Prevalence of Pits and Fissure Caries in 7 to 14 Year Old Children - A Retrospective Study

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ABSTRACT

Dental caries is considered to be a significant public health problem worldwide with cases being reported in both developed and developing countries. It has been reported that the occlusal surfaces with prominent pits and fissures morphology increases the risk of caries development. The aim of this study was to evaluate the prevalence of pits and fissure caries in 7-14 years children. It was a retrospective study conducted by reviewing 5,000 patient case records. A total of 1000 case records of patients for a period of December 2019 to April 2020 with complete records were reviewed and analysed. Patient's age, gender and presence of pits and fissure caries, caries in upper or lower arch were collected from the patient's case records. The obtained data was analysed using the SPSS version 23.0. Descriptive analysis was done for the assessment of age, gender and dental arches involved. Chi square test was used to evaluate the association of pits and fissure caries with age and gender. The overall prevalence of pits and fissures caries was about 61.7%. Prevalence among 7-9 years old children was 25.1%. Higher predilection for pits and fissures caries was seen in males (34.5%) when compared to females (26.0%). Most of the cases showed the presence of pits and fissures in both arches (63.7%). Within the limits of the present study, pits and fissures caries exhibit higher prevalence in 7-9 years old children, male predilection and more common in both arches in an individual. There is a paramount need to educate the parents and caregivers about the importance of preventive measure in preventing caries and progression of decay in children.

KEY WORDS: CHILDREN; PIT AND FISSURE CARIES; PREVALENCE; SCHOOL CHILDREN.

INTRODUCTION

Dental caries is considered to be a significant public health problem worldwide with cases being reported in both developed and developing countries. It is a complex multifactorial disease with numerous risk and preventive factors which affects individuals from all age groups, particularly in children; Dental caries are often associated with various risk factors including age, gender, dietary

habits and oral hygiene practices. In children, periods of tooth eruption, harmful dietary habits and types of muscle movements during suckling and swallowing are considered as the common factors of dental caries. These conditions are further exaggerated by the presence of dry mouth, poor oral hygiene and other factors which may contribute to the development of dental caries (Marsh, 2003; Sudha et al., 2005; Bagramian et al., 2009; Ayele et al., 2013; Al Agili, 2013; Al-Ansari, 2014; Christabel and Linda-Christabel, 2015; Nair et al., 2018; Aldossary et al., 2018; Raj et al., 2020).

Patterns of early childhood caries usually begin to change at the age of three which affects the first and second primary molars. A report stated that children with dental caries in the primary dentition tend to develop the same in the permanent dentition as they have demonstrated the factors required for developing dental caries in their early

Biosc Biotech Res Comm P-ISSN: 0974-6455 E-ISSN: 2321-4007

Identifiers and Pagination

Year: 2021 Vol: 14 No (10) Special Issue

Pages: 50-57

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DOI: <http://dx.doi.org/10.21786/bbrc/14.10.9>

Article Information

Received: 09th Aug 2021

Accepted after revision: 11th Oct 2021

life along with the presence of biofilm and environmental factors such as diet responsible for caries formation even after the loss of primary teeth (Li and Wang, 2002; Ayele et al., 2013; Govindaraju et al., 2017; Govindaraju et al., 2017a; Govindaraju et al., 2017b; Hall-Scullin et al., 2017; Mulani and Mathur, 2020).

The anatomy of the human dentition varies in which the anterior teeth exhibit smooth surfaces while the posterior teeth have smooth proximal surfaces and more tortuous morphology on the occlusal surface. The occlusal surfaces of the teeth are seen as incompletely coalesced areas represented by pits, fissures and grooves which act as stagnation sites for biofilm and cariogenic microorganisms. It has been reported that the occlusal surfaces with prominent pits and fissures morphology increases the risk of caries development to approximately 12.5% in the permanent dentition which accounts for most of the caries. The presence of plaque or biofilm on the pits and fissures of a partially erupted tooth also increases the risk of dental caries. Previous studies on the biofilm of pits and fissures caries described the presence of a unique architecture and specification of the biofilm based on the ecological niche where the roughened and opaque enamel underneath a layer of plaque is related to the presence of caries in the pits and fissures of a tooth (Dige et al., 2014; Carvalho et al., 2016; Wright, 2018; Mulani and Mathur, 2020).

Prevalence of dental caries in permanent teeth is mainly attributed to the individual morphology of the tooth in which pits and fissures on the occlusal surfaces of permanent teeth are particularly susceptible to the development of dental caries. The anatomy of the pits and fissures makes it difficult for proper oral hygiene practices such as tooth brushing to be carried out and less accessible for fluoride application as compared to the other surfaces of the tooth. Moreover, the development of pits and fissures caries is said to be more aggressive than the ability of fluoride to stimulate remineralization in these stagnation areas in order to prevent caries formation. Pits and fissures of the teeth increases the tendency of food accumulation which eventually becomes a shelter for microorganisms and stimulates the accumulation of dental plaque as they prevent oral hygiene practices to be carried out properly (Axelsson and Per Axelsson, 2004; Veiga et al., 2015; Somasundaram et al., 2015; Govindaraju and Gurunathan, 2017; Mahesh 2018; Wright, 2018; Raj et al., 2020).

Previously, it has been indicated that about 90% of dental caries in children are observed in pits and fissures areas which provides the rationale for sealant application due to its high prevalence in these areas. Another study revealed that pits and fissures caries contribute to approximately 80% to 90% of all caries in the permanent posterior teeth and 44% in the primary teeth. Genetic studies suggested that an individual's genetic determinants may affect the risk and resistance to dental caries by reporting that the heritable influence on pits and fissures caries development varies from 20% to 50%. First permanent molars usually exhibit high susceptibility to dental caries in the occlusal pits and fissures, followed by second permanent molars due to their morphological features, early period of eruption and its

position in the oral cavity (Kaste et al., 1996; Beauchamp et al., 2009; Shaffer et al., 2012; Aldossary et al., 2018; Jeevanandan and Govindaraju, 2018; Mulani and Mathur, 2020).

Various methods have been introduced to prevent the development of pits and fissures caries in which most studies recommended the application of pits and fissures sealants, particularly for pits and fissures that are deep and narrow in order to form a physical barrier that prevent further accumulation of plaque in specific anatomical areas of the tooth. Dental sealants refer to resin or glass-ionomer cement (GIC) based flowable materials applied on the occlusal surfaces of teeth as the first line of defense to prevent the development of dental caries, especially in children. Pits and fissures sealant acts by forming a micromechanical bond with the tooth which prevents the access by cariogenic microorganisms to their nutritional source and reduces the risk of caries development (Simonsen, 1978; Francis et al., 2007; Jeevanandan, 2017; Packiri et al., 2017; Ealla et al., 2018; Panchal et al., 2019; Mulani and Mathur, 2020).

Previous studies have discussed the effectiveness of pits and fissures sealants as a method of caries prevention and control in children which can be done in both individual and community level of interventions. Application of pits and fissures sealant as a primary preventive measure is highly recommended in order to prevent the development of dental caries, along with controlling and arresting the formation of incipient dental caries. Therefore, the pit and fissure sealant program are important among school children. Previously our team has a rich experience in working on various research projects across multiple disciplines (Ahovuo-Saloranta et al., 1999; Rose, 2001; Wright et al., 2016; Hou et al., 2017; Ravikumar et al., 2017; Aldossary et al., 2018; Gheena and Ezhilarasan, 2019; Ke et al., 2019; Malli Sureshbabu et al., 2019; Mehta et al., 2019; Samuel et al., 2019; Sharma et al., 2019; Varghese et al., 2019; Venu et al., 2019; Vignesh et al., 2019; Jain et al., 2019; Jose et al., 2020; Krishnaswamy et al., 2020; Muthukrishnan et al., 2020; Samuel et al., 2020; Sathish and Karthick, 2020). Now the growing trend in this area motivated us to pursue this project. Henceforth, this study was done to evaluate the prevalence of pits and fissure caries in 7 to 14 years old school going children of South Indian population.

MATERIAL AND METHODS

Study Design and Setting: A retrospective study was conducted by reviewing 5,000 patient case records of the Saveetha Dental College and Hospital, Chennai, India for a period of December 2019 to April 2020. A total of two examiners were involved in this study. An effort had been made to confirm that the sorted case records contained information on pits and fissure caries. Prior permission use of the case records analysis was obtained from the institutional review board with the ethical approval number of SDC/SIHEC/2020/DIASDATA/0619-0320.

Study Population and Sampling: A total of 1000 case records of patients with signed informed consent were sorted following the assessment of 5,000 case reports. The

inclusion criteria of this study were children within 7 to 14 years of age and both genders. The adult patients and medically compromised patients were excluded from the study. Convenience sampling method was done for this study.

Data Collection: Information on the patient's age, gender and pits and fissures caries present or absent and involved dental arch were collected from the patient's case records. Age of the patients were categorized for statistical convenience as 7-9yrs, 10-11yrs and 12-14 yrs. Management of incomplete or censored data was excluded from the study.

Statistical Analysis: Tabulation and analysis of the collected data were done using Statistical Package for Social Sciences for Windows version 23.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was done to assess the prevalence of pits and fissures caries in different age groups, gender and dental arches. Chi-square test was used to evaluate the association of pits and fissures caries with age and gender. Significant level test was set such that $p > 0.05$ is considered significant.

RESULTS AND DISCUSSION

Our present study involves a total of 1000 patients following the assessment of 5,000 case records based on the inclusion criteria of children within the 7 to 14 years of age and both genders while adult patients and medically compromised patients are excluded from this study. It is reported that pits and fissures caries are present in 617 (61.7%) of the children in our study. The age groups in this study consist of 7-9 years (28.10%), 10-11 (31.90%) and 12-14 years (40.00%). (Figure 1) Most of the patients are males (60.30%) compared to females (39.70%). (Figure 2) In most

of the cases, pits and fissures caries are present in both upper and lower arches of an individual in this study (63.70%) and lower arch (25.77%) is commonly involved with pits and fissures caries compared to upper arch (10.53%) (Figure 3). It is observed that there is a positive correlation present between pits and fissures caries and age ($p < 0.05$) (Figure 4) (Table 1).

High prevalence of pits and fissures caries is seen in children within 7-9 years (25.1%), followed by 12-14 years (19.9%) and 10-11 years (15.5%). It has been reported previously that the occurrence of dental caries in general tends to increase as the age increases with high prevalence among individuals in the low socioeconomic class. It was once generally accepted that pits and fissure of the teeth would become infected with bacteria within 10 years of erupting into the oral cavity. A previous study stated that only the first permanent molars are evaluated in their study involving children within 6 to 9 years of age as they are a key to the permanent dentition with high susceptibility to pits and fissures caries due to their morphology and have almost erupted in this age of children (Sayed and Salah, 2011; Babu et al., 2014; Aldossary et al., 2018; Raj et al., 2020).

According to Babu et al., sealant application should be done at the age of 3 to 4 years as they are the most important period for sealing the susceptible deciduous teeth, followed by 6 to 7 years age group for the first permanent molars and 11 to 13 years age groups for protecting the second permanent molars and premolars from pits and fissure caries. Previous studies revealed that nearly half of the children in their study on dental caries involved children from 11 to 15 years of age (51.5%) which was associated with sociodemographic factors and lack of awareness on oral hygiene (Babu et al., 2014; Gurunathan and Shanmugaavel, 2016; Zeru, 2019; Raj et al., 2020).

Table 1. Table representing association between pit and fissure caries based on age group and gender. There is a significant association between age and pits and fissures caries, Pearson Chi-Square value - 135.92; $p = 0.000$ (< 0.05). Similarly, there is a significant association between gender and pit and fissure caries, Pearson Chi-Square value - 6.863; $p = 0.009$ (< 0.05).

Pits and fissures caries			
Variables	Present n (%)	Absent n (%)	Statistical value
Age (Years)			
7 – 9	251 (25.10%)	30 (3.00%)	Pearson Chi-Square = 135.92 df = 2 p-value = 0.001
10 – 11	155 (15.50%)	164 (16.40%)	
12 – 14	199 (19.90%)	201 (20.10%)	
Gender			
Male	345 (34.50%)	258 (25.80%)	Pearson Chi-Square = 6.863 df = 1 p-value = 0.009
Female	260 (26.00%)	137 (13.70%)	

It is concluded that there is a statistically significant association between pits and fissures caries and gender ($p < 0.05$). (Figure 5). Higher predilection for pits and fissures caries is in males (34.5%) as compared to females

(26.0%). A previous study by Yee & McDonald et al., stated that there is a significant difference ($p < 0.001$) between genders with higher prevalence of dental caries seen in males compared to females, which is in accordance with

our study. This finding was associated with the difference in diet between males and females in which males often consume diets with more sweets than females with improper oral and dental care. Dhar et al., also mentioned higher caries prevalence in males (48.1%) compared to females (45.3%) but no significant difference between genders. A study described the greater attention that female adolescents have on their oral health care compared to males which is justified by the higher prevalence of pits and fissures sealant application in females compared to males. A report stated that dental caries are also affected by the timing of tooth eruption in which females tend to undergo earlier eruption of the molars compared to males which increases their risk of developing pits and fissures caries earlier than males (Yee and McDonald, 2002; Dhar et al., 2007; Peres et al., 2007; Poutanen et al., 2007; Malvania et al., 2014; Veiga et al., 2015; Raj et al., 2020; Gürcan and Bayram, 2021).

Figure 1: Figure showing the frequency distribution of different age groups. X axis represents the age groups. Y axis represents the number of patients in each age group. The age groups in this study consist of 7-9 years (28.10%), 10-11 (31.90%) and 12-14 years (40.00%).

Figure 2: Figure showing the frequency distribution of genders. X axis represents genders. Y axis represents the number of patients of each gender. Most of the patients in this study are males (60.30%) as compared to females (39.70%).

Comparing both arches, higher prevalence of pits and fissure caries are seen in the lower arch (25.77%) than the upper

Figure 3: Figure showing the frequency of pits and fissures caries based on dental arches. X axis represents the dental arches. Y axis represents the number of patients in each dental arch involved. In most of the cases, pits and fissures caries are present in both upper and lower arches of an individual in this study (63.70%) and lower arch (25.77%) is commonly involved with pits and fissures caries compared to upper arch (10.53%).

Figure 4: Figure showing the association between pits and fissures caries and its frequency among different age groups. X axis represents the age groups. Y axis represents the number of patients in each age group. Chi square test shows there is a significant association between age and pits and fissures caries, Pearson Chi-Square value - 135.92; $p=0.000$ (<0.05). Prevalence of pits and fissures caries (Green) were more among children within the 7-9 years age group (25.10%) when compared to the other age groups.

arch (10.53%), although in most cases pits and fissures caries are seen in both arches (63.70%) (Figure 3). A study by Aldossary et al., stated that higher prevalence of caries is seen in the lower arch (14.4%) as compared to the upper arch (7.7%) which is in accordance with our study. This finding is mainly attributed to the difference in the morphology of the teeth and the time of eruption with mandibular teeth erupting earlier than the maxillary teeth which increases their time of exposure in oral cavity. The morphology of

permanent molars includes prominent pits and fissures with tortuous defects extending from the surface of the tooth to the dentinoenamel junction seen in the occlusal surfaces, buccal or facial surfaces of mandibular molars and palatal surface of maxillary molars which increases the risk of developing pits and fissures caries in these areas.

Figure 5: Figure showing the association between pits and fissures caries and its frequency among genders. X axis represents the genders. Y axis represents the number of patients of each gender. Chi square test shows there is a significant association between gender and pit and fissure caries, Pearson Chi-Square value=6.863; $p=0.009$ (<0.05). Prevalence of pits and fissures caries (Green) were more among males (34.50%) when compared to females (26.00%).

The morphology of the pits and fissures on the surfaces of these teeth increases the risk of food accumulation which results in the formation of plaque over a period of time. This condition is influenced by the frequency and timing of fermentable carbohydrates intake which will be metabolized by specific microorganisms such as *Streptococcus mutans* leading to fermentation that releases large amount of acid and lowers the local pH that results in dissolution of the enamel and dentin minerals (Franco e Franco et al., 2007; Colak et al., 2013; Maher et al., 1992; Aldossary et al., 2018; Subramanyam et al., 2018; Santa et al., 2021).

Pits and fissures sealant is considered to be an effective and economical method for the primary prevention of dental caries which needs to be incorporated in oral health community programs. A study by Azarpazhooh et al., strongly supports the placement of sealants on primary and permanent molar teeth as both cost-effective and efficacious in the prevention of dental caries. This is further supported by Aldossary et al mentioning that school-based or national sealant programs should be highly promoted and implemented as an effective preventive approach, along with oral health education (Azarpazhooh and Main, 2008; Veiga et al., 2015; Carvalho et al., 2016; Hall-Scullin et al.,

2017; Govindaraju and Gurunathan, 2017; Aldossary et al., 2018; Mahesh, 2018; Raj et al., 2020).

A study explained that the application of primary preventive methods, particularly pits and fissures sealant complemented with oral health education will help to reduce the financial impact of oral treatments and risk of developing dental caries. The present study had few limitations of study design. Since it is a retrospective study, follow up of subjects was not possible to extrapolate the study results. This study also failed to assess the other confounding variables such as education, socioeconomic status and habits of the patients. Further prospective study including all possible factors for pits and fissures caries has to be investigated to prove the hypothesis. Our institution is passionate about high quality evidence based research and has excelled in various fields (Veiga et al., 2015; Pc et al., 2018; Ramesh et al., 2018; Ezhilarasan et al., 2019; Ramadurai et al., 2019; Sridharan et al., 2019; Vijayashree et al., 2019; Mathew et al., 2020). We hope this study adds to this rich legacy.

CONCLUSION

Within the limits of the present study, overall prevalence of pits and fissures caries was about 61.7%, pits and fissures caries were exhibited higher in 7-9 years old children, male predilection and more common in both arches in an individual. There is a paramount need to educate the parents and caregivers about the importance of pit and fissure application as a preventive measure in preventing caries and progression of decay in children.

Conflict of Interest: There was no conflict of interest.

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