The effects of unilateral premature loss of maxillary primary molars on the dental arch dimensions

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ABSTRACT

Background: The aim of the study was to evaluate the amount of changes in the horizontal and vertical maxillary arch dimensions measurements following the premature loss of primary molars.

Materials and methods: The sample consist of (50) children with unilateral prematurely extracted either first or second primary molars at the mixed dentition stage.

Results and Conclusions: Results shows that there was an increase in the vertical incisor to canine distance (A) with both premature loss of first & second primary molars due to distal movement of primary canines and at the same time there were a significant loss of space in the extraction space with premature loss of second primary molar due to a mesial movement of maxillary first permanent molars which at the same time tip lingually and this is clear obvious from the decrease in the inter-molars distances horizontally.

Keywords: Maxillary arch dimensions, premature loss, space closure. (J Bagh Coll Dentistry 2013; 25(4):95-99).

INTRODUCTION

One of the important services that the general dentist and the pedodontist can render for young patient is that of maintaining the arch length prior to the eruption of permanent teeth [(1)], the various functions of primary dentition are to provide mastication as well as to maintain the occlusion and space for the permanent teeth ,exfoliation of primary teeth and eruption of permanent successors is a normal physiological process ,when this normal process disrupted due to premature extraction of deciduous teeth a series of changes observed in the dental arches [(2,3)].

The majority of authors agree that in most cases the premature extraction of primary molars will cause crowding associated with either rotation, tipping or bodily movement of teeth [(3-6)].

Some authors reported a greater proportional space loss resulting from mesial migration of the posterior teeth [(7)]. Other researchers have reported somewhat different results, such as anterior teeth moving toward distal teeth with the extraction site separating them, and teeth adjacent to the extraction site moving in both directions toward the extraction space [(6,8)] ,others conducted a longitudinal review of 13 cases of premature loss of primary maxillary molars; the results showed a reduction in arch length and a mesial displacement of the permanent canine, which eventually became virtually blocked out [(9)].while another studies measured the amount of arch length changes following premature loss of primary molars unilaterally for both arches they found that a reduction in the dental arch length was observed both in the maxilla and mandible at the molar region and an increase in arch length in the canine region in the mandible [(3)] .

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Al-Dulayme [(10)] measured the vertical and horizontal maxillary arch dimensions in a sample of Iraqi children with full dentition without premature loss of primary teeth for the same age group of the present study at the mixed dentition stage ,the study concluded that the mean values of the maxillary arch widths are as follows (IC) which represent the inter-canine width were (33.98)mm and the (MB), (ML), (DB) and (DL) distances ,which represent the inter –molars widths were (50.79)mm, (40.66)mm, (52.68)mm and (41.99)mm respectively ,these measurements (widths) estimate the relative position of maxillary primary canines and the maxillary first permanent molars horizontally. While the mean values of the maxillary arch lengths at A,B,C and D were found to be (9.13)mm, (19.31)mm,(28.07)mm and (38.11)mm respectively, these measurements estimate the length of the maxillary arch antero-posteriorly ,where (A) represent the distance between the contact points of the maxillary permanent central incisors to the line tangent to the cusp tip of the maxillary primary canines, while (B,C,D) represent the distance from the midline of permanent central incisors to the line tangent of distal contact areas of primary first and second molars and the first permanent molars respectively..

The present study was carried out for Iraqi children at (8-9) years of age to measure the amount of changes in the maxillary horizontal and vertical dental arch dimensions due to the premature unilateral extraction of first or second primary molars during the mixed dentition stage.

MATERIALS AND METHODS

The sample of the present study consists of 50 Iraqi healthy children ranging in age between 8-9 years, at the mixed dentition stage, belonging to a mixed socioeconomic status selected from

different primary schools from Baghdad city. The children divided into two groups:

Group (1): It included 25 children (13 males and 12 females) have unilateral premature loss of maxillary first primary molars figure (1).

Group (2): It included 25 children (13 males and 12 females) have unilateral premature loss of maxillary second primary molars figure (2).

Both groups had the period of absence of prematurely extracted primary molars between 6-12 months. The remaining dentition was healthy with no extensive caries or malformation and had no history of space maintainer therapy or orthodontic treatment.

Dental study models were prepared by taking alginate hydrocolloid impressions for each child with perforated metal trays, pouring it with dental stone according to the manufacturing instructions, then for every dental cast a proper plaster base was made and trimmed then labeled with certain number [11].

Study Models Measurements

Figures (3) A and (4) A shows the Maxillary dental arch widths" horizontal" measurements which included [10]:

1- **IC**: inter-canine distance which extends between the cusp tips of right and left canine (and / or the centers of the facets of the weared primary canines).

2- **IM**: inter-molars distances which are represented by 4 distances:

 i. MB: The distance between the mesio-buccal cusp tips of right and left maxillary first permanent molars.

 ii. ML: The distance between the mesio-lingual cusp tips of right and left maxillary first permanent molars.

 iii. DB: The distance between the disto-buccal cusp tips of right and left maxillary first permanent molars.

 iv. DL: The distance between the disto-lingual cusp tips of right and left maxillary first permanent molars.

While figures (3) B and (4) B shows the maxillary dental arch length" vertical" measurements include four distances [10] which are:-

1- **A:** The distance between the contact points of the maxillary permanent central incisors to the line tangent to the cusp tip of the maxillary primary canines (or when worn, to the centers of resulting facets).

2- **B:** The distance between the contact points of the maxillary permanent central incisors to the line tangent to the distal surfaces of the maxillary primary first molars.

3- **C:** The distance between the contact points of the maxillary permanent central incisors to the line tangent to the distal surfaces of the maxillary primary second molars.

4- **D:** The distance between the contact points of the maxillary permanent central incisors to the line tangent to the distal surfaces of the maxillary first permanent molars.

Each of these landmarks were marked on the study casts by a sharp lead pencil to facilitate accurate recognition, then the occlusal surface of study casts were facing the glass window of the scanner directly, then accurate & exact image of the casts were saved and transferred to the Auto sketch program on Pentium 4 computer according to the instruction read from that software program, the Auto sketch (Germany) software provides a complete set of CAD tools for creating professional-quality precision drawing, such software program were accurately used in many other dental measurements [12].

Later on, the results obtained from the present study were compared with the results of previous Iraqi study [10] because the age of the studied sample was the same and no other study has been done in Iraq to measure such dimensions.

RESULTS

All the variables of the maxillary dental arch dimensions for the studied sample for both genders were subjected to the descriptive statistics (mean, Minimum, Maximum, range and standard deviation).

Table (1) demonstrates the maxillary dental arch dimensions for group (1), which shows that the mean values of the maxillary dental arch widths at IC were (33.67)mm and the MB, ML, DB and DL distances were (51.33)mm, (40.72)mm, (53.44)mm and (42.99)mm respectively ,while the maxillary dental arch lengths measurements for group (1)shows that the mean values at A ,C and D were (10.23)mm, (28.46)mm and (38.86)mm respectively. The (B) distance has been excluded because of the loss first primary molars. Two tailed t-test was applied to test the significance difference between the means of the groups, Table (2) shows the mean values of the maxillary arch dimensions of the group (1) and its comparison with the control group [10].

Table (3) demonstrates the maxillary dental arch dimensions for group (2), which shows that the mean values of the maxillary dental arch widths at IC were (33.05)mm and the MB, ML, DB and DL distances were (48.41)mm, (37.77)mm, (49.49)mm and (40.27)mm respectively. While the maxillary dental arch

lengths measurements for group (2) shows that the mean values at A,B and D were(10.29)mm, (20.59)mm, and (37.80) respectively, The (C) distance has been excluded because of the loss second primary molars .

Two tailed t-test was applied to test the significance difference between the means of the groups, Table (4) shows the mean values of the maxillary arch dimensions of the group (2) and its comparison with the control group [10].

DISCUSSION

The actual mechanism of tooth drifting is not clearly understood .the factors which may produce this drifting are occlusal force, ligament contraction and soft tissue pressure [13]. In the present study , a general look to tables (1) and (2) indicate that the arch lengths and widths of maxillary arches that undergoes unilateral premature loss of first primary molars ,is not so much different from the control group which has been elected by previous studies [10],nevertheless when we apply the t-test between them it shows no significant difference in all the parameters except at(A) length ,this give us a clue that the primary canines have been moved distally in anteroposterior direction only i.e. toward the space and this movement occur may be due to a pressure exerted from the permanent incisors [4-6,8,14,15], or the primary canines themselves tend to encroach the space distally without any change in the intercanine width and this disagree with other studies [3,16,17], our findings will lead us to many facts;

1-Intercanine width sustained normal when first primary molar prematurely extracted and this information is so valid to pedodontist and orthodontist during their routine work.

2- The significant difference in (A) length while there is no significant difference in the (C) length demonstrate that the second primary molars undergoes a very minimal tooth movement mesially when compared with the distal movement of the primary canines which mean that the extraction spaces has been lost by the distal migration of primary canines rather than the mesial movements of second primary molars.

In case of premature loss of primary second molars, most studies agreed that the loss of primary second molars will result in great space loss closure than any primary tooth, this makes the maxillary primary second molars the poorest choice in the mouth for premature extraction [17-22].

From the results obtained in table (3) and (4) together shows that the maxillary arch dimensions after the unilateral premature loss of second primary molars, there was also an increase

in A distance owing to the distal movement of primary canines in spite of they are adjacent to the first primary molars and this is because that the primary first molars also have moved distally and bucally due to an increase in B length from 19.32 to 20.59 , further more the(IC) distance was decreased although of non significant relation but still give us a fact that there was a loss or change in contact area between the primary canines and the first primary molars ,because each one of them have moved opposite to each other horizontally but at the same time they move distally together. These facts come in accordance with Northway et al. [5].

The main goal in this research is the relative position of the maxillary permanent first molars after the premature loss of each of the primary molars, in which we design to take 6 parameters, for this reason these parameter are illustrated in table (3) and they are (C) and (D) ;both are vertical dimensions that measure the relative position the maxillary permanent first molars antero-posteriorly (length) in the arch.

While the (MB), (ML), (DB) and (DL) all of them are horizontal dimensions that measure the relative position of the maxillary permanent first molars laterally or horizontally.

Again if we look carefully to table (1) & (2) we discover that there were no or very minimal decrease or increase in both vertical and horizontal distances that express the point to the relative position of the permanent first molars and such minimal changes actually has very little or no significant effect clinically ,since they were not exceeding the lee way space [6],this fact demonstrate that premature extraction of first primary molars are of less effect on the future position of the maxillary permanent first molars and this in accordance with many studies [5,8,16,18,19-22], and give us a fact that extraction of first primary molars when its compulsory done, needs a little concern as much as to construct a space maintainer at this age group 8-9 years. Generally, but for each clinical case one should think in a different manner, so Careful consideration of many factors is required when deciding whether space maintenance is indicated, radiographs and space analysis can be helpful.

Finally if we look at the results shown in table (3) & (4), the (A & B) vertical length are increased and significantly the A length where there is a premature loss of second primary molars which indicate that there was a distal movement of primary canines and first primary molars toward the extraction space at the same time there was a decrease in MB,DB, & DL length significantly and highly significant

difference when ML length decrease , indicating that the maxillary permanent first molars have moved mesially toward the space and at the same time moved lingually [19,22], which give us a fact that regaining the lost space does not need a simple single direction of tooth movement but a multiple types of tooth movements to reestablish the original position of the tooth. Thus the lingual movement in addition to mesial movement of the maxillary permanent first molars toward the extraction space is the new discovery of our research because our measurement were in a two dimensional figure.

As conclusions, premature loss of primary molars results in a change in arch length as follows:

1- Premature loss of first primary molar lead to increase in canine incisor distance i.e. vertical (A) length and at the same time a minimal change in intermolar distances.

2- Premature loss of second primary molar there will be also increase in (A) and (B) distances. And at the same time the first permanent molars drift mesially and tipped lingually as observed from the change in the size of extraction site and the horizontal inter molar disturbances.

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Table 1: Mean values of maxillary dental arch dimensions in millimeters for group (1)

	No.	Mean	± SD
IC	25	33.67	2.05
MB	25	51.33	3.18
ML	25	40.72	2.97
DB	25	53.44	3.02
DL	25	42.99	3.01
A	25	10.23	1.03
C	25	28.46	1.85
D	25	38.86	2.47

Table 2: Comparison of the mean values of maxillary arch dimensions for group (1) with the control group

	Al-Dulayme [10]	Means of group (1)	p-value
IC	33.98	33.67	0.57*
MB	50.79	51.33	0.50*
ML	40.67	40.72	0.95*
DB	52.69	53.44	0.33*
DL	42	42.99	0.30*
A	9.14	10.23	0.0009**
C	28.07	28.46	0.46*
D	38.11	38.86	0.26*

*Not significant ** significant *** highly significant

Table 3: Mean values of maxillary dental arch dimensions in millimeters for group (2)

	No.	Mean	±SD
IC	25	33.05	2.45
MB	25	48.41	2.87
ML	25	37.77	2.2
DB	25	49.49	7.36
DL	25	40.27	2.12
A	25	10.29	1.18
B	25	20.59	2.02
D	25	37.8	2.18

Table 4: Comparison of the mean values of maxillary arch dimensions for group (2) with the control group

	Al-Dulayme [10]	Means of group (2)	p-value
IC	33.98	33.05	0.14**
MB	50.79	48.41	0.0031**
ML	40.67	37.77	0.000***
DB	52.69	49.49	0.072*
DL	42	40.27	0.042**
A	9.14	10.29	0.0013**
B	19.32	20.59	0.063*
D	38.11	37.8	0.60*

* Not significant ** significant   *** highly significant

Fig. 1: Group (1) First primary molar loss

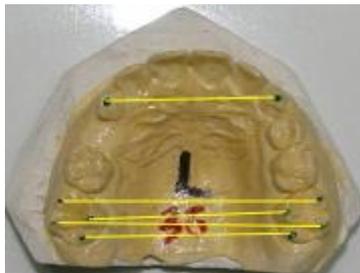**Fig. 2: Group (2) Second primary molar loss**

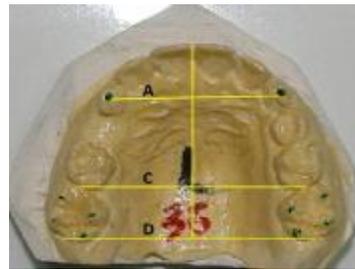**Fig. 3 A: Horizontal arch measurements for group (1)**

Fig. 3 B: Vertical arch measurements for group (1)

Fig. 4 A: Horizontal arch measurements for group (2)

Fig. 4 B: Vertical arch measurements for group (2)