potential on dental tissues	Analgesics, antibacterials, anti convulsants, antiemetic, antihistamines, antiparasites, antitussives, corticosteroids
2014	Nankar et al[1]	To evaluate & compare the	Combiflam can be	Augmentin, Valparin,

		cariogenic and erosive potential of 5 commonly prescribed PLM	regarded as highest cariogenic and erosive potential compared to the rest of PLM	combiflam, visyneral. orofer
2014	Scatena et al[10]	To evaluate the erosive effect of pediatric medicine on deciduous tooth enamel	Erosion of deciduous teeth is dependant on type of medicine and exposure time	Guaifenesin, ferrous sulphate, salbutamol sulfate
2014	Tupali A R et al[11]	To evaluate the erosive potential of commonly used PLM	All the PLM used in study showed an erosive effect on primary enamel surface	Paracetamol, ibuprofen, amoxicillin, erythromycin, phenobarbitone, multivitamins, diphenhydramine, benylin
2015	Saeed et al[12]	To evaluate cariogenic and erosive potential of pediatric liquid analgesics	PLA have pH values below critical value and high sugar content all of which increase the cariogenic and erosive potential	Paracetamol, Ibuprofen, paracetamol + ibuprofen
2015	Kiran et al[13]	To evaluate erosive potential of medicated syrup on primary teeth	Medicated syrup with low pH and high viscocity shows greater dissolution of enamel	crocin, ibugesic, ondem, asthalin, ascoril-D, valparin, Becousles, MOX
2015	Lussi et al[14]	To evaluate the erosive effect of dietary substances and medications on deciduous teeth	Drinks, medicaments consumed by children can cause erosion of deciduous teeth	Dafalgan, mucosolvan, fluimacil, tossamin, ventolin, clatriline
2016	Kulkarni et al[15]	To evaluate the effect of PLM on primary enamel surface	PLM produces a significant and gradual loss of surface microhardness	Ferium XT, Crocin, Wikoryl (Ambrolite D)
2016	Valinoti C A et al[16]	To analyse whether pediatric antibiotoic formula potential risk	Many antibiotics presented high	Amoxil 125, 250,500,200,400,

		for dental caries & erosion?	concentration of sugar and pH below critical pH so they can be considered as risk factor for caries and erosion	Apicilina 250, Bactrim 240, cefamox, zintamax
2016	Gaber et al[17]	to evaluate the effect of cpp-acp on the surface microhardness of primary tooth enamel eroded by antihistamine syrup	The anti histamine syrup causes erosion which was reduced after treatment with cpp-acp paste and showed an increase in surface microhardness	Antihistamine syrup
2016	Sowmya K et al[18]	To evaluate the erosive and cariogenic potential of pediatric liquid analgesics	Most PLA tested had pH values below the critical value, high viscosity and high total sugar content all of which accentuate the medicines cariogenic and erosive potential	Paracetamol, Ibuprofen, Combiflam, Mefenemic acid
2017	Mittal et al[2]	To evaluate the surface changes on primary tooth enamel by commonly used PLM using SEM	PLM frequently used have erosive effect on enamel of deciduous teeth with pH below 7	Paracetamol, multivitamin, ibuprofen, amoxicillin, azithtromycin, benzoylmetronidazole. Multivitamin, promethazine, sinarest
2017	Vidhi shah et al[19]	Comparitive evaluation of four most commonly used PLM	All 4 syrups are acidic in nature, and highest calcium dissolution seen in SADURI medicine	Benadryl, stodal(homeopathic), Adusol (unani), saduri (Ayurvedic)
2018	Deepthi M et al [20]	To analyse the cariogenic and erosive potential of pediatric anti epileptic liquid medicament	Most of the antiepileptic PLM showed cariogenic and erosive potential	Phenytoin, sodium valproate, carbamazepine, levipil, phenobarbitone
2018	Elham et al[21]	To valuate erosive and cariogenic	Most PLM are acidic in	Paracetamol, ibuprofen,

		potential of vaious PLM on primary tooth enamel	nature and the sugar content & Ca dissolution ability of PLM can significantly influence erosion in primary tooth enamel	amoxicillin, amoxicillin + clvulanate potassium, multivitamin, guaiphenesin
2019	Yun gyeong et al[22]	To evaluate the effect of commercial dry syrup on tooth surface	The erosive potential of dry syrup on tooth surface is present	Tylenol suspension, Theraflu dry syrup, modcoflu
2019	Nangalia et al[23]	Aim to evaluate effect of liquid medicinal syrup on primary enamel of paediatric patients	PLM have acidic pH and erosive potential	Analgesics, antihistamine
2020	Thejeswar et al[24]	To evaluate the sugar content in various brands of paracetamol syrup	A high sucrose (80%) content is present in the syrup	Paracetamol (5 types), pacinol, p-250, pyregesic ds, dolopar, paracip
2020	Siddiq H et al[25]	To evaluate the sugar content and erosive potential of commonly prescribed liquid oral medications	Pediatric liquid oral medications shows the presence of sugar, low endogenous pH, high titrable acidity, and high total soluble solids	Azithromycin, paracetamol, ibuprofen, amoxicillin, amoxcv, cefixime, cetrizeine, salbutamol, phenytoin, prednisolone

Table 2: Overview of studies related to cariogenic potential of pediatric medicament

Year	Author	Aim of the study	conclusion	Medicament used
2010	Izabel et al[7]	To evaluate the erosive and cariogenic potential of antihistaminic medicine	Antihistaminic medicine have high sugar content and has erosive and cariogenic potential	Dexamethasone, Loratadine, agasten, cetirtec, dexchlorphenarmine maleate
2013	Xavier et al[9]	To evaluate the erosive and cariogenicity potential of pediatric drugs: study of physiochemical parameters	Drug showed physiochemical characteristics indicative of a cariogenic and erosive potential on dental tissues	Analgesics, antibacterials, anti convulsants, antiemetic, antihistamines, antiparasites, antitussives, corticosteroids
2014	Nankar et al[1]	To evaluate & compare the	Combiflam can be	Augmentin, Valparin,

		cariogenic and erosive potential of 5 commonly prescribed PLM	regarded as highest cariogenic and erosive potential compared to the rest of PLM	combiflam, visyneral. orofer
2015	Saeed et al[12]	To evaluate cariogenic and erosive potential of pediatric liquid analgesics	PLA have pH values below critical value and high sugar content all of which increase the cariogenic and erosive potential	Paracetamol, Ibuprofen, paracetamol + ibuprofen
2016	Valinoti C A et al[16]	To analyse whether pediatric antibiotoic formula potential risk for dental caries & erosion?	Many antibiotics presented high concentration of sugar and pH below critical pH so they can be considered as risk factor for caries and erosion	Amoxil 125, 250,500,200,400, Apicilina 250, Bactrim 240, cefamox, zintamax
2016	Sowmya K et al[18]	To evaluate the erosive and cariogenic potential of pediatric liquid analgesics	Most PLA tested had pH values below the critical value, high viscosity and high total sugar content all of which accentuate the medicines cariogenic and erosive potential	Paracetamol, Ibuprofen, Combiflam, Mefenemic acid
2018	Deepthi M et al[19]	To analyse the cariogenic and erosive potential of pediatric anti epileptic liquid medicament	Most of the antiepileptic PLM showed cariogenic and erosive potential	Phenytoin, sodium valproate, carbamazepine, levipil, phenobarbitone
2018	Elham et al[20]	To evaluate erosive and cariogenic potential of vaious PLM on primary tooth enamel	Most PLM are acidic in nature and the sugar content & Ca dissolution ability of PLM can significantly influence erosion in primary tooth enamel	Phenytoin, sodium valproate, carbamazepine, levipil, phenobarbitone

Figure 1: Illustrative summary of search and review process