

Time and order of eruption of primary teeth for children in Mosul City, Iraq

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ABSTRACT

The aims of the study were to determine the time and sequence of eruption of primary teeth. Also, to determine the differences in timing of tooth emergence according to side, jaw and gender variation.

Timing and sequence of eruption were studied cross-sectionally in a group of (1843) children from Mosul City, Iraq: (940) were males and (903) were females aged between (2-37) months. The data were statistically analysed by using Karber's analysis in order to compute the mean and standard deviation of emergence.

The results showed that there are no significant differences between the mean time of corresponding right and left teeth in both genders. The findings of the study indicated that the males have their primary teeth to emerge earlier than those of females. The differences between the two genders are clearly seen in the eruption of maxillary lateral incisor and maxillary first molar. The males acquired all their primary teeth to emerge in shorter time span than the females (difference 2.04 months).

The results demonstrated that the maxillary teeth emerge before their mandibular opposing teeth in males with the exception of central incisor. However, in females, the mandibular teeth emerge before their maxillary opposing teeth with the exception of the canine and second molar.

A specific sequence of primary teeth emergence was found in both arches and for both genders. In general, the emergence of primary teeth started with the emergence of mandibular central incisor and ended with mandibular second molar.

Key Words: Eruption, primary teeth, emergence, deciduous teeth.

الخلاصة

إن الهدف من هذه الدراسة هو تحديد موعد وتسلسل بزوغ الأسنان اللبنية وكذلك تحديد الاختلافات في وقت بزوغ الأسنان حسب الجهة والفك والجنس. تم دراسة موعد وتسلسل بزوغ الأسنان بصورة مستعرضة في مجموعة مكونة من (١٨٤٣) طفل من مدينة الموصل، العراق؛ (٩٤٠) من الذكور و(٩٠٣) من الإناث تتراوح أعمارهم بين (٢-٣٧) شهر. حُللت البيانات إحصائياً باستخدام تحليل (كاربر) لحساب المعدل والانحراف المعياري لبزوغ الأسنان.

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أظهرت نتائج الدراسة عدم وجود اختلاف معنوي بين موعد بزوغ الأسنان الموجودة في الجهة اليمنى مع مثيلاتها الموجودة في الجهة اليسرى، كذلك فقد أظهرت نتائج الدراسة أن بزوغ الأسنان اللبنية عند الذكور يسبق بزوغها عند الإناث وأن أكثر هذه الاختلافات تظهر في بزوغ القاطع الجانبي العلوي والطاقن الأول العلوي. كما أن الذكور يستغرقون وقتاً أقصر من الإناث لإكمال بزوغ الأسنان جميعها (الفرق ٢,٠٤ شهر). كما أظهرت النتائج أن بزوغ الأسنان في الفك العلوي يكون قبل مثيلاتها في الفك السفلي بالنسبة للذكور عدا القاطع الوسطي، أما عند الإناث فإن بزوغ الأسنان في الفك السفلي يكون قبل مثيلاتها في الفك العلوي عدا الناب والطاقن الثاني.

أما فيما يخص تسلسل بزوغ الأسنان اللبنية فقد تم توضيح التسلسل الخاص للأسنان في كل من الفكين ولكلا الجنسين. بصورة عامة فإن بزوغ الأسنان اللبنية يبدأ بظهور القاطع السفلي وينتهي بظهور الضرس الثاني السفلي.

INTRODUCTION

Eruption is a process whereby a tooth moves from its developmental position within the jaw to emerge into the oral cavity⁽¹⁾. Eruption must be distinguished from the growth of a tooth, which means an increase in size irrespective of the relative position of the tooth to its neighboring tissue⁽²⁾, while the tooth emergence is the clinical appearance of any part of the tooth crown in the oral cavity^(3,4).

The early development of the child's primary dentition occurs during the period when he is learning to walk and adjust himself to his environment and establish some degrees of independence.

Many opinions for the mechanism of tooth eruption have been presented as root growth, bone growth, pulpal pressure, pulpal growth, traction by periodontal ligament, vascular pressure and blood vessel thrust⁽⁵⁻¹¹⁾, but there is no general agreement regarding the exact mechanism of eruption.

The timing of eruption of teeth is of clinical significance to the practitioner and of considerable importance to the child dental health planning for diagnostic, preventive and therapeutic measures.

Many studies have been conducted throughout the world concerning dental development and timing of primary teeth emergence. All of which agreed that a wide margin of variation existed between population groups. Although many factors associated with eruption have been widely investigated. Suggested factors which causing differences might include race⁽¹²⁾, environment⁽¹³⁾, socioeconomic condition⁽¹⁴⁾, climate⁽¹⁵⁾, type of food, the effect of dental treatment, health⁽¹⁶⁾, heredity factors⁽¹⁷⁾, systemic factors⁽¹⁸⁾ and local factors^(19,20).

In our country, only one study carried out concerning the emergence of primary teeth conducted before (21) years in Baghdad City by Baghdady and Ghose⁽²¹⁾.

So it is decided to carry out a cross-sectional study in Mosul City to determine the time and sequence of eruption of primary teeth.

MATERIALS AND METHODS

The investigation was conducted on a cross-sectional study. The sample selected were from medical health centers and nursery schools children in the city center of Mosul. In order to obtain a random sample, Mosul City was divided into four zones; two zones on the right bank of Tigris river separated by Ninevah street and its continuation, the other two zones on the left bank of the river separated by Kairalden–Al–Omary street and its continuation. Four medical health centers and two nursery schools were chosen from each zone. So the total number of health centers examined were 16 and the total number of nursery schools were (8), representing different socioeconomic levels of the children in Mosul City center.

The sample size was (1843) children, age range from (2) months to (3.7) months. The age of the children was calculated from the exact date of birth and was recorded in months and weeks.

The oral examination was carried in a vaccination room in health center. The examination was performed using (2) sterilized plane mouth mirrors under the normal daylight. This was done, while the mother was cradling her infant with her arms. For nursery school children, examination was performed in classrooms. The students were examined seated in a normal chair under the normal daylight. The accurate birthday was taken from the health chart or from their mother or from school registrant. If the exact date of childbirth was not available, the child was not included in the examination, also any child with history of serious systemic disease was excluded.

The criteria for tooth emergence: A tooth was defined as emerged when any part of its crown pierced the gingiva. The probe was used to be sure from the crown emergence when any suspension exists^(22, 23). Since no radiological examination was made, any congenital missing tooth was recorded as non-emerged.

It was very important that the examiner reviewed each day's case sheet collected on the same day for completeness and accuracy of recording. During this review, the age of each child was calculated by subtracting the birth date from the examined date and then the age of the child determined according to the nearest month or week.

The interval of rest for teeth measured can be found as has been used by Hellman⁽²⁴⁾. It is the longest period between the eruption of two successive primary teeth.

The mean eruption time for all the primary teeth was calculated according to Karber's method as investigated by Cornfield and Mantels⁽²⁵⁾ and used by Hayes and Mantels⁽²⁶⁾ to compute the eruption date. The t-test was used for a statistical significance.

RESULTS

The sample consists of (1843) children between the age of (2–37) months, (940) of the sample were males (51%) and (903) were females (49%) (table 1).

Table (2) showed the mean, standard deviation and standard error of time of eruption of primary teeth for the total sample by sex and for both jaws. The results indicate that the first tooth to erupt for both genders was mandibular central incisor [0.83 years (10.08 months) for males and 0.87 years (10.44 months) for females], then followed by subsequent teeth; the last tooth to erupt is the mandibular second molar, the mean age of eruption [2.28 years (27.36 months) for males and 2.49 years (29.88 months) for females] (Figure 1 a, b).

Table (1): Distribution of the sample by gender and age for primary teeth

Age (Years)	Males		Females		Total	
	No.	%	No.	%		
0.25	No.	107	50.00	107	50.00	214
	%	11.38		11.85		11.61
0.5	No.	122	53.04	108	46.96	230
	%	12.98		11.96		12.48
0.75	No.	117	50.64	114	49.35	231
	%	12.44		12.63		12.53
1.0	No.	80	51.95	74	48.05	154
	%	8.51		8.20		8.36
1.25	No.	87	54.38	73	45.62	160
	%	9.26		8.08		8.68
1.5	No.	82	60.74	53	39.26	135
	%	8.72		5.87		7.32
1.75	No.	48	53.33	42	46.67	90
	%	5.11		4.65		4.88
2.0	No.	46	46.00	54	54.00	100
	%	4.89		5.98		5.43
2.25	No.	50	47.62	55	52.38	105
	%	5.32		6.09		5.70
2.5	No.	50	46.73	57	53.27	107
	%	5.32		6.31		5.81
2.75	No.	73	47.10	82	52.70	155
	%	7.77		9.08		8.41
3.0	No.	78	48.15	84	51.85	162
	%	8.30		9.30		8.79
Total		940	51.00	903	49.00	1843

Table (2): Mean time of eruption (μ) in years and months with standard deviation (SD) and standard error (SE) of primary teeth of children in Mosul City center

Tooth Number	Males			Females			Both Genders		
	μ	SD	SE	M	SD	SE	μ	SD	SE
Maxilla									
A	1.03	0.20	0.013	1.07	0.20	0.019	1.05	0.20	0.009
B	1.20	0.26	0.015	1.43	0.22	0.021	1.19	0.24	0.011
C	1.76	0.28	0.018	1.70	0.26	0.025	1.73	0.28	0.013
D	1.44	0.23	0.014	1.67	0.23	0.023	1.43	0.23	0.011
E	2.27	0.26	0.019	2.27	0.26	0.027	2.26	0.25	0.013
Mandible									
A	0.83	0.20	0.012	0.87	0.20	0.017	0.85	0.20	0.009
B	1.34	0.27	0.015	1.34	0.27	0.024	1.44	0.27	0.011
C	1.82	0.30	0.019	1.74	0.26	0.025	1.79	0.28	0.013
D	1.53	0.24	0.015	1.51	0.24	0.024	1.53	0.24	0.011
E	2.28	0.25	0.019	2.49	0.24	0.025	2.26	0.24	0.013

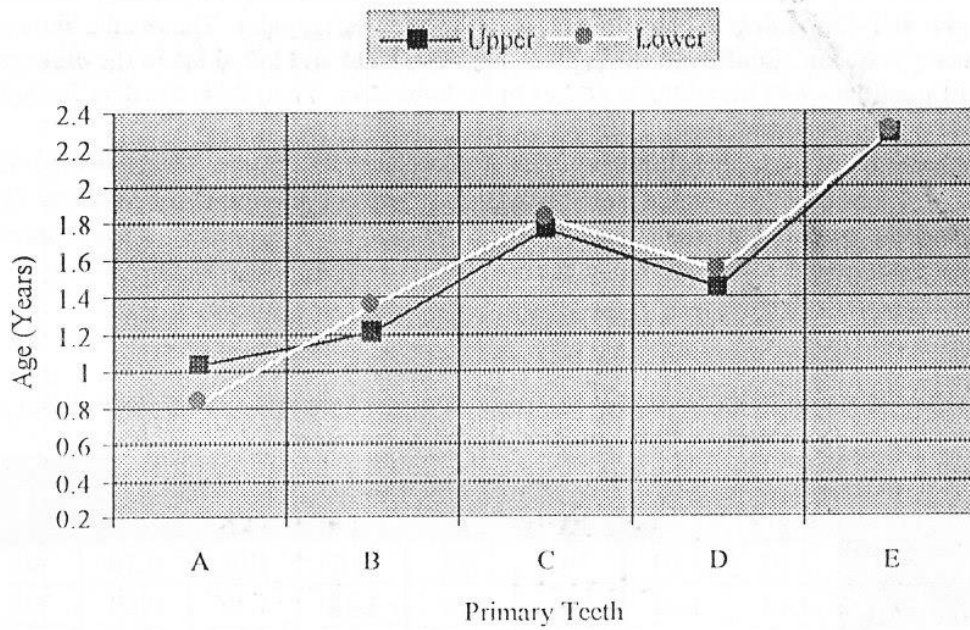


Figure (1a): Graph showing pattern of eruption by age and arch of the primary teeth in the total sample of males

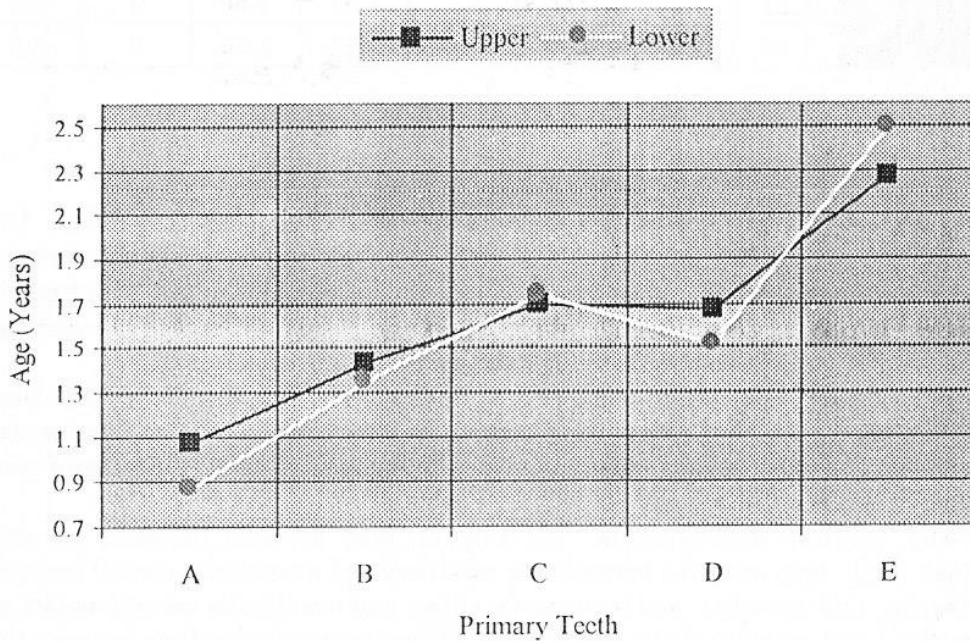


Figure (1b): Graph showing pattern of eruption by age and arch of the primary teeth in the total sample of females

Table (3) showed the mean and standard deviation for each primary tooth on the right and left sides of maxilla and mandible in each gender. The results showed that there was no significant difference between right and left sides in the emerged time of maxillary and mandibular arches in both genders. Therefore, the data for both sides were combined together.

The period during which eruption took place for primary teeth was (1.45) years (17.4 months) for males and (1.62) years (19.44 months) for females. The difference between males and females was (2.04) months. The pattern of the eruption curve for both genders was nearly the same.

Table (3): Different in mean emergence time between right and left sides of primary teeth in both genders (in years and months)

Tooth Number	Males				Females				
	Right	Left	t-test	p	Right	Left	t-test	p	
Maxilla	A	1.03	1.03	0	NS	1.07	1.06	0.70	NS
	B	1.21	1.21	0	NS	1.18	1.17	0.60	NS
	C	1.76	1.76	0	NS	1.70	1.70	0	NS
	D	1.45	1.44	0.66	NS	1.41	1.43	1.21	NS
	E	2.27	2.27	0	NS	2.27	2.27	0	NS
Mandible	A	0.83	0.83	0	NS	1.06	1.07	0.69	NS
	B	1.35	1.35	0	NS	1.38	1.39	0.39	NS
	C	1.82	1.82	0	NS	1.74	1.74	0	NS
	D	1.51	1.52	0.60	NS	1.51	1.50	0	NS
	E	2.29	2.28	0.60	NS	2.24	2.24	0	NS

Table (4) showed the jaw differences for primary teeth emergence time. The results indicated that the most maxillary teeth, lateral incisor, canine and first molar emerged significantly earlier than opposing mandibular teeth for males. This trend is reversed with central incisor, while there is no significant difference between the emerged time of maxillary and mandibular second molar.

In females, maxillary second molar emerged significantly earlier than mandibular antagonist, but mandibular central and lateral incisors and first molar emerged significantly earlier than maxillary antagonist. There is no significant difference between maxillary and mandibular canines.

The greatest difference in the eruption time between the jaws for any individual tooth type occurred between the maxillary and mandibular central incisors of the males (2.3 months) and between maxillary and mandibular second molars of the females (2.64 months), while the smallest difference in eruption time between the teeth of opposing jaws occurred with the eruption of the maxillary and mandibular second molars for the males (0.18 months) and the maxillary and mandibular canines for the females (0.48 months) (Table 5).

Table (4): Differences in mean eruption time of primary teeth between maxillary and mandibular teeth in both genders (in years and months)

Tooth Number	Upper	Lower	t-test	P
	Mean ± SD	Mean ± SD		
Males				
A	1.03 ± 0.63	0.83 ± 0.21	6.70	S
B	1.20 ± 0.26	1.34 ± 0.27	9.74	S
C	1.76 ± 0.29	1.82 ± 0.29	4.05	S
D	1.44 ± 0.23	1.53 ± 2.44	6.96	S
E	2.27 ± 0.26	2.28 ± 2.55	1.25	NS
Females				
A	1.07 ± 0.20	0.87 ± 0.20	15.29	S
B	1.43 ± 0.22	1.34 ± 0.27	6.05	S
C	1.70 ± 0.26	1.74 ± 0.26	2.04	NS
D	1.67 ± 0.23	1.51 ± 0.24	11.73	S
E	2.27 ± 0.26	2.49 ± 0.24	37.70	S

Table (5): Difference in mean age of eruption of primary teeth between maxilla and mandible in males and females (in years and months)

Teeth	A	B	C	D	E
Males					
Maxilla	1.03	1.20	1.76	1.44	2.27
Mandible	0.83	1.34	1.82	1.53	2.28
Difference	0.19	0.14	0.06	0.08	0.01
Females					
Maxilla	1.07	1.43	1.70	1.67	2.27
Mandible	0.87	1.34	1.74	1.51	2.49
Difference	0.20	0.09	0.04	0.16	0.22

Table (6) represents the differences in mean emergence time of the primary teeth between females and males. The results indicated that maxillary lateral incisor, first molar, and mandibular central incisor and second molar emerged significantly earlier in males than females. The reverse is true with maxillary and mandibular canines, which emerged significantly earlier in females than in males; while there is no significant difference in the emerged time of the maxillary central incisor, second molar, and mandibular lateral incisor and first molar between males and females.

The greatest gender differences occurred in the eruption of maxillary lateral incisor and maxillary first molar, which were (0.22) years (2.76 months) for both teeth. While the smallest gender differences occurred in the eruption of maxillary second molar which was (0.003) years (0.036 months) (Table 7).

The interval of rest for primary teeth found to be in males between the eruption of the mandibular canine and maxillary second molar and it was (5.4 months), and in females the interval of rest occurred between the mandibular canine and the maxillary second molar (6.36 months).

Table (6): Differences in mean eruption time of primary teeth between males and females (in years and months)

Tooth Number	Males	Females	t-test	P
	Mean ± SD	Mean ± SD		
Upper				
A	1.03 ± 0.63	1.07 ± 0.20	1.36	NS
B	1.20 ± 0.26	1.43 ± 0.22	16.02	S
C	1.76 ± 0.29	1.70 ± 0.26	4.41	S
D	1.44 ± 0.23	1.67 ± 0.23	17.37	S
E	2.27 ± 0.26	2.27 ± 0.26	0.24	NS
Lower				
A	0.83 ± 0.21	0.87 ± 0.20	2.4	S
B	1.34 ± 0.27	1.34 ± 0.27	0.51	NS
C	1.82 ± 0.29	1.74 ± 0.26	5.78	S
D	1.53 ± 0.24	1.51 ± 0.24	1.72	NS
E	2.28 ± 0.25	2.49 ± 0.24	17.0	S

Table (7): Difference in mean age of eruption of primary teeth between males and females (in years and months)

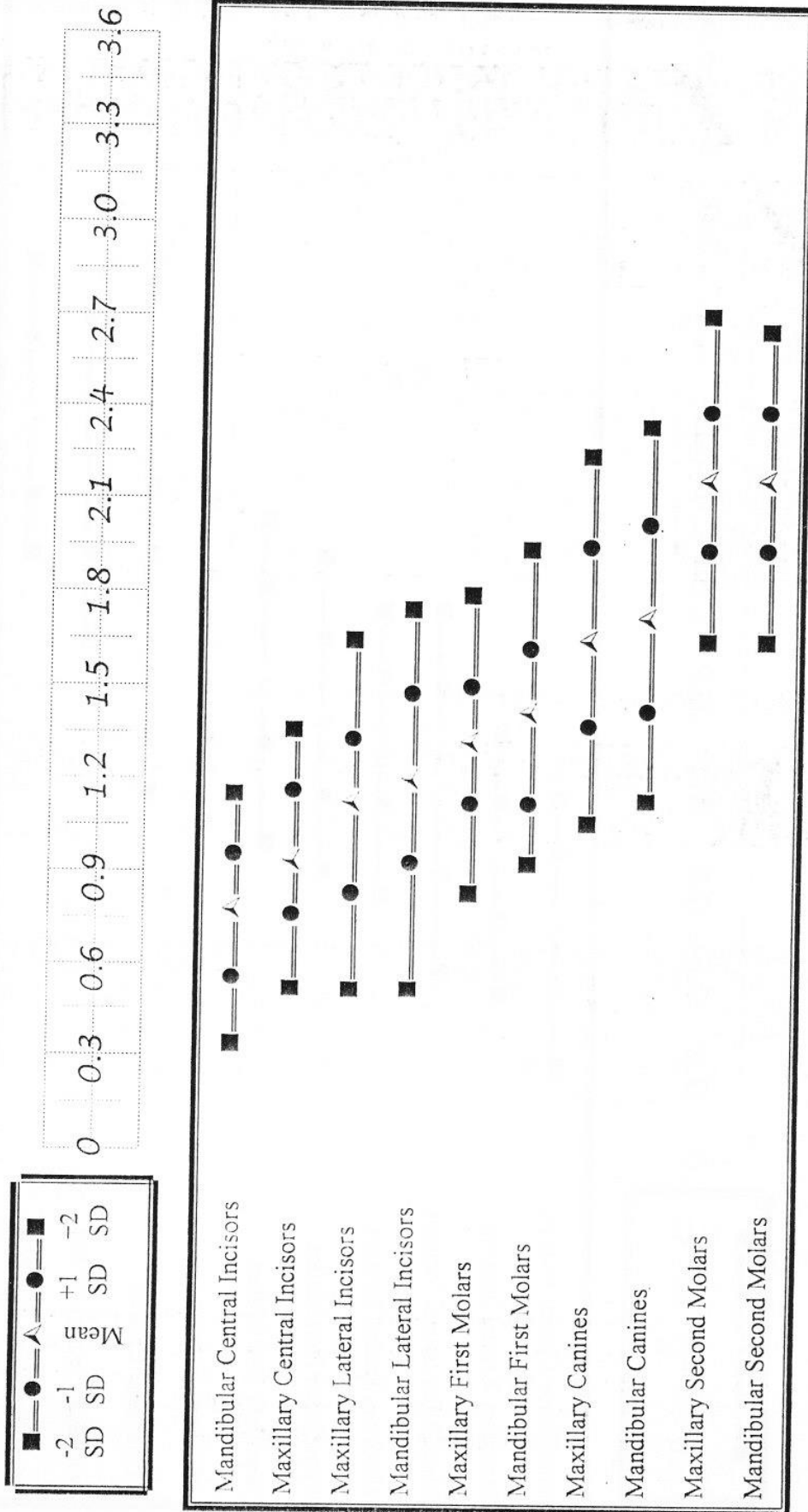
Teeth	A	B	C	D	E
Maxilla	0.039	0.225	0.063	0.225	0.003
Mandible	0.032	0.008	0.083	0.023	0.202

Figure (2 a, b) showed the sequence of eruption, using the mean plus and minus one and two standard deviation. The order of eruption in each jaw was similar in both genders as follows: Central incisor, lateral incisor, first molar, canine and second molar. In males all maxillary teeth emerged earlier than mandibular teeth except central incisor. In females only maxillary canine and second molar emerged earlier than mandibular one.

DISCUSSION

Among different methods available to study the dichotomous variables, the Karber's analysis was used in the current study. It is a simple method of computing the mean age and standard deviation of tooth emergence by using both arithmetic age and logarithm of the age from birth. Many studies over the world adopted Karber's method for computing the emergence age of primary dentition successfully^(21, 27), and for permanent teeth^(28, 29).

Figure (2a): Sequence and range of eruption time in males (mean $\pm 2 \times SD$) for primary teeth



This study is the first investigation of time of eruption of the primary teeth in Mosul children and it is a largest study for eruption of primary teeth for Iraqi children.

The study of timing of primary teeth is of clinical significance to the practitioner and of considerable importance in child dental health planning for diagnostic, preventive and therapeutic measures. However, a reliable chronology of primary tooth eruption within normal limits is essential to help clinicians recognize and interpret delayed or advanced dentition^(30, 31). It is, also, very important to nutritionists who may use the number of erupted teeth to assess the age of an infant when the date of birth is unknown^(32, 33).

In the present study, the age range of the examined children was chosen in a wide scale ranging from (2) months to (37) months in order to cover the clinical emergence age of both maxillary and mandibular primary teeth. A cross-sectional study was preferred because it takes less time, cost and it is more representative of the population.

The study revealed that there is no significant difference between right and left sides for both jaws and genders. This was in agreement with other study⁽³⁴⁾.

The timing of primary teeth emergence in this study was nearly the same in comparison with a Britain study⁽³⁵⁾, while later than those reported for Australian children⁽³⁴⁾ and that for Britain-Negro children⁽³⁵⁾.

In the present study, the period during which eruption took place was greater than that for Zegreb children⁽³⁶⁾.

In general, some differences may be due to local environmental factors such as the texture of food, the health of the community⁽¹⁶⁾, others may be related to genetic differences⁽¹⁷⁾. It is accepted that ethnic factors affected the early emerging primary teeth more than the late primary teeth^(37, 38).

According to jaw differences, the results indicated that, in males, most maxillary teeth, lateral incisor, canine and first molar emerged significantly earlier than opposing mandibular teeth. This trend is reversed with central incisor, while there were no significant differences between emerged time of maxillary and mandibular second molar. In females, mandibular central, lateral incisors and first molar emerged significantly earlier than maxillary antagonists, but maxillary second molar emerged earlier than mandibular antagonists; no significant difference between maxillary and mandibular canine. In general, the maxillary teeth emerged earlier than mandibular antagonists except central incisor for both genders and lateral incisor in females only. This result disagreed with the study of Lavelle⁽³⁰⁾, while other studies agreed with this study in a fact that mandibular central incisor emerged earlier than maxillary antagonist^(31, 36, 39).

The greatest jaw difference occur between the central incisors of the males (2.3 months) and second molars for the females (2.64 months). This result was greater than that for Australian children⁽³⁴⁾. They found that the greatest jaws differences in males occur in central incisors (1.8 months) and in females also occur in central incisors (1.9 months). The smallest jaw differences occur between second molars for males (0.18 months) and canines for the females (0.48 months). These findings were nearly the same for Australian children⁽³⁴⁾, which indicated that the smallest jaw was also occur between second molars in males (0.2 months), and in females between canines (0.1 months).

According to gender differences, the study revealed that the mean time of eruption earlier in males than in females, except for the maxillary and mandibular canines and mandibular second molars. This finding is in agreement with other studies^(31, 39-41); but disagreed with the other studies^(27, 35, 42, 43).

The greatest gender differences were occurring between the maxillary lateral incisor and maxillary first molar (2.76 months). The smallest gender differences occurred in the eruption of maxillary second molar, which was (0.036 months). This result differs from that of the Australian study⁽³⁴⁾, which found that the greatest gender differences occur between the mandibular second molar (18.0 months); the smallest gender differences between the maxillary central incisor (1.2 months).

The interval of rest for primary teeth in this study for both genders occurred between the emergence of the mandibular canine and maxillary second molar (5.4 months for males and 6.36 months for females). This result is in accordance with that of Britain study in Gloucester⁽³⁵⁾ that found the period with the same tooth type (5.88 months for males and 5.64 months for females), but disagreed with the result of Australian children⁽³⁴⁾ which demonstrated that the interval of rest occurred between the mandibular canine and mandibular second molar (7.2 months for males and 11.16 months for females).

The sequence of eruption was the same in both sexes as central incisor, lateral incisor, first molar, canine, second molar. This result is in agreement with other studies^(34, 36, 39-41).

The findings of this study is in accordance with previous Iraqi study⁽²¹⁾, except that in males the mandibular second molars emerged earlier than maxillary and in females most maxillary teeth erupt earlier except for the central incisor and second molar. Also the time of teeth emergence in this study found to be later than those found by previous Iraqi study⁽²¹⁾. The total period during which the emergence of all primary teeth took place increase (0.6 months) for males and (0.84 months) for females than previous study⁽²¹⁾.

There are differences in eruption of primary teeth in (21) years due to difference in life style nowadays due to general circumstances of our country and poverty, nutrition due to embargo, which play a very important role in child development. However, the emergence time for first teeth which is mandibular central incisor was more than previous study⁽²¹⁾ about (0.84) months in males and (0.17) months in females, and the emergence of last tooth mandibular second molar more about (0.36) months in males and (4.8) months in females than previous study⁽²¹⁾.

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