



Occlusal Characteristics of The Primary Dentition in Salah Al-Din City

Jamal K. M. ^{(1)*}

Khalid J. Falah ⁽²⁾

Faisal S. Mayuof ⁽³⁾

⁽¹⁾ Department of Orthodontic dentistry, College of Dentistry, University of Tikrit, Iraq.

Article Info:

-Article History:

-Received: 12/8/2022

-Accepted: 29/8/2022

-Available Online:

Jun, 2023

Keywords:

Occlusal characteristics,
primary dentition.

©2023 COLLEGE OF DENTISTRY
TIKRIT UNIVERSITY. THIS IS AN OPEN
ACCESS ARTICLE UNDER THE
CC BY LICENSE

<https://creativecommons.org/licenses/by/4.0/>



*Corresponding Author:

Email:

jamalkhidher@yahoo.com

Assist. Prof. Department of
Orthodontic dentistry,
College of Dentistry,
University of Tikrit, Iraq.

Abstract

Occlusal characteristics that are found in the primary dentition have a substantial role in the occlusal characteristics which will appear in permanent dentition. Consequently, a good background of Occlusal characteristics in children is substantial for dental practitioners. Use an observational, cross-sectional study on selected children randomly in Salah Al-Din to define the occlusal characteristics of primary dentition in the group of Salah Al-Din's children. Objective: Collecting more data and information about the occlusal characteristics of primary dentition in a group of Salah Al-Din's children. Methods: In randomly form selected 413 children between 3 and 6 years old from Salah Al-Din governorate as the sample. Under natural daylight or room light, the examination was done on all children to observe needed characteristics with the inclusion criteria. Prevalence of different types of terminal plane, primary canine relationship, anterior and posterior crossbite overjet, overbite, and primate spaces of the primary dentition were estimated. In the terminal plane we see that the flush terminal plane is the most prevalent type (63.20%). In a primary canine relationship, Class I was the most common type (80.39%). The ideal form of overjet was most common (88.86%). The most common form of overbite was the normal overbite (82.32%). Anterior and posterior have low prevalent (3.63%,1.94% respectively). Observed that primate space was present in 71.19% of the upper arch, and 60.05% is the ratio of mandible space. Conclusion: Most of the sample has desirable occlusal characteristics such as Flush terminal plane, Class 1 canine relationship, normal overjet etc., and undesirable occlusal characteristics have low prevalence as anterior open bite, reverse overjet..etc.

Introduction:

The period that begins from the eruption of the first primary tooth (mostly primary mandibular central incisors at the 6th month of age) and finishes with the eruption of the first permanent tooth (mostly mandibular permanent first molars at the 6th year of age) called the primary dentition, primary dentition (usually) is completed in 2 to 3 years of age (1), (2). Great worry to a pediatric dentist created by morphological differences of primary dentition and that related to morphological differences may be associated with clinical problems such as delayed shedding, dental caries, anomalies in the permanent dentition, impaction of successors, permanent double teeth, and supernumerary teeth (3). Primary teeth have importance in the life of children as they help in mastication, in speech, contribute to aesthetics, and preserve the integrity of the dental arches (2). The primary dentition is a mirror in which the propensities are reflected permanent dentition and it directs the eruption of permanent teeth into their right place (2), (5), (6). The relationship between maxillary teeth and mandibular teeth of jaws in dentistry is called occlusion. Occlusal relationship character different from one population to another depending on many factors including hereditary, environment, and ethnicity (1). There are corresponding between the primary and permanent dentitions in the occlusal relationships, but some terms are a little different. The major predictor of the permanent molar relationship is the terminal plane relationship (relationship between the distal surfaces of the maxillary and mandibular primary second molars which is divided into three types: flush terminal plane, distal step, and mesial step relation). The most common relationship of the Permanent molar teeth is the Angel class I molar relationship resulting from the flush terminal plane (which is the most common in primary dentition) followed by the Angel class II molar relationship resulting from the distal step relation and at least Angel class III resulted from mesial step relation (1), (2).

Based on key features of occlusion in the child's dentoalveolar system during the developmental years, the characteristics of permanent dentition occlusion can be predicted well (6). The deviation from the normal alignment of the teeth is called malocclusion. After tooth decay and periodontal disease, malocclusion is most common in oral pathologies. Malocclusion is not classified as a disease but as a morphological difference that may or may not lead to the pathological state (3). We have two causes to develop malocclusion local factors such as unfavorable oral habits, the developmental position of teeth, and tooth anomalies, or general factors such as hereditary, growth disorders, and environmental (3). The normal characteristics of occlusion in the primary dentition CI I primary canine relationship, flush terminal plane molar relations, normal overjet, and overbite and spacing. Each one of them has its specific effect on the occlusal relationship of the permanent dentition (1), (5). One of the common and very substantial characteristics of pediatric dentistry is primary dentition spacing. It is a signal of adequate development of permanent occlusion (5). Correct arrangement of the permanent dentition and absence of crowding showed when spacing is found (1). Spaces in primary dentition are divided into two types: the first type which is seen between the teeth, mostly the incisors called physiological spaces, the second type which is found distally to the canine in the lower arch and mesially to the canines of the upper arch called primate spaces (2). There is little information obtainable to occlusal characteristics in children in Iraq. The objective of this study was to have more information about the terminal plane, canine relation, overjet, overbite, crossbite, and primate space, in children of Salah Al-Din.

Materials and Methods:

Our cross-sectional study was conducted at Tikrit University, dentistry college on 413 children (206 females and 207 males) with an age range between 3 – 6 years old.

Parents are given one day to return their response on whether they will allow their children to join in studying or not. Only children whose parents give their agreement, involved in the study. 10-35 children were examined daily.

Inclusion Criteria:

Children aged from 3 years to 6 years of age. Primary teeth erupted completely. Present or absent space between teeth.

Exclusion Criteria:

The child with Present medical history. The eruption of any permanent tooth. Severe caries on the occlusal surface Cavities on a proximal surface of multi-teeth. Missing teeth due for any reason. Developmental anomaly teeth.

Two examiners using natural daylight or room light, a mouth mirror, and an overbite ruler did the examination and the datum insert in a special case sheet Figure (1). Bite in a centric occlusion asked from the child. In the younger age group, the examiner guides the jaw into the centric occlusion and takes into account the international standards of infection control protocol. The characteristics included in studies are the terminal plane, canine relation, overjet, overbite, crossbite, and primate space.

1. The terminal plane relationship between maxillary and mandibular second primary molars were evaluated and recorded as:

Flush Terminal Plane: The distal aspect of maxillary primary second molars and mandibular primary second molars are included in one vertical plane.

Distal Step Molar Relation: The distal aspect of the maxillary primary second molar anteriorly to the distal aspect of the mandibular primary second molar.

Mesial step molar relation: The distal surface of the maxillary primary second molar posteriorly to the distal aspect of the mandibular primary second molar.

2. The primary canine relationship was evaluated and recorded as:

Class I: Distal aspect of the mandibular primary canine and the tip of the maxillary primary canine tooth in one vertical plane.

Class II: The distal aspect of the mandibular primary canine to the tip of the maxillary primary canine distally.

Class III: The distal surface of the mandibular primary canine to the tip of the maxillary primary canine mesially.

3. Overjet: distance between the maxillary and mandibular incisal edges of the primary incisors in the occlusal plane using a millimeter gauge and record:

Ideal: If the distance is equal to or less than 2 mm.

Increased: If the distance is more than 2 mm.

Reversed: If there is an anterior cross-bite was also assessed. (3)

4. The overbite was measured according to the amount of the mandibular incisor covered by the completely erupted maxillary incisor.

Normal overbite: maxillary incisors cover half of the mandibular incisor.

Increased overbite: maxillary incisors cover more than half the mandibular incisors.

Edge-to-edge relation.

Anterior open bite- gap existed between the maxillary and mandibular incisal edges of incisors along the vertical plane.

5. Anterior cross-bite: tooth or more of maxillary anterior teeth position lingually to the mandibular incisors.

6. Posterior cross-bite: tooth or more maxillary molars position lingually to the buccal cusps of the opposing mandibular teeth.

7. Primate spaces (in maxilla and mandible) are present or absent. (7)

Statistics:

The Chi-square test is an analytical test used to compare the variable value assessed within the population. For all analyses, a p-value of > 0.05 was not significant, a p-value of ≤ 0.05 was significant and a p-value of ≤ 0.001 represented a highly significant relation.

Results:

The study Data collected from Salah Al-Din offered a sample of 413 children aged 3-6 years. The study population had 207 (50.1%) males and 206 (49.9 %) females Figure (2). Of them ages 86 (20.82%) were 3 years old, 143 (34.62%) were 4 years old, 106 (25.67%) were 5 years old and 78 (18.89%) were 6 years old Table (1). Tables (2), and (3) showed that the flush terminal plane molar relationship (63.20%) (65.70% in male, 60.68% in female) was the most prevalent molar relation, then Distal Step Molar Relation (31.23%) (30.43% in male, 32.04% in female) and Mesial step molar relation (5.57%)(3.86% in male, 7.28% in female) was least prevalent molar relation.

Genders were collected from all age groups and there were no significant differences between them concerning occlusion ($P=0.02643$). Table (4) showed that the Flush terminal plane molar relationship is most common at age 5 years (68.87%) and least in age 6 years (60.26%), Distal Step Molar Relation most in 3 years (38.37%) and least in 5 years (21.7%), and Mesial step molar relation mostly in 6 years (10.26%) and least in 3 years (0%). In age groups, there were significant differences ($P=0.0069$). Tables (2), and (3) showed that the frequencies of Class I to III canine relationships were 80.39% (80.68% In male, 80.10% in female), 4.36% (4.83% in male, 3.88% in female, and 15.25% (14.49% in male, 16.02% in female) respectively. Genders were collected from all age groups and there were no significant differences between them concerning occlusion ($P=0.8291$). Table (4) showed that CI I is most common in 4 years (93.01%) and least in 3 years (61.63 %), CI II is most common in 3 years (9.3%) and least in 5 years (1.1.89%), CI III most common in 6 years (29.49%) and least in 4 years (4.9%). Highly statistically significant differences were seen ($p<0.0001$). Tables (2), and (3) showed that an ideal overjet was observed among 88.86% (88.89% in males, 88.83% in females) children followed by an increased overjet of 8.72% (7.25% in males, 9.71% in females), while

the least frequent type was reverse overjet 2.42% (3.86% in male, 1.46% in female). Genders were collected from all age groups and there were no significant differences between them concerning occlusion ($P=0.2245$). Table (4) showed that ideal overjet very frequently occurring in 3 years (94.19%) and less frequently in 6 years (70.51%), increase mostly in 6 years (29.49%) and least in 4 years (2.1%), reversed most common in 4 years (5.59%) and least in 3 & 6 years (0 %). Highly statistically significant differences were seen ($p<0.0001$).

Tables (2), and (3) showed that the evaluation of overbite showed that 82.32% (79.23% in male, 84.95% in female) of children had an ideal overbite, 10.41% (11.11% in male, 9.71% in female) had increased bite while 4.12% (4.83% in male, 3.88% in female) had an anterior open bite, and 3.15% (4.83% in male, 1.46% in female) had an edge to edge. Genders were collected from all age groups and there were no significant differences between them concerning occlusion ($P=0.2074$).

Table (4) showed that normal overbite is most common in 5 years (87.74%) and least in 6 years (64.10%), the increase is most common in 6 years (29.49%) and least in 4 years (3.5%), edge to edge mostly in 4 years (4.9%) and least in 6 years (0%), anterior open bite most common in 6 years (6.41%) and least in 5 years (1.89%). Highly statistically significant differences were seen ($p<0.0001$). Tables (2), and (3) showed that prevalence rates of anterior and posterior crossbite were 3.63% (4.83% in male, 2.43% in female) and 1.94% (2.42% in male, 1.46% in female), respectively. Table (4) showed that anterior and posterior crossbite was less prevalent in all ages, anterior crossbite mostly in 4 years (5.26%) and least in 3 years (0%), posterior crossbite common mostly in 5 years (4.72%), and least in 3 and 6 years (0%). Tables (2), and (3) showed that prevalence rates of maxillary and mandibular space 71.19% (73.43% in male, 68.93% in female) and 60.05% (63.3% in male, 56.79% in female)

respectively. Genders were collected from all age groups and there were no significant differences between them concerning occlusion ($P=0.5464$). Table (4) showed that maxillary & mandibular space has a high prevalence, maxillary space mostly in 4 years (75.52%) and least in 5 years (67.92%), mandibular space mostly in 6 years (67.95%) and least in 3 years (55.81%). there were no significant differences ($P=0.5701$).

Discussion:

Many epidemiological studies have been done to collect information about the characteristics of the primary dentition observed in various populations. Rare statistical data on the Salah Al-Din population gave rise to us to undertake this study. The present study was a cross-sectional study on 413 children aged 3-6 years planned to determine the types of terminal plane relationship, canine relationship, overjet, overbite, posterior and anterior crossbite, and Primate spaces in maxillary and mandible of the primary dentition to provide a baseline data concerning these characteristics among Salah Al-Din. Understanding the different changes that take place during the shift from primary dentition to a permanent one is essential to any clinician concerned with the early interceptive treatment (8). The importance of primary dentition for the development of permanent dentition and the found space or not in the primary dentition has long been a subject of discussion. Many studies of the primary dentition in preschool children in several ethnic groups (9). Problems in the permanent dentition are likely to have been present in the preceding primary dentition to them (10). Healthy and well-arranged permanent dentition can be predicted if the primary dentition has spaced (11). The primary dentition occlusion is established completely at 3 years of age and extends until about 6 years of age when the first permanent tooth begins to erupt (mostly mandibular permanent first molars) (12). The flush terminal plane is the most common

occlusal relationship in children in the primary dentition (13). In the current study, 63.19% of the children were reported with the flush terminal plane molar relationship which is relatively similar to the results reported in Anu V. et al 2020(14) and Sharma K. et al 2021 (15), but the result showed opposite to Kumar D. et al 2019(16) which be flush terminal plane second common (36%) after mesial plane (56%). The percentage was more common in 5 years of age (68.87%) and the other values are approximately equal for the rest of the ages 61.63%, 61.54% and 60.26% to 3, 4 and 6 respectively and this result opposite to which seen in Abuaffan A. et al 2014 (2) which be lower in 5 years of age. And this characteristic is seen in males mostly and this is opposite to which found in Davidopoulou S. et al 2022(13) but similar to which seen in Sharma et al 2021.(15) In the present study (31.29%) of the Salah Al-Din children were recorded with distal step, which was the second prevalent type of terminal plane, and slightly more in females and this is in harmony with those found in Sharma K. et al 2021 (15) but opposite to which seen Kumar D. et al 2019(16) which be most common. In our study, the mesial step was the least prevalent type of terminal plane and reported at 5.52% of the population similar roughly to which seen in Gunmeen S. et al 2014 (3) and Badr S. et al in Lebanon 2020(4). In the primary canine relationship, the prevalence of class 1 was as high as 80.39% in this study. Moreover, the prevalence of class 2 (4.36%) and class 3(15.25%) similar results had been obtained by other authors among different populations (3) but disagree with the result which saw by Hegde S. et al 2012(6) class 3 is less prevalent than class 2. In distribution it on gender we see similar with Gunmeen S. et al 2012 (3) by male has most prevalent in classes 1 and 3 but different in class 2 which is more in a male in our study but less than a female with Gunmeen S. et al 2012 (3). Different from what we saw in Yehia L. et al (17) in our study see a different distribution of primary canine relationships, in 3 years classes 1, 2 and 3 have 61.63%, 9.3%, and

29.07% respectively in 4 years classes 1,2 and 3 have 93.01%, 2.1%, and 4.9% respectively in 5 years class 1,2 and 3 have 90.57%, 1.89%, and 7.55% respectively in 6 years class 1,2 and 3 have 64.10%, 6.41%, and 29.49% respectively and that with the Highly significant result ($p < 0.0001$). Out of the 413 children surveyed, 88.86% had ideal overjet, 8.72% more than 2 mm, while 2.42% showed reversed overjet, harmonious with Vegesna M. et al 2014(5) and Gunmeen S. et al (2018) (3). In the age result, we have a highly significant result ($p < 0.0001$), in 3 years ideal, increase and reverse overjet has 94.19%, 5.81%, and 0% respectively, in 4 years ideal, increase and reverse overjet has 92.31%, 2.1%, and 5.59% respectively in 5 years ideal, increase and reverse overjet has 93.4%, 4.72%, and 1.89% respectively in 6 years ideal, increase and reverse overjet has 70.51%, 29.49%, and 0% respectively. 2.32% of the children had normal overbite agreed with what was seen by Vegesna M. et al 2014 (5) and 10.41% with an increasing overlap roughly with what was seen in Hegde S. et al 2012(6) and Rai A. et al 2020(18), 3.15% showed edge to edge relation like which seen in Yehia L. et al (17) and in Hegde S. et al 2012(6), and 4.12% had anterior open bite harmony to Badr A. et al in Lebanon 2020(4) and Yehia L. et al (17). In the distribution of this value, we see a highly significant result of $p < 0.0001$. But there is no significant evidence of distribution in gender groups like what we see in Gunmeen S. et al (2018) (3) and Rai A. et al 2020(18). In our study, the anterior crossbite relationship was observed only in 3.63% of children, and that is near to English (19), Saudi Arabian (12), and Italian (20) populations. In the distribution of this value, we saw similarities between our study in Salah Al-Din and Italia (20) that anterior crossbite is found mostly at 4 years of age. Posterior crossbite was less observed in our study population compared with an anterior crossbite which involved 1.94% of the population, this rate is near to what is seen in Indian (3), Lebanese (4), and Italian (20) populations. Unlike what is seen in anterior crossbite

there is a different distribution of this characteristic in age groups between our study in salah al-din and Ferro et al (20) in Italia, 5 years of old has the most prevalence of posterior crossbite While in Ferro R. et al (20) mostly in 4 years old. When we discuss the primate space, we observe that maxillary space (68.93%) most prevalent than mandibular space (56.79%) and that what is seen in other studies (21)– (23) with most prevalent (both) in males more than female, like what observe in Sun K. et al 2018 (21) and Lochib S. et al. 2015 (22). Agree with Lochib S. et al. 2015 (22) and Sun K. et al 2018 (21) our study noted that maxillary is most prevalent in 4 years of age, in mandibular space like what noted by Sun K. et al 2018 (21) that is mostly in 6 years of age and that disagree which was noted by Sun K. et al 2018 (21) in 4 years of age like maxillary space in the same study. This study provided more information on the state of dentition, occlusal pattern, and spacing in the primary dentition of Salah Al-Din's children, which we have little of them. Although the results reference a low prevalence of malocclusion in the primary dentition of this population.

Conclusions:

This study provides information on the prevalence of the flush terminal plane, class I primary canine relation, normal overbite, ideal overjet, and spacing are the most common of the study population without any significant variations in gender. These results suggest desirable occlusal characteristics and spacing in primary dentition are most common and the undesirable occlusal characteristics were found to be less. however, we have two suggestions for the future, the first is to carry out a longitudinal study to observe the transfer of these characteristics between primary and permanent dentitions favorably or not and the second suggestion is to have cross-section studies on other populations in different regions of Iraq which will give us bank of data. These points will enable us to predict problems and make early treatment plans to control them.

Name: _____

Age : _____

Gender : _____

1. Terminal plane relationship:

Flush Terminal Plane

Distal Step Molar Relation

Mesial step molar relation

2. The primary canine relationship:

Class 1

Class 2

Class 3

3. Overjet: = ____ mm

Ideal / Increased / Reversed

4. Overbite: = ____ mm

Normal coverage / Increased / Edge to edge / Anterior open bite

5. Anterior cross-bite: presence / absence

6. Posterior cross-bite: presence / absence

Maxillary : presence / absence

7. Primate spaces:

Mandible : presence / absence

Note:

Figure (1): case sheet

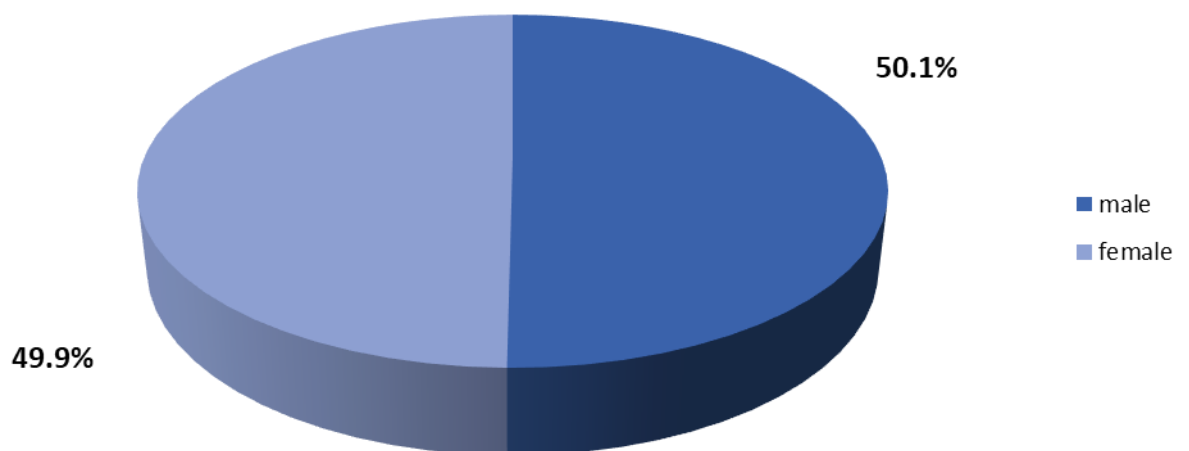


Figure (2): category gender in the study

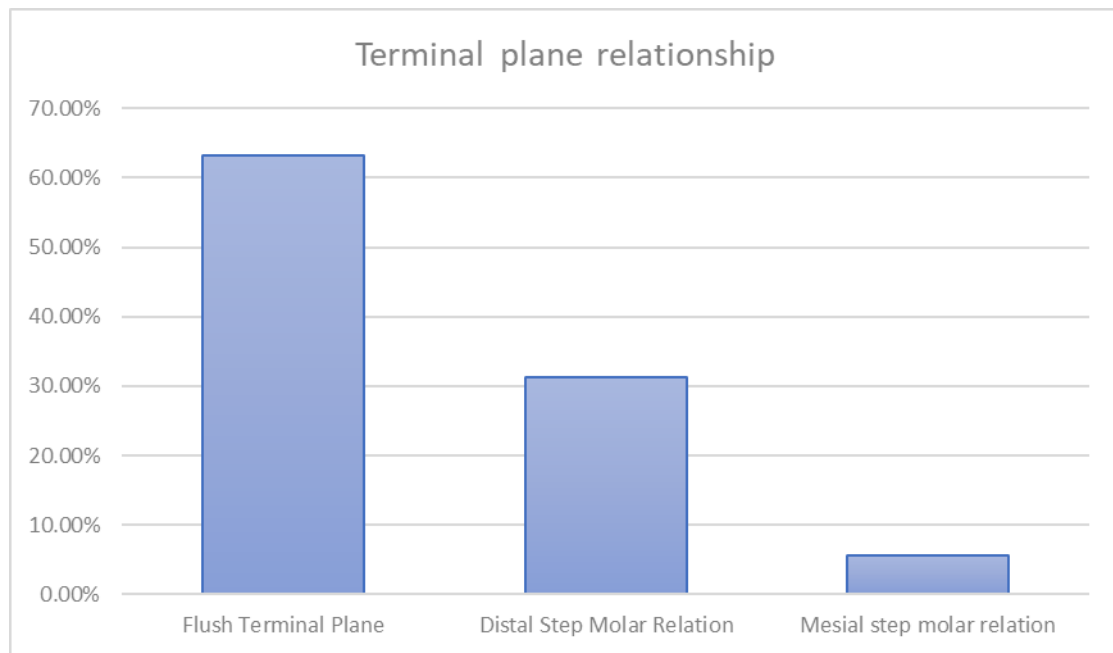


Figure (3): Prevalence of Terminal plane relationship in children of Salah Al-Din

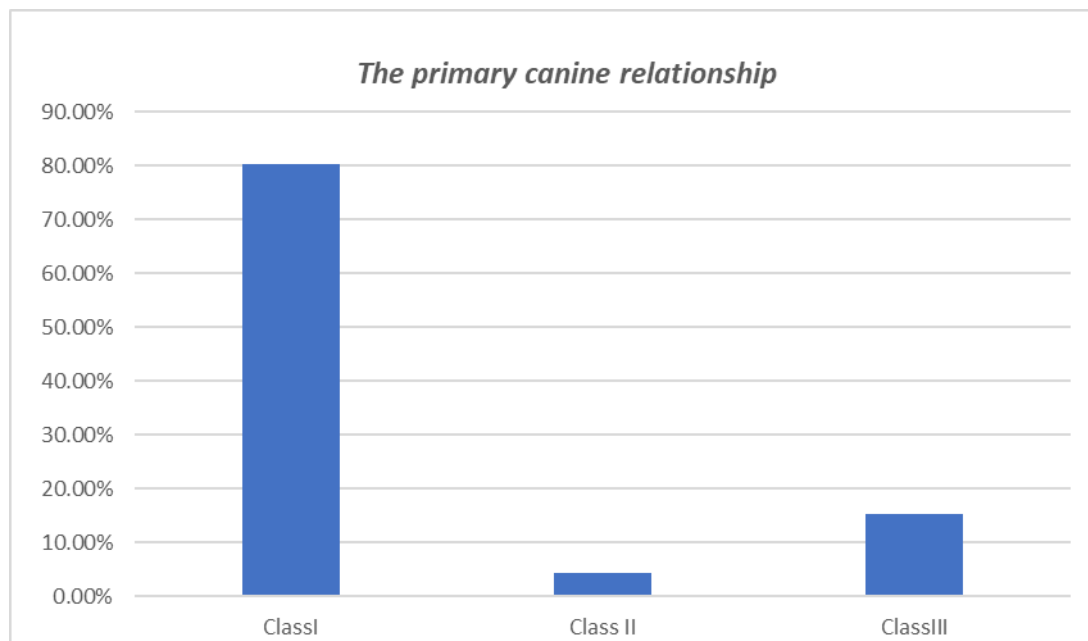


Figure (4): Prevalence of the primary canine relationship in children of Salah Al-Din

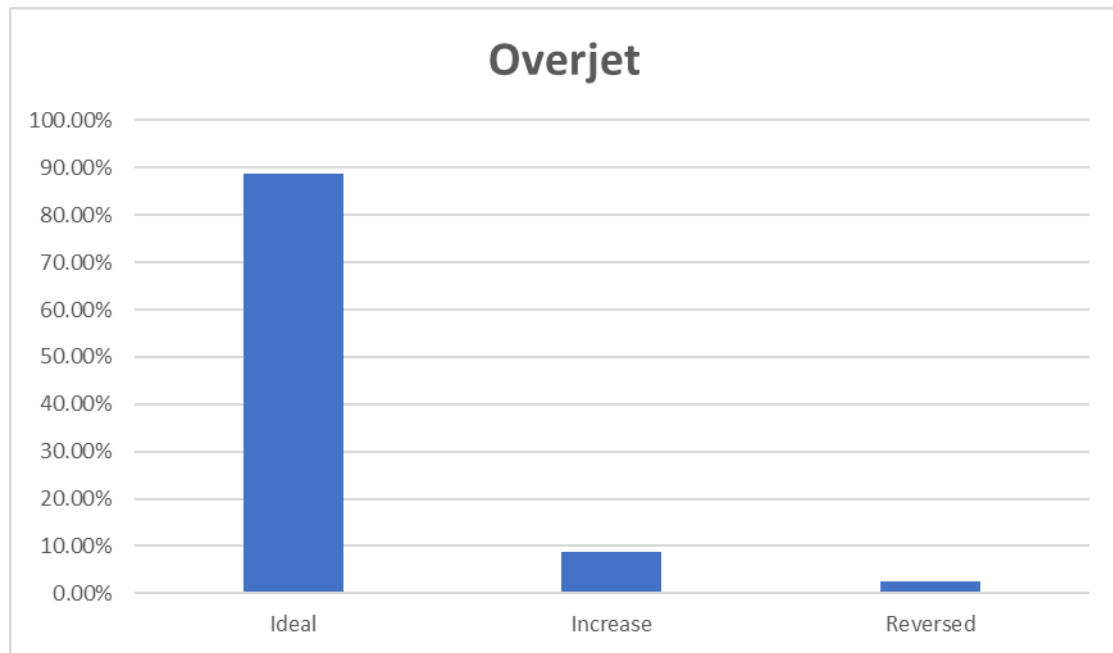


Figure (5): Prevalence of overjet in children of Salah Al-Din.

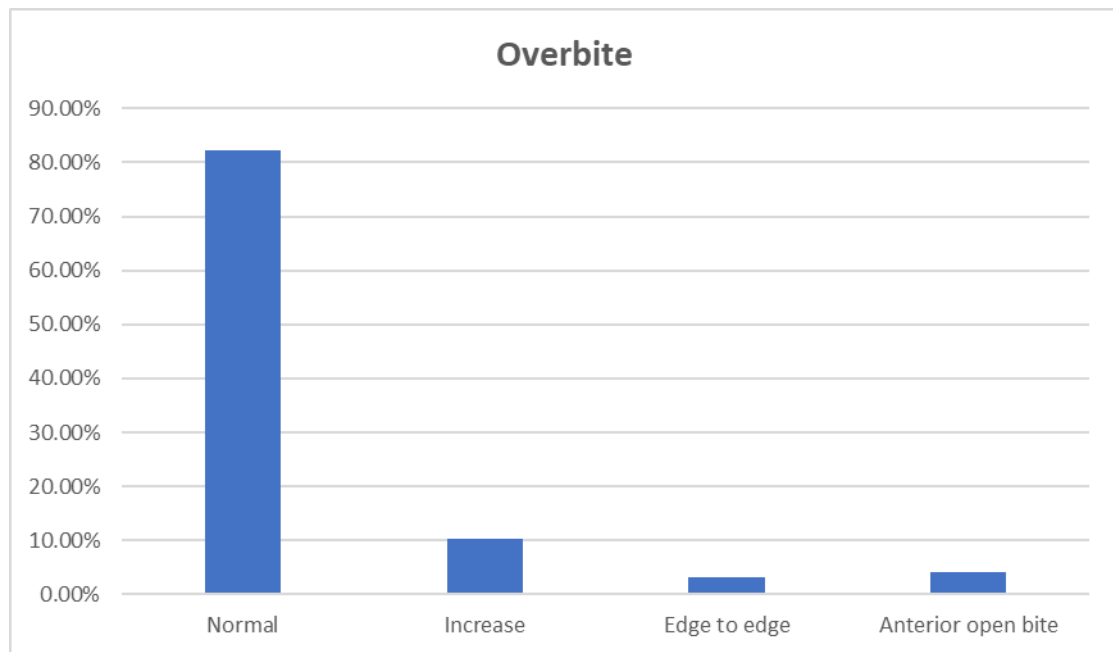


Figure (6): Prevalence of Overbite in children of Salah Al-Din.

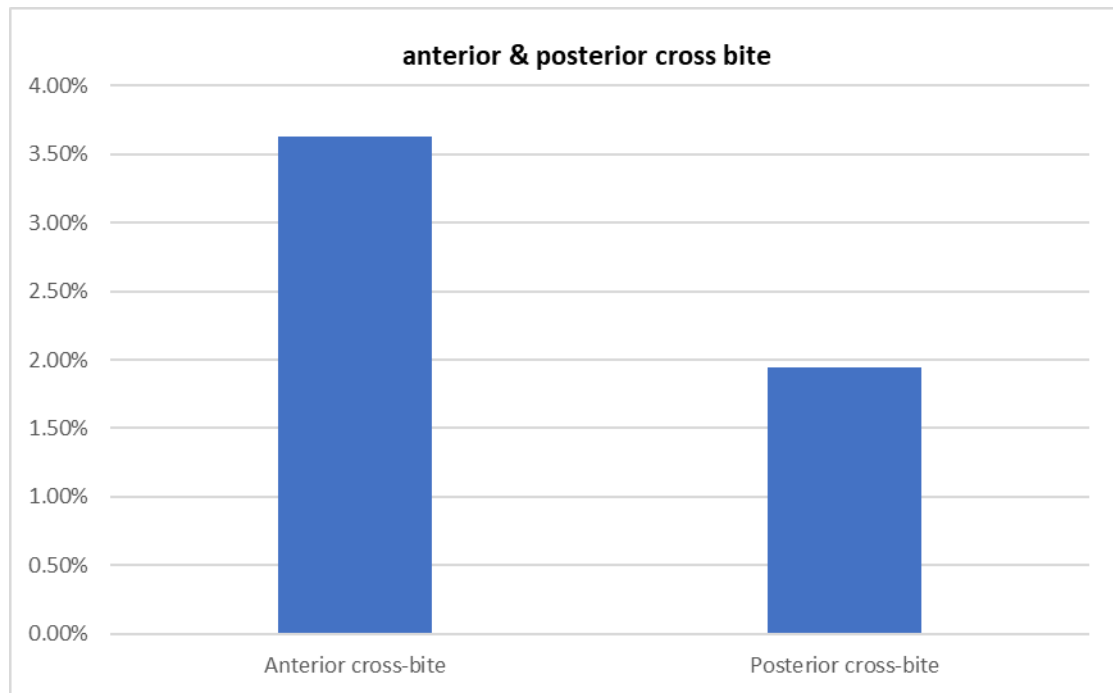


Figure (7): Prevalence of anterior & posterior cross bite in children of Salah Al-Din

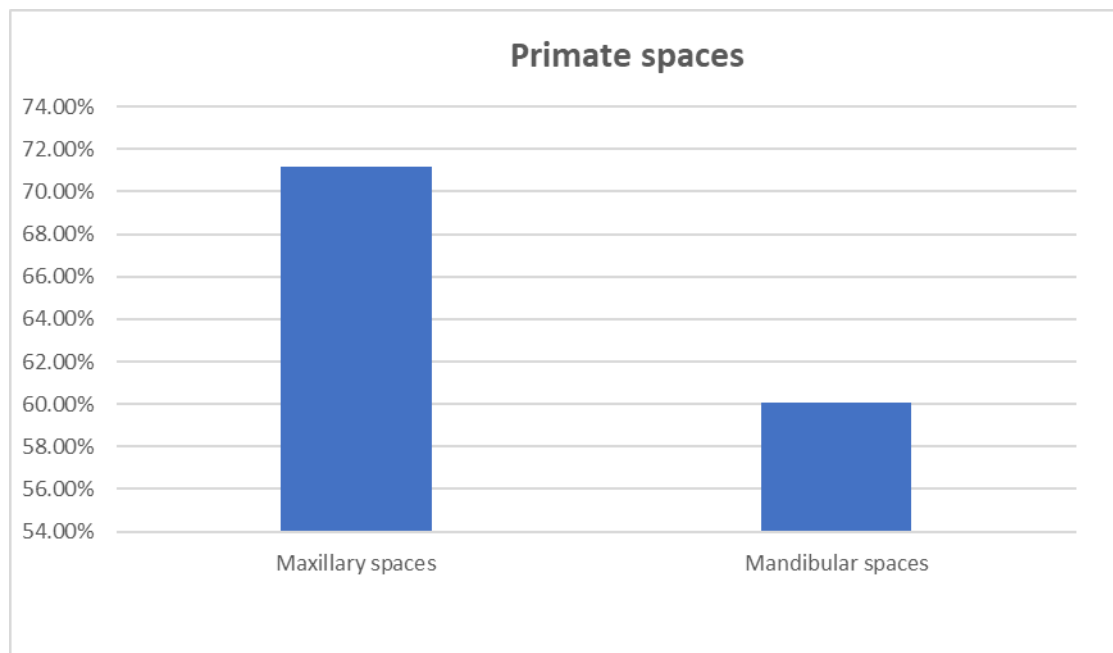


Figure (8): Prevalence of Primate spaces in children of Salah Al-Din.

Table (1): category age in the study.

age	No. of children (n=413)	No. of children (%)
3 years	86	20.82%
4 years	143	34.62%
5 years	106	25.67%
6 years	78	18.89%

Table (2): Prevalence of occlusal characteristics in childre

Characteristics	Type	No.	Percentage (%)
Terminal plane relationship	Flush Terminal Plane	261	63.20%
	Distal Step Molar Relation	129	31.23%
	Mesial step molar relation	23	5.57%
The primary canine relationship	Class I	332	80.39%
	Class II	18	4.36%
	Class III	63	15.25%
Overjet	Ideal	367	88.86%
	Increase	36	8.72%
	Reversed	10	2.42%
Overbite	Normal	340	82.32%
	Increase	43	10.41%
	Edge to edge	13	3.15%
	Anterior open bite	17	4.12%
Anterior cross-bite		15	3.63%
Posterior cross-bite		8	1.94%
Primate spaces	Maxillary spaces	294	71.19%
	Mandibular spaces	248	60.05%

Table (3): Prevalence of occlusal characteristics in gender groups.

Characteristics	Type	Male		Female		p-value
		No.	(%)	No.	(%)	
Terminal plane relationship	Flush Terminal Plane	136	65.70%	125	60.68%	0.2643 Not significant
	Distal Step Molar Relation	63	30.43%	66	32.04%	
	Mesial step molar relation	8	3.86%	15	7.28%	
The primary canine relationship	Class I	167	80.68%	165	80.10%	0.8291 Not significant
	Class II	10	4.83%	8	3.88%	
	Class III	30	14.49%	33	16.02%	
Overjet	Ideal	184	88.89%	183	88.83%	0.2245 Not significant
	Increase	15	7.25%	20	9.71%	
	Reversed	8	3.86%	3	1.46%	
Overbite	Normal	164	79.23%	175	84.95%	0.2074 Not significant
	Increase	23	11.11%	20	9.71%	
	Edge to edge	10	4.83%	3	1.46%	
	Anterior open bite	10	4.83%	8	3.88%	

Anterior cross-bite		10	4.83%	5	2.43%	
Posterior cross-bite		5	2.42%	3	1.46%	
Primate spaces	Maxillary spaces	152	73.43%	142	68.93%	0.5464 Not significant
	Mandibular spaces	131	63.30%	117	56.79%	

Table (4): Prevalence of occlusal characteristics in the age groups.

Characteristics	Type	3 years		4 years		5 years		6 years		p-value
		No.	(%)	No.	(%)	No.	(%)	No.	(%)	
Terminal plane relationship	Flush Terminal Plane	53	61.63%	88	61.54%	73	68.87%	47	60.26%	0.0069 significant
	Distal Step Molar Relation	33	38.37%	50	34.97%	23	21.70%	23	29.49%	
	Mesial step molar relation	0	0.00%	5	3.50%	10	9.43%	8	10.26%	
The primary canine relationship	Class I	53	61.63%	133	93.01%	96	90.57%	50	64.10%	<0.0001 Highly significant
	Class II	8	9.30%	3	2.10%	2	1.89%	5	6.41%	
	Class III	25	29.07%	7	4.90%	8	7.55%	23	29.49%	
Overjet	Ideal	81	94.19%	132	92.31%	99	93.40%	55	70.51%	<0.0001 Highly significant
	Increase	5	5.81%	3	2.10%	5	4.72%	23	29.49%	
	Reversed	0	0.00%	8	5.59%	2	1.89%	0	0.00%	
Overbite	Normal	73	84.88%	124	86.71%	93	87.74%	50	64.10%	<0.0001 Highly significant
	Increase	7	8.14%	5	3.50%	8	7.55%	23	29.49%	
	Edge to edge	3	3.49%	7	4.90%	3	2.83%	0	0.00%	
	Anterior open bite	3	3.49%	7	4.90%	2	1.89%	5	6.41%	
Anterior cross-bite		0	0.00%	8	5.59%	5	4.72%	3	3.85%	
Posterior cross-bite		0	0.00%	3	2.10%	5	4.72%	0	0.00%	
Primate spaces	Maxillary spaces	61	70.93%	108	75.52%	72	67.92%	53	67.95%	0.5701 Not significant
	Mandibular spaces	48	55.81%	80	55.94%	67	63.21%	53	67.95%	

References:

1. Padmanabhan, V., Madan, B., & Shahid, S. (2021). Occlusion and occlusal characteristics of the primary dentition in Emirati schoolchildren. *Dental Journal (Majalah Kedokteran Gigi)*, 54(2), 92-95.
2. Abuaffan, A. H., & Abd-Alrahman, R. M. (2014). Occlusal characteristics of primary dentition in Sudanese children in Khartoum state. *Brazilian Dental Science*, 17(2), 03-09.
3. Gunmeen, S., Manjul, M., Rashu, G., Sunil, G., Ankita, B. (2018). Assessment of occlusal characteristics in primary dentition of preschool children in Amritsar, Punjab, India. *Current Trends in Diagnosis and Treatment*, 2(1), 15-21.
4. BY Badr, S., & H Yahfoufi, S. (2020). Assessment of the occlusal characteristics of the primary dentition among Lebanese preschool children: A base line study cross-sectional study. *BAU Journal-Health and Wellbeing*, 2(2), 5.
5. Vegesna, M., Chandrasekhar, R., & Chandrappa, V. (2014). Occlusal characteristics and spacing in primary dentition: a gender comparative cross-sectional study. *International scholarly research notices*, 2014.
6. Hegde, S., Panwar, S., Bolar, D. R., & Sanghavi, M. B. (2012). Characteristics of occlusion in primary dentition of preschool children of Udaipur, India. *European journal of dentistry*, 6(01), 051-055.
7. Farsi, N. M., & Salama, F. S. (1996). Characteristics of primary dentition occlusion in a group of Saudi children. *International journal of paediatric dentistry*, 6(4), 253-259.
8. Shavi, G. R., Hiremath, N. V., Shukla, R., Bali, P. K., Jain, S. K., & Ajagannanavar, S. L. (2015). Prevalence of spaced and non-spaced dentition and occlusal relationship of primary dentition and its relation to malocclusion in school children of Davangere. *Journal of international oral health: JIOH*, 7(9), 75.
9. Vinay, S., Keshav, V., & Sankalecha, S. (2012). Prevalence of spaced and closed dentition and its relation to malocclusion in primary and permanent dentition. *International Journal of Clinical Pediatric Dentistry*, 5(2), 98.
10. Shoba, F., Dhvani, G., Eraveni, R., Jayasudha, K., Jaysukh, S., & Shaila, C. (2017). Occlusal traits of primary dentition among pre-school children of Mehsana District, North Gujarat, India. *Journal of Clinical and Diagnostic Research*, 11(1), ZC92-ZC96.
11. Facal-García, M., & Suárez-Quintanilla, D. (2002). Diastemas in primary dentition and their relationships to sex, age and dental occlusion. *European Journal of Paediatric Dentistry*, 3(2), 85-90.
12. Farsi, N. M., & Salama, F. S. (1996). Characteristics of primary dentition occlusion in a group of Saudi children. *International journal of paediatric dentistry*, 6(4), 253-259.
13. Davidopoulou, S., Arapostathis, K., Berdouses, E., Kavvadia, A., & Oulis, C. (2022). Occlusal features of 5-year-old Greek children. A national pathfinder survey.
14. Anu, V., Pavani, B., Dornadula Pavani, B. J., Lubna, F. A., & Saikrishna, Y. V. (2020). Distribution of School Children Based on the Type of Terminal Plane in Primary Dentition: A Study among 3-to 5-year-old Children in Chennai, Tamil Nadu, India. *International Journal of Clinical Pediatric Dentistry*, 13(2), 136.
15. Sharma, K., Bihani, T., & Kumar, V. (2021). Prevalence of Malocclusion in Primary Dentition in Southeast Part of Haryana, India: A Cross-sectional Study. *International Journal of Clinical Pediatric Dentistry*, 14(6), 757.
16. Kumar, D., & Gurunathan, D. (2019). Primary canine and molar relationships in centric occlusion in 3-to 6-year-old children: a cross-sectional survey. *International Journal of Clinical Pediatric Dentistry*, 12(3), 201.
17. Yehia, L. A. B., AL-Haddad, K. A., Al-labani, M. A., Al-Shamahy, H. A., & Shaga-aldeen, H. M. occlusal characteristics of the primary dentition among a sample of Yemeni preschool children.
18. Rai, A., Koirala, B., Dali, M., Shrestha, S., Shrestha, A., & Niraula, S. R. (2020). Occlusal Characteristics of Primary Dentition among School Going Children. *Journal of Nepal Health Research Council*, 18(3), 386-393.
19. Foster, T. D. (1969). Occlusion in the primary dentition Study of children at 2 1/2 to 3 years of age. *Brit. dent. J.*, 126, 76-79.
20. Ferro, R., Besostri, A., Olivieri, A., Quinzi, V., & Scibetta, D. (2016). Prevalence of cross-bite in a sample of Italian preschoolers. *Eur. J. Paediatr. Dent*, 17, 307-309.
21. Sun, K. T., Li, Y. F., Hsu, J. T., Tu, M. G., Hung, C. J., Hsueh, Y. H., & Tsai, H. H. (2018). Prevalence of primate and interdental spaces for primary dentition in 3-to 6-year-old children in Taiwan. *Journal of the Formosan Medical Association*, 117(7), 598-604.
22. Lochib, S., Indushekar, K. R., Saraf, B. G., Sheoran, N., & Sardana, D. (2015). Occlusal characteristics and prevalence of associated dental anomalies in the primary dentition. *Journal of epidemiology and global health*, 5(2), 151-157.
23. Kadiyala, S. V., & Chidambaranathan, K. (2018). Prevalence of Primate and Anterior Spacing for Primary dentition in 3 to 6 year old children in Chennai. *Research Journal of Pharmacy and Technology*, 11(12), 5413-5416.