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PREVALENCE OF INTERPROXIMAL CARIES IN PRIMARY MOLARS OF FIVE-YEAR-OLD CHILDREN AND ITS CONSEQUENCES ON OCCLUSION OF PERMANENT DENTITION

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Abstract:

Aim: *The aim of this study was to investigate the difference in caries prevalence of number of interproximal surfaces between first and second primary molars based on quadrant dmfs in 5-year-old children. To gain knowledge about these aetiological factors of premature primary molars tooth loss and loss of space in the posterior segment is essential to take clinical decisions for the affected population and to establish a protocol for diagnosing and treating.*

Study design: *Cross-sectional observational study.*

Place and duration of study: *This study was carried out in Department of pedodontics Nishter Institute of dentistry Multan from feb 2019 to auguest 2019.*

Methods and statistics: *For this study 435 children, all living in Multan city of punjab pakistan presented to our hospital were asked to participate. Clinical examinations were performed and only carious lesions on the mesial and distal surfaces with involvement of the dentine were reported. No radiographs were taken. Systematic differences in dmfs between first and second molars in the same quadrant of each primary dentition were tested with the Wilcoxon signed rank test.*

Results: *Second primary molars, even after correction for caries had a statistically significant higher total dmfs than the first primary molars. On proximal surfaces, the first primary molars had significant more caries than the second primary molars. The d-component constituted the major part of the caries index.*

Conclusions: *Second primary molars, corrected for decay in the pits and buccal/palatal fissures of this molar, are more affected by caries than first primary molars. Correlation was observed between the variable loss of space and the number of interproximal surfaces on the primary Molar involved.*

Key words: *Interproximal caries, premature tooth loos, loos of space,*

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INTRODUCTION:

The development of the primary dentition and the transition to the permanent dentition has a fairly predictable pattern in the typical child. The primary dentition of most children has interdental spacing throughout both arches. A smaller proportion of children have no interdental spacing, increasing the probability and severity of crowding in the permanent dentition. Prior to the eruption of the permanent first molars, the primary molars in children with spacing begin to develop interdental contacts, decreasing the space available in the arch. When the permanent incisors erupt, many children will exhibit transitional crowding because of the larger size of the permanent incisors (incisor liability). Some of this crowding can be resolved with the exfoliation of the primary molars, as the primary molars are larger than the permanent premolars (leeway space). Primary molar exfoliation can also result in the late mesial shift of permanent first molars, which can improve the molar relation of the average child from end-on toward Class I. Deviations from this typical pattern can have a negative effect on occlusion and alignment .A major cause of deviation is premature loss of primary Molars, which can result from dental caries, infection, trauma or crowding. Premature tooth loss can increase the need for orthodontic treatment, making it very important to intervene in the event of extraction or premature exfoliation.[1],[2] Use of space maintainers can counteract the effects of early tooth loss and reduce the severity of negative outcomes such as crowding, ectopic eruption, tooth impaction and poor molar relationship.[3] Early loss of teeth in the primary dentition has different consequences depending on which teeth are lost and the child's existing alignment and occlusion. Potential consequences must be considered during the assessment of orthodontic problems to determine whether space maintenance is required and what type of space maintainer would be most appropriate

First Molars

Primary first molars are commonly lost because of caries or infection — both unilaterally and bilaterally. The literature is controversial regarding the effects of early loss of primary first molars. Most studies report space loss within the first four to six months after extraction,[4][,5] with migration of the primary canines and permanent incisors toward the edentulous space in both arches.[6],[4],[7],[8] Some studies report minor mesial movement of maxillary primary second molars.[7],[8] Space loss can result in blocked out permanent canines, more commonly occurring in the maxilla.[9] Other studies suggest that there is no statistically significant loss in arch width, length and perimeter following loss of the primary first molars.[4],[5],[8] Overall, reports suggest that patients in the full primary dentition [10] and those in the mixed dentition with good intercuspation of permanent molars are less susceptible to space loss.[5]therefore, some authors question the need for space maintenance following early loss of primary first molars under these circumstances.[4],[5],[8] However, space maintenance is generally considered to be important for children during the mixed dentition stage.[10] An appropriate appliance for isolated loss of the primary first molar is the band and loop. In the event of loss of multiple teeth, fixed bilateral space maintainers or removable appliances may be considered.

Second Molars

Early loss of primary second molars is less controversial. There is a high probability of space loss, with a greater loss of arch length in the maxilla than in the mandible.[6] The effects are far worse when tooth loss occurs prior to the eruption of the permanent first molar, whose eruption into the oral cavity is guided by the distal surface of the primary second molars. Premature loss of primary second molars clearly requires space maintenance. If tooth loss occurs after the permanent molar erupts, a bilateral fixed appliance is the most appropriate, although a reverse band and loop may be appropriate. Prior to eruption of the permanent molar, a distal shoe or a removable appliance can be considered. In the event of multiple teeth lost, bilateral fixed appliances or removable appliances are appropriate options.

The second primary molars are more often affected by caries than the first primary molars.[11] In the United Kingdom, Holt found that at the age of 5 years of age caries mainly affects the primary molars, especially the second primary molar.[12] In 4-year-olds in Ireland it was also noted by Holland and Crowley [1982] that the second primary molars are most commonly affected by caries.[13] Not only in Europe has this been seen but also in the USA 5-year-olds show more caries lesions on the second molars, especially in the mandible [Autio-Gold and Tomar, 2005].[14] Elsewhere in the world, for example in 4-year-olds in Beijing (China), occurrence of caries is also higher in the second primary molar than the first primary molar. The most striking differences were seen on the occlusal surfaces [Douglass etal., 1995].[15] This is also not a new phenomenon: Watt etal [1997] investigated the caries prevalence in the primary dentition of a mediaeval population in Scotland. They noticed that first primary molars generally showed a lower caries prevalence than second primary molars, significantly lower for the older age band (6-12.9 years).[16] Up to now how-ever all the studies mentioned above were based on dmft data and the dmfs has rarely been studied.

Accordingly, the aim of this study is to look for a comparable difference in caries prevalence between the interproximal surfaces offirst and second primary molars in 5-year-old punjab's children.

CLINICAL PROCEDURE:

A clinical oral examination was performed to determine those children that were unilaterally or bilaterally with tooth loss or affected by interproximal caries. The exploration was performed in department of pedodontics on a dental unit under light using a mirror, and gloves and a mask were also used.

Children were selected who presented with unilateral or bilateral loss of a dental organ or interproximal caries in teeth D and/or E. Dental examinations were performed by seven previously calibrated dentists. Interproximal surfaces were evaluated by visual examination. If in doubt, a dental probe was used for plaque removal, detection of fissure sealants and careful examination of surfaces. Only carious lesions with involvement of the dentine were reported. Lesions on the mesial and distal surfaces were reported.

The inclusion criteria were: patients presented in the opd of hospital; male or female; age 5 years; parents provided informed consent; and child who had interproximal caries or tooth loss that affected a primary upper or lower molar.

The exclusion criteria were: the child was undergoing orthodontic and/or orthopedic treatment; had a space maintainer; presented with dental abscess/infection; refused to be clinically evaluated

Due to medical ethical reasons, no radiographs were taken.

Data management and statistics. The data were entered in a computer file, dmft and dmfs indices were computed, using SPSS 11.0. To test the statistical differences between first and second primary molars, the Wilcoxon's signed rank test was used. For the test to compare dmfs of both primary molars, a p-value < 0.05 was used as an indication of significance, for different surfaces we use a p-value <0.01 as a correction for multiple testing.

RESULTS:

In this study 435 patients (49%girls) participated. The mean dmft for all primary teeth was 2.5, 51% of the children had no carious lesions in their primary dentition. The distribution of the children according to the number of dmft is shown in Table 1. The d-component constituted the major part of the dmft-index. In 55 children, for example, the mean dmft was 0.28 and the mean dt 0.22. Therefore, almost 80% of the dmft number was due to untreated decay. Furthermore, the dmft number of second primary molars was higher than that of first primary molars in the same quadrant. The mean dmft in second primary molars varied between 0.26 and 0.31, the mean dmft in first primary molars varied between 0.14 and 0.21.

There were no fissure sealants found in primary molars in this investigation. Because first primary molars have no buccal pit or palatal fissure, we excluded these sites in the comparison between first and second primary molars with respect to dmfs. After this, the second primary molars had still significantly more dmfs. In Table 2, the mean dmfs per interproximal surface is given for each primary molar separately. There were not only significant differences in total dmfs between first and second primary molars, but also at the surface level where significant differences were seen (Table 2).

Table 1.Distribution of 5-year old children according to the total number of decayed, missing and filled teeth based on oral examinations without the support of radiographs .

	Dmft				
	0	1-5	6-10	11-15	16-20
Percentage of children	51	32	11	5	1

Tooth	Dmfs proximal surfaces
55	0.10 **
54	0.16
65	0.08 **
64	0.16
75	0.11 ***
74	0.19
85	0.12 *
84	0.17

significant difference with the same surface of the adjacent first primary molar (p<0.005, **p<0.01, ***p<0.001

Table 2.average dmfs score in 5 year-old children based on oral examinations (without x-rays of individual primary teeth

On the proximal surface it was the other way around: in all quadrants the first primary molars had more caries (mean dmfs of 0.16 – 0.19) than the second primary molars (mean dmfs of 0.08 – 0.12) ($p < 0.05$ and $p < 0.001$).

DISCUSSION:

Children from higher social classes are reported to have on average lower dmfs scores than those from lower classes [Kalsbeek et al.,1996].[17] Moreover, as no radiographs were taken, caries lesions are under recorded, which can result in a difference in caries estimation up to a level of 60% [Roeters, 1992].[18] As can be seen, the d-component constituted the major part of the caries index. This finding has been confirmed by earlier studies [Douglass et al.,1995;[15] Gizani etal., 1999;[19] Autio Gold and Tomar, 2005].[14] This is seen as an important finding and there is still a need for further investigations on this subject [Roeters, 1992].[18] Our study confirms that second primary molars have more caries than first primary molars [Holland and Crowley, 1982; Li etal., 1993; Douglass et al.,1995; Holt, 1995; Gizani et al., 1999].[11]

Furthermore we looked at the mesial and distal surfaces to see if second primary molars have more caries on all these surfaces. On the proximal surface, first primary molars had significantly more caries lesions than second primary molars. This can be explained by the fact that at the age of 5 years the first permanent molars are not erupted yet, so the second primary molar has only one proximal surface (mesial) which is in contact with another tooth. On the contrary, the first primary molar has contact points with both the canine and the second primary molar, creating an additional predilection site to develop proximal caries. If radiographs had been used, the difference between the number of proximal dmfs of both molars might even have been larger.

Possible causes for the difference in caries prevalence are:

● plaque retention: brushing the second primary molar is more difficult than brushing the first primary molar and nat ural cleaning is probably better on the first primary molar;

● eruption-time: the first primary molars erupt earlier than the second primary molars;

● anatomy of the tooth;

● prevalence of developmental disturbances in the primary dentition.

Plaque retention could be an explanation, but plaque is not the only cause of caries. Feeding pattern, tooth brushing and fluoride intake are also very important and most likely comparable for first and second primary molars in the same oral cavity [Al-Malik et al., 2003].[20]

The second primary molars erupt 10-12 months later than the first primary molars, at an age of 24-30 months [van der Linden, 1994].[23] One could assume that the first primary molar has more caries due to a longer presence in the oral cavity. But this is not supported by the literature. Only in special cases (e.g. early childhood caries), are the teeth attacked by caries in sequence of eruption [Veerkamp and Weerheijm,1995;[21] Douglass et al., 2001].[22]

The anatomy of the tooth could also be an explanation. In1981, Bimstein etal. investigated which tooth surface is most likely to develop caries. They found that the difference in caries prevalence between the first and second primary molar could be explained by the buccal pit in the second molar in the mandible and the palatal fissure in the second molar in the maxilla [Bimstein et al., 1981].[24] Since we excluded these surfaces, the tooth-anatomy was not a major explanation for the differences seen. This is supported by other authors [Douglass et al., 2001].[22] Fissure sealants in the primary molars also influence the anatomy of the fissures. But in this investigation, the children did not have sealants in their primary molars. So that was also not an explanation for the differences found. Developmental defects can also be an explanation. In the permanent dentition Molar Incisor Hypomineralisation (MIH) hypomineralisation of systemic origin of 1-4 permanent first molars, frequently associated with affected incisors, occurs. Clinically, MIH molars have an abnormality in the translucency of the enamel due to hypomineralisation [Weerheijm,2003]. Although it does not always occur, the hypomineralised enamel can chip off easily leading to unprotected dentine and unexpected rapid caries development [Weerheijm, 2003].[25] Due to a higher sensitivity to caries, these molars are sometimes restored extensively [van Amerongen and Kreulen, 1995].[26] The unusual form of the restoration often indicates, however, that a caries lesion may not have been the only reason for restoration [van Amerongen and Kreulen, 1995].[26] Fissure sealants in MIH molars seem to protect against breakdown and encourage further post-eruptive maturation [Fearne et al., 2004].[27]

In addition, teeth with hypoplasia in the primary dentition are more vulnerable for caries [Pascoe and Seow, 1994;[28] Montero et al., 2003].[29] Sometimes in second primary molars MIH-like opacities are seen. This is completely different than a caries lesion. In this investigation we can only

hypothesise on the size and form of the restorations, so more investigations are needed. Further studies, looking at the amount of dental decay and possible developmental disturbances, are needed, such as investigations done in the permanent dentition for MIH-molars.

Furthermore, other possible causes have to be taken into account. Discussion of the possible causes suggests that developmental disturbances are among the best explanation for the differences in caries prevalence found. If developmental disturbances in the second primary molars are an important cause for this difference, their prevalence has tobe rather high, which needs confirmation.
This study evaluated the relationship between the loss of posterior space and 2 events that are of clinical importance in pediatric dentistry: interproximal caries and tooth loss (both in molars). The loss of posterior space also had a close relationship with the type of condition (proximal caries vs tooth loss), and also with the number of affected surfaces. As in Mexico,[30,31,32] studies performed in other countries showed that tooth decay and early tooth loss represent a public health problem among school-age children.[33,34–37,38–40] The premature loss of a temporary molar affected by caries before the eruption of the first permanent molars causes significant mesial movement of the first permanent molar or the second primary molar, which are mesialized at the moment of the eruption, using the available space and thereby reducing the arc length. This leads to a collapse of the arcade.[41]

To avoid loss of space when a tooth is lost, the American Academy of Pediatric Dentistry recommends placing a space maintainer. The objectives of space maintenance are to prevent the loss of the arch length, and/or the perimeter of the arch, maintaining the relative position of the existing dentition.[42] Previous studies show that the loss of space is greater in the mandible than in the maxilla if a second primary molar is lost compared with a first primary molar,[43] and the greatest amount of space loss was observed in the first 6 months after the loss of the dental organ.[44]

The present study has some limitations that must be taken into account for an adequate interpretation of the results. We could not accurately measure the time at which the participants had lost the tooth. However, it was difficult to locate participants with this characteristic. Additionally, in contrast with longitudinal studies, there may be an ethical dilemma with follow-up, because in those the researchers do not perform the necessary treatment (space maintainer) on children who lost teeth.
The use of preventive and interceptive orthodontic appliances is intimately related to a fundamental knowledge of anatomy and physiology.[45] Although some authors suggest that space maintainers should be indicated only in cases of premature loss of the second primary molars and should be placed within the first 3 months after such extractions,[46] other authors suggest that various factors must govern this situation.[47,45] The early loss of teeth in the primary dentition has different consequences based on which teeth are lost and the existing alignment and occlusion.[47] However, it is important to identify the risk factors and reduce the appearance of interproximal caries, and also premature loss of the primary teeth, such as the adverse effect of loss of posterior space, by making the parents aware and providing information on the importance of preserving the primary dentition.

CONCLUSION:

Second primary molars have more caries than first primary molars and the differences in caries prevalence are the largest on the occlusal surface. The causes are yet unknown, but developmental disturbances may be amongst them.
Interproximal caries and tooth loss are risk factors for the loss of space in the posterior segment in pakistani's schoolchildren. It is necessary that decision-makers consider this problem to be a priority and promote preventive programs.

Why this paper is important

Despite advances in prevention, the prevalence of children with dental caries (coronal and interproximal) and premature loss of primary molars is high, with clinical consequences as the loss of space in the posterior segment. The results of this article should reinforce the importance of prevention of dental caries and premature loss of primary molars, and its impact on the development of a sound infant occlusion

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