Correlation of premature loss and molar relationship of mixed dentition children with a very high def-t index

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ABSTRACT

Introduction: Premature loss is the loss of tooth before its normal period of time. Premature loss can be seen in children aged 7-9 years old with the loss of deciduous maxillary and/or mandibular canine, first molar, and/or second molar. Premature loss of deciduous tooth and large cavities in canine, first molar, and/or second molar in mixed dentition period can cause abnormal molar relationship. The purpose of this study is to analyze the relationship between premature loss and molar relationship in children aged 7-9. **Methods:** This type of study was analytical observational study with the approach of cross sectional. The samples are 43 children aged 7-9 years old in SDN Ciawi SDN Cikeruh 1, and SDN Cikeruh 2 West Java who had been chosen using purposive sampling method. The result of this study, which has been statistically tested using Spearman's Rank correlation test **Results**: There was a positive correlation between premature loss and molar relationship. Among 43 children with premature loss of deciduous canine, first molar, and second molar, 23 children (53.5%) have anomalies in molar relationship caused by first permanent molar(s) drifting. **Conclusion:** There was a relationship between premature loss and molar relationship in children aged 7-9 in SDN Ciawi SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java, Indonesia.

Keywords: Premature loss, deciduous tooth, molar relationship.

INTRODUCTION

Premature loss of tooth can be defined as loss of tooth before its normal period of time. Premature loss of tooth can happen because of caries, ectopic eruption, congenital diseases, arch length deficiency which causes deciduous tooth resorption, and trauma.[2, 3]

Premature loss can lead to reduced arch length and adversely affect occlusion, molar relationship, and tooth alignment leading to the need for orthodontic treatment.[4] Early loss was defined as extraction of the first primary molar between 7 1/2 and 9 1/2 years and/or extraction of the second primary molar between 7 1/2 and 10 1/2 years, and extraction of the first and/or second primary molar before 7 1/2 years of age. Permanent successors normally erupt when a child is 11-12 years old for maxillary canine, 9-10 years old for mandibular canine, 10-11 years old for maxillary first premolar, 10-12 years old for mandibular first premolar, 10-12 years old for maxillary second premolar, and 11-12 years old for mandibular second premolar. Premature loss of deciduous teeth and large cavities on deciduous canine, first molar, and/or second molar in mixed dentition can cause abnormal teeth alignment such as crowding.[4] Mesial drifting of first permanent molar because of the loss of deciduous molar before its normal time may form abnormal molar relationship.[5] Molar relationship can be affected by whether there is or there is no canine, first molar, and/or second molar, interdental space, and also terminal plane relationship in deciduous teeth. Deciduous teeth maintain a space for permanent teeth eruption.[5] Mesial drift of first permanent molars after premature loss of second deciduous molar may cause abnormality of molar relationship. The effect of deciduous second molar premature loss on molar relationship is greater if the first permanent molar hasn't erupted yet when second deciduous molar has lost, because first permanent molar's position while erupting is guided by distal surface of second deciduous molar.

The WHO deft/DMFT index calculation criteria were categorized as very low in the value of 0.0-1.1; low in the value of 1.2-2.6; moderate in the value of 2.7-4.4; high in the value of 4.5–6.5; and very high in the value above 6.6.[9] The prevalence of certain type of malocclusion, which is crowding, is found higher in individuals with high def-t. Deciduous teeth premature loss and caries in canine, first molar,

and second molar in mixed dentition is associated with loss of space which results to crowding.

A study in Cimahi, West Java in 2015 proves that there is a relationship between premature loss of deciduous teeth and malocclusion. 28 out of 77 children (36.4%) aged 7-11 years old in SDN Cimahi experienced premature loss of deciduous teeth and 59 out of 77 children of children with premature loss has malocclusion (76.62%). The number of children with premature loss of deciduous teeth and class I malocclusion is 35 children (45.5%), 18 children (23.4%) with class II malocclusion, and 6 children (7.8%) for class III malocclusion.[8]

Molar relationship is affected by whether there is interdental space and also terminal plane relationship of deciduous teeth. The direction of permanent first molar eruption is guided by distal surface of deciduous second molar. Terminal plane relationship has a major role on permanent first molar relationship. Flush terminal plane generally develops into class I molar relationship[15]. In Flush terminal plane occlusal relationship, the permanent first molars have a cusp-to-cusp relationship. Flush terminal plane will become class I molar relationship in permanent dentition.[10] In the presence of a terminal flush plane, the permanent first molars initially have a cusp-to-cusp relationship. The mandibular permanent first molar must move 2-3 mm anteriorly to change the end-to-end relation into a class I molar relation. The transformation of the end-to-end relation into a class I molar relation can be done in 2 ways, namely early mesial shift and late mesial shift.[12] Early mesial shift is the mesial shift of the permanent first molars in the early stages of erupted mandibular first permanent molars. The eruption force of the permanent molars pushes the primary molars forward, that is, toward the primate space, then a class I molar relationship is formed. Because this change occurs at the beginning of the mixed tooth period, it is called the early mesial shift. Late mesial shift or shift of the permanent first molars to the mesial direction that occurs at the end because there is no room for sufficient development, the erupting permanent first molars may not reach the Class I molar relation in the early mixed dentition period. Class I molar relationship can be formed after the second primary molars exfoliated, by utilizing the Leeway space in such

cases. Because it occurs at the end of the mixed dentition period, it is called the late mesial shift.[13] The effect of the mesial step on the molar relationship is that when the second primary molar is mesial step, the permanent first molar immediately erupts to form a class I molar relationship. In some cases, class III molar relationship can also be formed if the growth of the mandible continues. The influence of the distal step on the primary dentition period usually causes a class II molar relationship in the period of the permanent tooth. In some cases, class I molar relations can be formed.[14]

The reason we chose the age range of 7-9 years old was because first permanent molars have fully erupted and contacted in that age range, so the relation of the first permanent molars could be assessed on both sides of the jaw. The effect of deciduous teeth premature loss can be seen in mixed dentition period. In this study, 53.5% (23) children out of 43 have class I type 5 molar relationship because of premature loss. The purpose of this study is to know the effect of premature loss of deciduous tooth on molar relationship in mixed dentition period. Subjects of this study were children aged 7-9 years old in SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java.

METHODS

This research was conducted in an analytical observational study method with the approach of cross-sectional study. The subjects were children aged 7-9 who are students of SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java, Indonesia, children who were willing to be a research subject, children with loss of deciduous canine, first molar, and/or second molar in maxilla and/or mandible, and children who have gotten consent by their parents or guardian.

The subjects were not children who have systemic disease(s), children who currently consume medication to treat their systemic disease(s), children who undergo an orthodontic treatment or use a space maintainer, and children with malnutrition.

During the examination process, sampling was done purposively. Questionnaires and informed consent were given to the parents several days before the examination. Subjects were chosen according to the inclusion criteria in the questionnaire and the willingness to participate in this study as seen on the informed consent signed by parents, also from the intra oral examination, children with deciduous canine, first molar, and/or second molar premature loss were included as the subjects. The tools and materials needed in this research are mouth mirror, dental explorer, tray, informed consent, def-t index and orthodontic examination sheets.

Out of 113 students of SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, 43 of them have experienced premature loss, therefore were included into the study. The examinations of the research subjects were done by one person and the other 2 persons helped in the preparation and writing down the examination results.

The study was done by doing extra oral and intra oral examinations. Equipment used were mouth mirror, dental explorers, tray, mask, gloves, examination sheets, informed consent, pen, tissue, and 70% alcohol. Extra oral examinations were done by examining the face profile of the children. Intra oral examinations were done using mouth mirror and dental explorer by checking the children's teeth which have erupted fully and also partially, examining the children's first permanent molars relationship and def-t index, and seeing the condition of the children's teeth and oral condition as a whole. The results of the examinations were written down in the examination sheets. The results were then statistically analyzed by Spearman's Rank method. The Ethical Exemption number for this study is 320/UN6.KEP/EC/2018, issued by The Research Ethics Committee Universitas Padjadjaran Bandung.

First permanent molar relationship of 113 children was observed in this study with def-t index by doing intra oral examination. The operational definition of malocclusion in this study is the type of malocclusion caused by premature loss of deciduous molar(s), which was class I type 5 first permanent molar relationship on left/right/both sides of the jaw. Molar (mesial) drift can be defined as the tendency of molar to move in a mesial direction within the

arch with an aim to maintain interproximal contact between teeth and usually happpend in premature loss case. Premature loss was determined in these 7-9 year old children who have lost deciduous first molar and/or deciduous second molar on one side or both sides of the jaw. If a child have lost deciduous first and/or second molar but the permanent first premolar and/or permanent second premolar haven't erupted although according to the child's age it must have erupted, then it is considered as permanent successors have not erupted. If the permanent first and/or second premolar have eupted, it is consdered as permanent successors have erupted.

RESULTS

The results of this study proves that there is a relationship between premature loss and molar relationship in students of SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java. Premature loss has significant effect on first permanent molar relationship in children who don't have permanent successors yet, and has no significant effect in children who already have permanent successors, with research confidence level of 95%.

Table 1. Age distribution table of children with premature loss

No.	Age	Number of children
1.	7 years old	7 children
2.	8 years old	20 children
3.	9 years old	16 children
	Total	43 children

Table 1 shows that out of 43 children with premature loss, 7 children were 7 years old (16.2%), 20 children were 8 years old (46.5%), and 16 children were 9 years old (37.2%).

Table 2. Gender distribution table of children with premature loss

No.	Gender	Number of children
1.	Boy	26 children
2.	Girl	17 children
	Total	43 children

Table 2 shows that out of 43 children with premature loss, 26 children were boys (60.5%) and 17 children were girls (39.5%).

Dental examination results show that def-t index of the children with premature loss of deciduous teeth in SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java combined is 7.2.

Research results show that the number of children with malocclusion caused by the first permanent molar(s) that drifted is 23 children, 15 of them are children who don't have permanent successors yet, and 8 children already have permanent successors.

Table 3. def-t index of children with premature loss in SDN Ciawi, SDN Cikeruh 1, dan SDN Cikeruh 2 Jatinangor, West Java,

No	Name of School	def-t index	def-t index classification
1	SDN Ciawi	5,9	High
2	SDN Cikeruh 1	6,7	Very high
3	SDN Cikeruh 2	8,4	Very high
	def-t index of SDN Ciawi, SDN Cikeruh 1, dan SDN Cikeruh 2 combined	7,2	Very high

Table 4. Premature loss of deciduous teeth and abnormalities in molar relationship in students of SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java

No	Classification of Children with Premature Loss	The Number of Children with Premature Loss	The Number of Children with Malocclusion Caused By Premature Loss
1	Permanents Successors Have Not Erupted Yet	22	15
2	Permanent Successors Have Erupted	21	8
	Total	43	23

Table 5. The number of deciduous teeth premature loss based on each teeth with the classification of molar

Teeth		Number of teeth	Percentage (%)	Molar Relationship Classification
Canine (c)	53	2	2.4	Class I type 5 (2)
	63	2	2.4	Class I (1) Class I type 5 (1)
	73	2	2.4	Class I type 5 (2)
	83	2	2.4	Class I (1) Class I type 5 (1)
First molar (m1)	54	11	13	Class I (4) Class I type 5 (6) Class III (1)
	64	14	16.7	Class I (6) Class I type 5 (6) Class III (2)
	74	12	14.3	Class I (4) Class I type 5 (6) Class III (2)
	84	10	11.9	Class I (3) Class I type 5 (5) Class II (1) Class III (1)
Second molar (m2)	55	3	3.6	Class I type 5 (2) Class III (1)
	65	7	8.3	Class I (4) Class I type 5 (3)
	75	6	7.2	Class I (1) Class I type 5 (4) Class III (1)
	85	13	15.5	Class I (3) Class I type 5 (9) Class III (1)
Total		84		

Table 5 represents the data of the number of teeth which was loss prematurely in each region and their impact on molar relationship classification in the same region. As much as 2 teeth 53 were loss prematurely and resulted in 2 cases of class I type 5 molar relationship in the same region. As much as 2 teeth 63 were loss prematurely and resulted in 1 case of class I molar relationship and 1 case of class I type 5 molar relationship in the same region, and so on. Table 5 shows that the percentage of deciduous canine premature loss in SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 was 9.6%, 55.9% for the first deciduous molar premature loss, and 34.6% for the second deciduous molar premature loss. Table 3 also shows the classification of molar relationships in premature loss of each deciduous tooth

Table 6. Correlation between premature loss of deciduous teeth and first permanent molars relationship in students of SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java with no permanent successors

Variable	r_s	t_{score}	p-value	Sign / Non-sign	Correlation
P.Loss & Molar	0.43	2.16	0.0215545	Sign	18.91

P.Loss: Premature Loss of Deciduous Canine, First, and/or Second Molar
Molar: First Permanent Molars Relationship

The results of Spearman's Rank correlation test with the value of α = 0.05 are p-value = 0.02, and the correlation score is 18.91. Statistically, it can be stated that premature loss has a significant effect on first permanent molars relationship in children with no permanent successors which means there's a relationship between premature loss and molar relationship in children who don't have permanent successors yet.

Table 7. Correlation between *premature loss* of deciduous teeth and first permanent molars relationship in students of SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java who already have permanent successors

Variable	r_s	t_{score}	p-value	Sign/Non-sign	Correlation
P.Loss & Molar	0.34	1.56	0.0679541	Non_sign	11.32

P.Loss: Premature Loss of Deciduous Canine, First, and/or Second Molar
Molar: First Permanent Molars Relationship

The results of Spearman's Rank correlation test with the value of α = 0.05 are p-value = 0.06, and the correlation score is 11.32. Statistically, it can be stated that premature loss doesn't have a significant effect on first permanent molars relationship in children with permanent successors which means there's no relationship between premature loss and molar relationship in children who already have permanent successors.

DISCUSSION

Premature loss is mostly caused by caries.[1] def-t index in children with premature loss in SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor is considered very high. Premature loss of deciduous molars can cause mesial drifting of first permanent molar(s) which causes significant space loss in dental arch. Premature loss of deciduous teeth causes drifting which can lead to crowding.[1] Other than that, premature loss of deciduous teeth can cause malposition of adjacent teeth, impaction of the associated permanent tooth, increased overbite, arch asymmetries, occlusal impairment, and disrupted eruption pattern.[6]

Research result in 43 children in SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 shows that premature loss of deciduous canine, first molar, and/or second molar causes abnormality of molar relationship in 23 children (53.5%). Among 43 children with premature loss, 7 children were 7 years old (16.2%), 20 children were 8 years old (46.5%), and 16 children were 9 years old. Among those 43 children, 26 children were boys (60.5%) and 17 children were girls (39.5%). Premature loss of deciduous canine, first molar, and/or second molar has a significant impact on abnormalities of molar relationship in research subjects with no permanent successors, while in research subjects with permanent successors, premature loss of deciduous canine, first molar, and/or second molar has no significant effect on abnormalities of molar relationship.

A study in India with children aged 5-10 year old as the subject shows that prevalence of early loss of primary teeth was 16.5%, and boys had more primary teeth lost (9.28%) than girls (7.22%). Prevalence of early loss of primary teeth was higher at 8 years of age.[16] A study in Yemen with 5-10-year-old age group shows that there was no statistically significant difference between genders. Prevalence of early loss of primary teeth was high (40.54%), and was higher at 8 years of age.[19]

A study in an elementary school in Cimahi shows that the prevalence of malocclusion there is 76.6%, which means more than half of students there has malocclusion. A study in an elementary school in Brazil in 2008 shows the prevalence of malocclusion is 77.7% and in Tirana in 2013 the prevalence of malocclusion is 72.9%. The percentage difference might be due to difference of study subject age, race, and socio-economy.[7,8,15]

In this study result, table 5 shows that the highest percentage of deciduous teeth lost prematurely was first molar with the percentage of 55.9%. In Cimahi, the highest percentage of deciduous teeth lost prematurely was also first

molar with the percentage of 41.8%. Same result also happened in Romania with the percentage of lost deciduous first molar as much as 48.8%, in India 60.36%, and in Jordan 40%. Meanwhile a study in Brazil shows the highest number of prematurely lost deciduous teeth was second molar (54.1%), the same as in Yemen (13.5%). Meanwhile in Canada the highest number was canine.[8,16,17,18,19]

Empty space caused by premature loss of deciduous teeth which have not been replaced by permanent teeth causes posterior and anterior teeth to drift, therefore, there is disturbance in the molar relationship. Deciduous teeth play a role in maintaining space for the eruption of permanent teeth.[5] Mesial drift of permanent first molar after premature loss of deciduous second molar can result to abnormality of molar relationship. The effect of deciduous second molar premature loss to molar relationship is greater if permanent first molar hasn't erupted yet when deciduous second molar has already exfoliated, because the eruption of permanent first molar's direction is supposed to be guided by distal surface of deciduous second molar.[5]

Premature loss of deciduous teeth can accelerate or delay the eruption of permanent successors, depends on the time the premature loss occurs. The eruption of permanent successors mostly tend to be delayed because premature loss of deciduous teeth mostly happen before the root of deciduous teeth resorp. This happens because there are some abnormal changes in connective tissue on top of the permanent successors and also formation of thick gingiva.[3]

According to results of the study which has already been done, there is a relationship between premature loss and molar relationship in children aged 7-9 in SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java, Indonesia.

CONCLUSION

There is a relationship between premature loss and molar relationship in mixed dentition period of children aged 7-9 years old in SDN Ciawi, SDN Cikeruh 1, and SDN Cikeruh 2 Jatinangor, West Java.

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