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## Malocclusion and Premature Teeth Loss: its Prevalence and Association among Yemeni Schoolchildren in Sana'a

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### Abstract

**Objectives:** This study was conducted in Sana'a city, Yemen to detect the prevalence of early loss of primary teeth and its consequence on malocclusion.

**Materials and methods:** This cross-sectional observational study included 1079 school children aged 7-12 years, and for the detection of the following characteristics, the samples were clinically examined: Angle's classification of malocclusion, anterior open-bite, overjet, lateral open-bite, overbite midline shift and cross-bite. Also, the early loss was classified according to the chronological age of an eruption of the permanent teeth proposed by Kronfeld.

**Results:** The prevalence of malocclusion among school children was 81.1% and the normal first-class molar relationship was found only in 18.9%, while the class I malocclusion included the highest rate of the sample 74%, followed by the class II with a 9.5% relationship, the class III included only 1.1%. There was an increased association between early tooth loss and the development of malocclusion as this association was 0.2 times in Class I ( $p < 0.001$ ), increased in Class II to 2.2 times (0.01), and then increased to 3.7 times in Class III ( $p = 0.02$ ).

**Conclusion:** This result underscores the significance of raising awareness regarding this dilemma and the requirement to focus further efforts towards prevention of early tooth loss and interference to maintain dental health, thus recovering chewing functions and aesthetics for individuals and the entire population.

### Keywords

Malocclusion; Premature loss; Prevalence; Primary teeth

## Introduction

Investigation and survey of dental health problems in Yemen are in spite of everything fairly small and limited, even though there were studies that dealt with the problems of dental caries, the prevalence and pattern of third molar impaction in adults and children, periodontal infections, and causes of extraction of permanent teeth [1-8], however no exploration converge the prevalence of premature loss of primary teeth and its effect on malocclusion. Early loss of primary teeth is a worldwide problem. Premature loss is described as the loss of a deciduous tooth prior to the age of normal exfoliation [9]. The most common cause of early tooth loss is tooth decay, trauma, periodontal disease and early root resorption [7,8,10-12]. Early loss of primary teeth leads to early or late eruption of subsequent teeth [12]. Pediatric patients may suffer various effects, for instance anti-extrusion, dental rotation, dental crowding, craniofacial development disorders, development of harmful habits, especially post-impact tooth and reduction in dental arch length [12]. The association between the early tooth loss prevalence; and ethnicity and the environmental factors has been confirmed by many studies [9-12]. Malocclusion is a general dental health problem, its psychological and functional impact is significant, and its prevalence among children is high [13]. The reasons of malocclusion are environmental or genetic and/or a mix of equally factors, alongside with a variety of local factors for instance harmful oral habits, the shape of the teeth, dental abnormalities and teeth location of growth, can cause malocclusion [7, 8, 13, 14]. Regarding the early loss of deciduous teeth, it was earlier mentioned so as to the early loss of primary teeth can have an effect on the time of natural eruption of permanent successors by whichever inhibiting or speed up their eruption [15]. It is reflected on a qualifying cause for occlusal and location variances in mixed and permanent teeth [16]. It is normally recognized that the early loss of primary teeth, particularly the molar, might be in the lead to a deficiency from outer space, malocclusion and midline differences in permanent teeth [17]. Additionally, the early loss of the primary teeth reduces the arch length necessitated for the following teeth, and as a result, it pre-eliminates impaction crowding, and rotation of permanent teeth [18]. The present study was designed to ascertain the rate of the premature loss of primary teeth and its effect on malocclusion in Sana'a city, Yemen.

## Materials and Methods

Among Yemeni school children in primary schools (public and private) in Sana'a, Yemen, this cross-sectional descriptive study was conducted to determine the rate of malocclusion related with early tooth loss. From the selected Sana'a schools, a total of 1079 boys and girls aged 7-12 years were randomly selected and screened. Selected schools are located in different areas of the city to avoid having children from the same area (Table 1).

The criteria factors for every malocclusion measurement described by Angle, [19] were divided malocclusion into various groups that were recognized on the occlusal relations of the first molar. Using the standard method [20], data were collected by one examiner, the first researcher (Tharwa). With a simple examination under sufficient light, sometimes if natural light was insufficient, artificial light from a torch was used a clinical examination was done for each child. The children who were selected and refused to participate were replaced by new children.

## Ethical Approval

The written consent in all cases was obtained. Approval was obtained from the participants prior to including in the study. Ethical approval was obtained from the Medical Research and Ethics Committee of the Faculty of Medicine and Health Sciences, Sana'a University with reference number (852) on 11/11/2018.

## Data Analysis

Data were investigated and obtainable using tables where percentage (%) was used to describe qualitative variables. The odds ratio (OR), 95% confidence interval, chi-square with Yate correction and Fisher's tests were used to illustrate the significance of the association between early loss of primary teeth and incidence of malocclusion at a significance level less than 0.05 (P) by SPSS software (IBM Corp. Released 2012).

## Results

Table 1 shows the distribution according to age, gender, type of school and school district for the 1079 selected children who participated in this study. The study included almost the same number for age groups where the number of children aged 7-9 years was 48.8% and 10-12 years old was 51.2%, as well as in terms of gender, the number of boys was 50.6% and girls were 49.4%. Regarding school types, 70.5% of the children selected were from public schools and only 29.5% were selected from private schools. With regard to the districts, most of the children were from Al-Thawrah district (62%) (large population density), while 15.8% were from Old Sana'a and 22.2% were from Al-Safiah. The outcomes in Table 2 show that the totality malocclusion was 81.1%, and the Class I malocclusion included the highest percentage of the sample 70.4%, finding 73.2% for the age group of 7-9 years higher than that of the age group of 10-12 years of 67.8%. This difference was statistically significant ( $X^2 = 6.24$ ,  $P < 0.05$ ). The second class was present at 9.5%, while the third class contained only 1.1% of the entire sample. Consistent with gender and school type, a statistically non-significant difference ( $P > 0.05$ ) was found in the incidence of malocclusion. The current study was planned to determine the statistical relationship between early tooth loss and the development of malocclusion. There was an increased association between early tooth loss and the

development of malocclusion as this association was 0.2 times in Class I ( $p < 0.001$ ), increased in Class II to 2.2 times (0.01), and then increased to 3.7 times in Class III ( $p = 0.02$ ) (Table 3).

| Variables   |             | frequency | %    |
|-------------|-------------|-----------|------|
| Age         | 7-9yrs      | 527       | 48.8 |
|             | 10-12yrs    | 552       | 51.2 |
| Gender      | Boys        | 546       | 50.6 |
|             | Girls       | 533       | 49.4 |
| School type | Government  | 761       | 70.5 |
|             | Private     | 318       | 29.5 |
| Districts   | Al- Thawrah | 669       | 62   |
|             | Old Sana'a  | 170       | 15.8 |
|             | Al- Safiah  | 240       | 22.2 |

**Table 1:** The distribution of schoolchildren participants in the study according to age, gender, school type and district (n=1079). Mean age  $\pm$ SD= 9.5 $\pm$ 1.7.

| Angle classification | Age (year) |      | Gender    |       |      |       | School type |      |         | Total  |     |
|----------------------|------------|------|-----------|-------|------|-------|-------------|------|---------|--------|-----|
|                      | 7-9 yrs    |      | 10-12 yrs | Boys  |      | Girls | Government  |      | Private | N=1079 |     |
|                      | N=527      |      | N=552     | N=546 |      | N=533 | N=761       |      | N=318   |        |     |
|                      | freq.      | %    | freq.     | freq. | %    | freq. | freq.       | %    | freq.   | freq.  | %   |
| Class I normal       | 83         | 15.8 | 121       | 103   | 18.9 | 101   | 141         | 18.5 | 63      | 204    | 19  |
| Total malocclusion   | 444        | 84.3 | 431       | 443   | 81.1 | 432   | 620         | 81.5 | 255     | 875    | 81  |
| Class I              | 386        | 73.2 | 374       | 384   | 70.3 | 376   | 540         | 71   | 220     | 760    | 70  |
| Class II             | 52         | 9.9  | 51        | 53    | 9.7  | 50    | 70          | 9.2  | 33      | 103    | 9.5 |
| Class III            | 6          | 1.1  | 6         | 6     | 1.1  | 6     | 10          | 1.3  | 2       | 12     | 1.1 |
| P-value              | 0.0085*    |      | 0.998     |       |      |       | 0.666       |      |         |        |     |
| X <sup>2</sup>       | 6.24       |      | 0.035     |       |      |       | 1.57        |      |         |        |     |

**Table 2:** Prevalence of Angle classification according to age, gender and school type.

| Angle classification   | With no premature loss (n = 565) |      | With premature loss (n = 310) |      | Odds ratio | 95% CI   | P      |
|------------------------|----------------------------------|------|-------------------------------|------|------------|----------|--------|
|                        | No                               | %    | No                            | %    |            |          |        |
| Class I normal         | 165                              | 29.2 | 39                            | 12.6 | 0.3        | 0.2-0.57 | <0.001 |
| Class I Malocclusion   | 512                              | 90.6 | 248                           | 80   | 0.3        | 0.2- 0.5 | <0.001 |
| Class II Malocclusion  | 49                               | 8.7  | 54                            | 17.4 | 2.2        | 1.5-3.3  | 0.01   |
| Class III Malocclusion | 4                                | 0.88 | 8                             | 2.3  | 3.7        | 1.1-12.4 | 0.02   |

|                                |     |      |     |      |     |          |      |
|--------------------------------|-----|------|-----|------|-----|----------|------|
| Mid-line shift                 | 237 | 41.9 | 156 | 50.3 | 1.3 | 1.0-1.7  | 0.05 |
| Cross-bite Unilateral          | 109 | 19.3 | 75  | 24.2 | 1.3 | 0.9-1.8  | 0.08 |
| Cross-bite Bilateral           | 23  | 4.1  | 25  | 8.1  | 2.1 | 1.2-3.7  | 0.01 |
| Anterior open bite             | 65  | 11.5 | 28  | 9    | 0.7 | 0.4-1.2  | 0.25 |
| Unilateral posterior open bite | 11  | 1.9  | 8   | 2.6  | 1.3 | 0.5-3.3  | 0.5  |
| Bilateral posterior open bite  | 11  | 1.9  | 8   | 2.6  | 1.3 | 0.5-3.3  | 0.5  |
| Abnormal Over jet              | 323 | 57.2 | 189 | 61   | 1.2 | 0.88-1.5 | 0.2  |
| Abnormal Over-bite             | 311 | 55   | 177 | 57.1 | 1.2 | 0.88-1.5 | 0.26 |

**Table 3:** Relationship between malocclusion with premature loss and without premature loss of the primary teeth.

With regard to over jet, the current study accounted that 323 (57.2%) of children who did not lose a premature primary tooth had an abnormal over jet compared to 189 (61%) of children who lost premature primary tooth. Concerning abnormal Over-bite, the current study found that 311 (55%) children of who did not lose their premature primary teeth had an abnormal Over-bite matched up to 177 (57.1%) of children who lost premature primary teeth.

## Discussion

Loss of premature primary teeth is an apprehension not just due to function loss on the contrary also due to the increased likelihood of other teeth erosion [18]. Prediction of subsequent primary tooth loss may be beneficial in formative treatment [21]. Furthermore, the loss of premature deciduous teeth affects the progress of the natural occlusion and generates an increased require for orthodontics treatment [21]. Primary early loss of teeth has been noticed in explore studies in numerous regions in the globe [7,8,22-25]. In the current study, 1079 children were examined, they aged 2-12 years, 318 of whom were in private schools and 761 were in public schools. The selected children were from the city of Sana'a, Yemen. Of the 1079 children, 875 (81.1%) had at least one premature loss that was either deciduous or molar canines, while 51% of children studied in Saudi Arabia [26] and 24.9% of children studied in Brazil [9] had early tooth loss. Compared to Saudi results, Danish and Brazilian, the children in the current investigation experienced significantly higher rates of premature loss of deciduous teeth. The dissimilarity could be connected to the higher mean of decayed teeth, which was found to be 4.0. It may also be for the reason that parents do not care about the primary teeth because they have the idea that the deciduous teeth will be replaced. Furthermore, in spite of the high rate of early tooth loss, upon inspection there was only two children wore space maintainers.

It has been stated and confirmed that early loss of primary teeth can affect the natural eruption time of permanent successors by either inhibiting or accelerating their appearance [23]. The etiology of malocclusion is to some extent controversial, conversely, it is simply multi-factorial, with effects being equally hereditary [27] and ecological [28]. There are three normally expected etiological factors for malocclusion: structural factors - the shape, size and virtual positions of the upper and lower jaws. Variants can be produced by environmental or behavioral factors such as masticatory muscles, nocturnal mouth breathing, cleft lip and cleft palate. The influence of muscle factors - and the function and shape of the

muscles that frame the teeth - may be the cause of malocclusion. This can be influenced by habits for instance pacifier, finger-sucking, tongue-thrusting and nail-biting [29]. Dental reasons - the size of the teeth relative to the jaw, early loss of teeth may result in spacing or median migration causing crowding, abnormal eruption course or timing, extra teeth (hypernumerous), or too few teeth (hypodontia). There is no particular cause of malocclusion, and whilst planning orthodontic therapy it is regularly helpful to be concerned about the above factors and their effect on malocclusion. These influenced by oral habits and pressure which leads to malocclusion [26,29-31].

The current study was planned to determine the statistical association between premature tooth loss and the occurrence of malocclusion. There was an increased association between premature tooth loss and the development of malocclusion, where this association was 0.2 times in the first class ( $<0.001$ ), and increased in the second class to 2.2 times (0.01), and then increased to 3.7 times in the third class ( $p=0.02$ ) (Table 3). The outcomes of the present study definite the importance of premature tooth loss as a major factor for the development of malocclusion in Sana'a city as reported elsewhere [23,26,31]. Additionally, the results of the current study confirmed that premature loss of primary teeth is the most common local factor that leads to malocclusion due to its interfering with the harmony of adult teeth, leading to crowding initiated by migration of adjacent teeth [31].

Regarding the over jet, the current study reported that 323 (57.2%) of children who did not lose a primary tooth prematurely had an abnormal over jet compared with 189 (61%) of children who lost an premature primary tooth. This is supported by the results of Proffit et al. [32] who showed that, between 8-11 years, 45.2% of children had a slight increase in the over jet also by the findings of Al-Shahrani et al. [26] where they showed that, between 9-11 years, 53 (62.3%) children who did not lose a primary tooth prematurely had a slight increase in the over jet compared to 41 (57.7%) of the premature primary tooth loss who had mild impairment increased over jet [26]. Overbite is a vertical measurement of the degree of overlap between the upper and lower incisors. Regarding abnormal overbite, the current study found that 311 (55%) of children who did not lose their premature primary teeth had abnormal overbite compared to 177 (57.1%) of children who lost premature primary teeth. Tauscher et al [33] showed that increased overbite and over jet were the most common malocclusions in the early mixed dentition period. As a result, the extensive variety of orthodontic-related traits identified in the current study underscores the necessity for orthodontic screening at or before 9 years of age. Additionally, this study put emphasis on the importance of early detection of premature primary tooth loss to avoid future malocclusion.

Therefore, the early loss of deciduous teeth affects the development of the natural occlusion and generates an increased require for orthodontic intervention. Finally, due to the adverse effects of early loss of primary teeth, it is necessary to augment the mouth Health awareness through the implementation of school dental health programs to bring up to date children and their parents of the harmful effects of early loss of primary teeth. The value of primary teeth, children and their parents should be made aware of them to care for their preservation. Also, children with early loss of primary teeth should be educated to preserve space if required. Parents of such children also should be recommended to bring their children to the dental hospital for dental procedures.

## Conclusion

There was a high rate of malocclusion, with Class I malocclusions being the most common. There were higher rates of early loss of deciduous teeth with a significant association between malocclusion and early tooth loss. This result underscores the significance of raising awareness about this problem and the prerequisite to focus more efforts towards prevention of early tooth loss and intervention to maintain dental health, thus improve chewing functions and aesthetics for individuals and the entire population. Additionally, our results underscore the magnitude of early recognition of early loss of primary teeth to prevent malocclusion.

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