PREVALENCE OF MALOCCLUSION AMONG SCHOOLCHILDREN IN BENI-SUEF, EGYPT

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ABSTRACT

Objective: The aim of this study was to assess the prevalence of malocclusion and different occlusal traits among Egyptian schoolchildren in Beni-Suef.

Materials and methods: Three hundred and ninety-six students aged 9 - 15 years followed the inclusion criteria and participated in the study. The children were examined to assess the molar relationship according to Angle's classification, overjet, overbite, crossbite, crowding, spacing and maxillary midline diastema.

Results: Normal occlusion was found in 22.5% of the sample. Class I malocclusion was observed in 61.4% of the subjects. The prevalence of Class II division 1and Class II division 2 malocclusions were 10.6% and 1% respectively. Class III malocclusion was detected in 4.5% of the examined children. Increased overjet was found in 33.3% of the subjects. Deep bite was the most prevalent abnormality (49.7%), whilst open bite showed the least prevalence (0.8%). Anterior and posterior crossbite represented 10.1% and 7.3% of the sample respectively. Crowding, spacing and maxillary midline diastema were registered in 29%, 19.4%, and 16.7% of the examined children respectively. There was no statistically significant difference between males and females in any of the studied occlusal traits. The prevalence of maxillary midline diastema increased significantly in the mixed dentition.

Conclusion: Class I malocclusion was the predominant category among children in Beni-Suef, while Class II division 2 malocclusion revealed the least frequency. The most prevalent abnormality was deep bite followed by increased overjet and crowding. Open bite malocclusion showed the least prevalence.

KEYWORDS: Prevalence, malocclusion, occlusal traits, Beni-Suef, Egypt.

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INTRODUCTION

Malocclusion is a departure from the normal relation of the teeth and dental arches due to distortion of normal development. Malocclusion is caused by hereditary and / or environmental influences that affect the oral health condition. Various oral functions such as mastication, swallowing and speech are impaired by associated malocclusion. Besides, malocclusion has a negative impact on dentofacial esthetics, individual's self-esteem, and emotional stability. Moreover, malocclusion could be associated with pain and poor quality of life. [1]

Recording the type and distribution of occlusal characteristics provides a valuable role in the assessment of malocclusion. A regional or racial malocclusion may recall for designing a specific health policy to improve the specialists' dexterity and enhance the resources desired for facing a specific malocclusion. Sufficient data should be required to clarify the prevalence of malocclusion traits and determine the priorities for developing appropriate treatment strategies.

Assessing the malocclusion in the permanent dentition may have negative influences on certain abnormalities as missing the chance of intercepting the problem and increasing the probability of providing a more complicated form of malocclusion. Screening malocclusion in the mixed dentition expands the scope of intervention and promotes the possibility of normal development of the dental arches. Planning preventive, interceptive and corrective treatments requires early diagnosis and detection of specific abnormalities such as crossbites. [2]

Reviewing the literature, several studies have been published to assess the prevalence of malocclusion in different populations. [2-22] Few studies have been conducted on the Egyptian population. To our knowledge, there were no available data regarding the prevalence of malocclusion in Beni-Suef governorate. Therefore, special attention is required

to assess the various occlusal traits to provide basic values for the benefit of early intervention in Beni-Suef. Subsequently, the aim of this study was to determine the prevalence of malocclusion and occlusal characteristics in 9 to 15-year-old schoolchildren in Beni-Suef, Egypt.

MATERIALS AND METHODS

Sample

This study was carried out on 396 (189 males and 207 females) students in Beni-Suef Governorate. The age was ranged from 9 – 15 years old. Ethical approval was obtained from the Research Ethics Committee of Faculty of Dentistry, Beni-Suef University. Permission was obtained from the educational authorities of the Directorate of Education in Beni-Suef Governorate and the schools' principals. Informed consents were signed by the students' parents before recording the data.

Sample size was calculated according to Daniel analysis [23] with P=35% and the desired precision ± 0.05. The minimum number of students recorded by sample size calculation was 349 students when the total population number was 94765 students based on the data received by the Directorate of Education.

The sample design was a stratified two-stage cluster sample. According to the geographic distribution, Beni-Suef is divided into Eastern and Western divisions. The schools represented the clusters. Five schools were randomly selected for each division from the website of the Ministry of Education with a total number of 10 schools. Forty students were randomly selected from each school and 400 students were examined. Four students were excluded from the study because they did not follow the inclusion criteria. The number of students included was 396 representing the actual sample size of the study.

The inclusion criteria of the children participated in the study:

1) The age ranged from 9 to 15 years old.

2) The children should be free from any systemic diseases, syndromes, craniofacial anomalies, trauma, or surgery that could affect the occlusion.

3) The children should have no history of previous orthodontic treatment.

The sample was divided according to the age into two groups: 9 – 12 years (215 students) and > 12 – 15 years (181 students).

METHODS

Diagnosis was carried out by two examiners (the two authors). Examination was performed in the school clinic with the child seated on a chair under good illumination of the day light using latex gloves, disposable mouth mirrors and plastic rulers. Assessment of the inter and intraarch relationship[24 - 26] was performed and the data were registered in a diagnostic chart (Table 1). The examination included assessment of the molar relationship according to Angle's classification, measuring overjet and overbite, and recording the presence of crossbite (anterior and posterior), crowding, spacing and midline diastema. No radiographs or study models were used for obtaining the data.

Angle's classification: the key to occlusion is the relative position of the first molars.

Class I malocclusion: the mesiobuccal cusp of the upper first permanent molar occludes into the buccal developmental groove of the lower first permanent molar. The anteroposterior relation is normal. The abnormality could be any of the following: rotation, labial or lingual inclination, crowding, spacing, deep bite, open bite or posterior cross bite.

Class II malocclusion: the mesiobuccal cusp of the maxillary first permanent molar occludes mesial to the buccal groove of the mandibular permanent

first molar. Class II malocclusion has 2 divisions: Class II division 1 and Class II division 2.

Class III malocclusion: the mesiobuccal cusp of the maxillary first permanent molar occludes distal to the buccal groove of the mandibular permanent first molar.

Overjet is the distance between the labial surface of the most labial mandibular central incisor and the incisal edge of the most labial maxillary central incisor when the teeth are in centric occlusion. The distance was measured parallel to the occlusal plane with the use of a plastic ruler. Normal overjet ranged from 2 to 3.5 mm. A reverse overjet was recorded when the labial surfaces of the maxillary incisors occluded posterior to the lingual surfaces of the mandibular incisors.

Overbite is the amount of vertical overlap between the maxillary and mandibular central incisors. This relationship can be described either in millimeters or as a percentage of how much the upper central incisors overlap the crowns of the lower incisors. Normal overbite was obtained when the upper incisor covered ⅓ of the lower incisor or in the range of 1 to 3 mm. When there was a lack of vertical overlap, the condition was described as open bite and the vertical distance between the maxillary and mandibular incisor edges was measured in millimeters.

The presence of crossbite (anterior and posterior), crowding, spacing and midline diastema was recorded.

Normal occlusion was reported when the following criteria were detected:

1. Class I molar relation.

2. Positive overjet: 2 - 3.5 mm.

3. Normal overbite relation (the upper incisor covered ⅓ of the lower incisor or in the range of 1 to 3 mm).

4. Well-aligned arches.

TABLE (1): Diagnostic chart

Name:	School:
Age:	**Area of the school:**
Sex:	**Telephone number:**
Angle's Classification: • Class I malocclusion • Class II malocclusion • Class III malocclusion	
Overjet: • Normal: 2 - 3.5 mm	**Overbite:** • Normal overbite: the upper incisor covers ⅓ of the lower incisor or 1- 3 mm.
Increased • Moderate > 3.5 - 6 mm • Increased > 6- 9 mm. • Severe > 9 mm.	**Increased** • Moderate ≥ 3.5 - 6 mm • Severe > 6 mm
Reduced: < 2 mm	**Reduced:** < 1 mm
Reverse overjet • 0 - 1 mm. • > 1 - 3.5 mm. • > 3.5 mm (no masticatory or speech difficulties) • > 1 mm < 3.5 mm (masticatory or speech difficulties). • > 3.5 mm (reported masticatory and speech difficulties.).	**Open bite** • > 1 mm - 2 mm (anterior or posterior). • > 2 mm - 4 mm (anterior or posterior). • > 4 mm (anterior or posterior).
Crossbite:	
Anterior Crossbite: • Teeth involved:	
Posterior Crossbite:	
Unilateral: • Teeth involved:	**Bilateral:** • Teeth involved:
Crowding:	**Spacing:** • Midline diastema: • Spacing:

After 4 weeks of the initial examination, 10% of the sample was re-examined to check for intra-examiner and inter-examiner variability.

Statistical analysis:

Categorical data were presented as frequency and percentage values and were analyzed using Fisher's exact test followed by multiple pairwise comparisons utilizing multiple Z-tests with Bonferroni correction. Inter-and intra-examiner reliability were analyzed using intraclass correlation coefficient (ICC). The significance level was set at $p \leq 0.05$ within all tests. Statistical analysis was performed with R statistical analysis software version 4.1.2 for Windows*.

* R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

RESULTS

This study was carried out on 396 children aged 9 -15 years. The distribution of the sample (demographic data) according to gender, age and dentition period was presented in Table (2). Table (3) showed the prevalence of different occlusal traits. The association between gender and malocclusion was demonstrated in Table (4). There was no statistically significant difference between males and females in any of the studied occlusal traits.

TABLE (2): Demographic data.

Parameter		Number	Percentage (%)
Gender (n=396)	**Male**	189	47.7%
	Female	207	52.3%
Age in years (n=396)	**9-12 Y**	215	54.3%
	> 12-15 Y	181	45.7%
Dentition period (n=396)	**Mixed**	244	61.6%
	Permanent	152	38.4%

TABLE (3): Prevalence of different occlusal traits.

Parameter		Number	Percentage (%)
Classification of malocclusion (N=396)	Normal occlusion	89	22.5%
	Class I	243	61.4%
	Class II division 1	42	10.6%
	Class II division 2	4	1.0%
	Class III	18	4.5%
Overjet	Normal (2 - 3.5 mm)	215	54.3%
	Increased overjet (Moderate > 3.5 - 6 mm)	108	27.2%
	Increased overjet (Increased > 6 - 9 mm)	15	3.8%
	Increased overjet (Severe > 9 mm)	9	2.3%
	Decreased overjet (< 2 mm)	35	8.8%
	Reverse overjet (0 - 1 mm)	7	1.8%
	Reverse overjet (> 1 - 3.5 mm)	7	1.8%
Overbite	Normal Overbite (1 – 3 mm)	180	45.5%
	Increased overbite (Moderate ≥ 3.5 - 6 mm)	160	40.4%
	Increased overbite (Severe > 6 mm)	37	9.3%
	Decreased overbite (< 1 mm)	16	4.0%
	Open bite (> 1 mm – 2 mm (ant or post))	0	0.0%
	Open bite (> 2 mm – 4 mm)	3	0.8%
	Open bite (> 4 mm (ant or post))	0	0.0%
Crossbite	None	327	82.6%
	Anterior cross bite	40	10.1%
	Posterior cross bite (unilateral)	23	5.8%
	Posterior cross bite (bilateral)	6	1.5%
Arch length discrepancy	None	138	34.9%
	Crowding	115	29%
	Spacing	77	19.4%
	Midline diastema	66	16.7%

Table (5) showed the association between dentition period and malocclusion. There was no statistically significant difference in the prevalence of malocclusion traits between mixed and permanent dentition periods except the midline diastema (more prevalent in the mixed dentition) and cases with no arch length discrepancy (more prevalent in the permanent dentition).

The inter-examiner reliability was 0.999 which indicated strong agreement. The values of intra-examiner reliability for examiners 1 and 2 were 0.995 and 0.991 respectively which suggested high reproducibility.

TABLE (4): Association between gender and malocclusion.

Parameter		Male		Female		p-value
		n	%	n	%	
Malocclusion (n=396)	Normal occlusion	41	21.7%	48	23.2%	**0.903**
	Class I	120	63.4%	123	59.4%	
	Class II division 1	19	10.1%	23	11.1%	
	Class II division 2	2	1.1%	2	1.0%	
	Class III	7	3.7%	11	5.3%	
Overjet	Normal (2 - 3.5 mm)	104	55.0%	111	53.6%	**0.490**
	Increased overjet (Moderate> 3.5 - 6 mm)	51	27.0%	57	27.6%	
	Increased overjet (Increased > 6 - 9 mm)	7	3.7%	8	3.9%	
	Increased overjet (Severe > 9 mm)	7	3.7%	2	1.0%	
	Decreased overjet (< 2 mm)	14	7.4%	21	10.1%	
	Reverse overjet (0 - 1 mm)	4	2.1%	3	1.4%	
	Reverse overjet (> 1 - 3.5 mm)	2	1.1%	5	2.4%	
Overbite	Normal Overbite (1 - 3 mm)	80	42.3%	100	48.3%	**0.353**
	Increased overbite (Moderate ≥ 3.5 - 6 mm)	77	40.7%	83	40.1%	
	Increased overbite (Severe > 6 mm)	23	12.2%	14	6.8%	
	Decreased overbite (< 1 mm)	7	3.7%	9	4.3%	
	Open bite (> 1 mm – 2 mm (ant or post))	0	0.0%	0	0.0%	
	Open bite (> 2 mm – 4 mm)	2	1.1%	1	0.5%	
	Open bite (> 4 mm (ant or post))	0	0.0%	0	0.0%	
Crossbite	None	157	83.1%	170	82.1%	**0.303**
	Anterior cross bite	22	11.6%	18	8.7%	
	Posterior cross bite (unilateral)	9	4.8%	14	6.8%	
	Posterior cross bite (bilateral)	1	0.5%	5	2.4%	
Arch length discrepancy	None	64	33.9%	74	35.7%	**0.910**
	Crowding	56	29.6%	59	28.5%	
	Spacing	39	20.6%	38	18.4%	
	Midline diastema	30	15.9%	36	17.4%	

*Values with different superscript letters within the same horizontal row are significantly different. * = Significant (p ≤ 0.05)*

TABLE (5): Association between dentition period and malocclusion.

Parameter		Mixed		Permanent		p-value
		n	%	n	%	
Malocclusion (n=396)	Normal occlusion	56	23.0%	33	21.7%	**0.602**
	Class I	150	61.5%	93	61.1%	
	Class II division 1	27	11.1%	15	9.9%	
	Class II division 2	1	0.4%	3	2.0%	
	Class III	10	4%	8	5.3%	
Overjet	Normal (2 - 3.5 mm)	130	53.2%	85	55.9%	**0.338**
	Increased overjet (Moderate> 3.5 - 6 mm)	70	28.7%	38	25.0%	
	Increased overjet (Increased > 6 - 9 mm)	7	2.9%	8	5.2%	
	Increased overjet (Severe > 9 mm)	6	2.5%	3	2.0%	
	Decreased overjet (< 2 mm)	20	8.2%	15	9.9%	
	Reverse overjet (0 - 1 mm)	7	2.9%	0	0.0%	
	Reverse overjet (> 1 - 3.5 mm)	4	1.6%	3	2.0%	
Overbite	Normal Overbite (1 - 3 mm)	114	46.8%	66	43.4%	**0.106**
	Increased overbite (Moderate ≥ 3.5 - 6 mm)	93	38.1%	67	44.1%	
	Increased overbite (Severe > 6 mm)	25	10.2%	12	7.9%	
	Decreased overbite (< 1 mm)	12	4.9%	4	2.6%	
	Open bite (> 1 mm – 2 mm (ant or post))	0	0.0%	0	0.0%	
	Open bite (> 2 mm – 4 mm)	0	0.0%	3	2.0%	
	Open bite (> 4 mm (ant or post))	0	0.0%	0	0.0%	
Crossbite	None	205	84.1%	122	80.3%	**0.378**
	Anterior cross bite	25	10.2%	15	9.9%	
	Posterior cross bite (unilateral)	12	4.9%	11	7.2%	
	Posterior cross bite (bilateral)	2	0.8%	4	2.6%	
Arch length discrepancy	None	69B	28.3%	69A	45.4%	**<0.001***
	Crowding	65	26.6%	50	32.9%	
	Spacing	51	20.9%	26	17.1%	
	Midline diastema	59A	24.2%	7B	4.6%	

Values with different superscript letters within the same horizontal row are significantly different.

* = Significant (p ≤ 0.05)

DISCUSSION

Assessing the prevalence of malocclusion plays a vital role in determining health problems. The prevalence of malocclusion differs among various populations, ethnic differences, and age groups.[6, 9] Early diagnosis and intervention are considered essential treatment strategies to maximize the benefit of achieving occlusal harmony and balanced dentofacial aesthetics.

This study was conducted on 396 schoolchildren fulfilling the inclusion criteria in Beni-Suef Governorate. While the total number of examined children was 400 students, four students were excluded from the study because of current or previous orthodontic treatment.

The age of the examined subjects was ranged from 9-15 years old. This range allows early detection of abnormal occlusal characteristics and provides a better chance for starting interceptive treatment.

In the present study, normal occlusion was observed in 22.5% of the sample. This finding was in agreement with the result of another Egyptian study which found normal occlusion in 25.7% of the subjects.[17] The result corresponded with those of the Iranian[28] population (22.9%) and was close to recorded values in French[10] (27.5%) and black American subjects[3] (27%). However, the current result was lower than the finding of El-Mangoury and Mostafa[4] on the Egyptian population (34.33% normal occlusion) in 1990 which may be attributed to changes in the socioeconomic and environmental factors. The result was also lower than was observed in the Syrians[27] as normal occlusion was noticed in 38.5 % of the studied sample. In contrast to other studies, the present finding was higher than detected data of the Kenyans[3] (16.8%), Chinese[6] (7.1%), Nepalese[13] (14.42%), Nigerians[15] (11.8%), Anatolians[16] (10.1%), Indians[18] (16.7%), and Libyans[29] (4.4%). Variation in the prevalence of normal occlusion and malocclusion among different populations could be influenced by genetic and environmental factors.

Class I malocclusion was found in 61.4% of the sample. Concerning the prevalence of Class I malocclusion in the Egyptian population, the result was consistent with the finding of El-Attar et al.,[21] (65.4%) and close to the result of Fsifis et al., [17] (51.5%). On the other hand, a lower rate was detected by El-Mangoury and Mostafa[4] (33.33%). With regard to other populations, the current finding was harmonious with Moroccans[12] (61.4 %), Libyans[29] (66.5%), Chinese[6] (58.8%), Rwandans[30] (60.9%) and Latinos[31] (62.9%), Jordanians[33] (55.3%), and Kuwaitis[34] (57.8%). Although the prevalence of Class I malocclusion in our study (61.4%) was higher than Anatolians[16] (34.9%), Nepalese[13] (48.5%), Iranians[28] (41.8%), black Americans[3] (44%), Kenyans[3] (51.7%), Britons[32] (44.3%), and Syrians[27] (30%), it was lower than obtained records of Brazilians[11] (76.7%), Nigerians[15] (80.3%), Tanzanians[35] (93.6%), Kenyans[19] (70%), and Saudis[22] (84.9%).

The prevalence of Class II malocclusion in the present study was 11.6%. The prevalence of Class II division 1 and Class II division 2 malocclusions were 10.6% and 1% respectively. The current result agreed with the report of Fsifis et al.,[17] (16.4%) on the Egyptian population, however other Egyptian studies revealed higher percentages as exhibited by El-Mangoury and Mostafa[4] (20.96%), Rashid and Hanem[36] (20.2%) and El-Attar et al.,[21] (27.2%). The prevalence of Class II malocclusion varied greatly among populations. Even though, our finding coincided with Indians[18] (9.35%), Saudis[22] (9%), and Kenyans[3] (7.9%), it was higher than observed prevalence in Nigerians[15] (6.3%) and Tanzanians[35] (4.4%). Moreover, compared to the current study, higher prevalence of Class II malocclusion was detected in Pakistanis [37] (58.8%), Anatolians [16] (44.7%), Nepalese [13] (32.68%), Kuwaitis [34] (31.2%), Moroccans [12] (24%), Chinese[6] (21.5%), Finns [5] (22 % for males and 15 % for females), and Brazilians[11] (19.2%).

Class III malocclusion was found in 4.5% of the sample in the current study. This finding was compatible with previous Egyptian studies performed by Fsifis et al., [17] (5.9%) and El-Attar et al.,[21] (7.4 %) and was consistent with reports from other populations as Nepalese[13] (4.32%), Brazilians[11] (4.2%), Indians[18] (4.1%), Libyans[29] (3.7%), Britons[32] (3.2%), and Colombians[9] (3.7%). In contrast to our result, lower prevalence of Class III malocclusion was noticed in Finns[5] (1%), Jordanians[33] (1.4%), Nigerians[15] (1.6%), and Tanzanians[35] (2 %), while higher prevalence was detected in Kenyans[3] (16.8%), Chinese[6] (12.6%), Pakistanis[37] (12.2%), Syrians[27] (12%), Rwandans[30] (10.3%), Anatolians[16] (10.3%), and Latinos[31] (9.1%).

In the present study, Class I malocclusion was the most prevalent abnormality (61.4%), while Class II division 2 showed the least prevalence (1%). Similarly, this pattern of distribution was reported in former studies on Egyptians[36], Indians[18], Chinese[6], Saudis[22], Syrians[27], Libyans[29], Iranians[28], and Latinos[31]. Despite that, Class II malocclusion was the most prevalent category in Anatolians[16] (40% for Class II division 1 and 4.7% for Class II division 2) and Pakistanis[37] (32% for Class II division 1 and 5.2% for Class II division 2 and 21.6% for subdivisions).

Normal overjet was found in 54.3% of the sample in the current study. This finding was in agreement with preceding reports on Egyptians[21] (60.4%), Germans[2] (60.2%), Libyans[29] (51%), Kuwaitis[34] (53.2%), and Britons[32] (48.9%). Higher values of normal overjet were detected in other studies on Egyptians[17] (71.8%), Indians[18] (76.4%), Moroccans[12] (63.9%), Chinese[6] (68.2%), Anatolians[16] (64.5%) and Tanzanians[35](73.3%). Variation in the percentages was related to different ethnic influences and registration methods as some studies [12,16,17,35] demonstrated a wider range in determining the normal overjet.

Early treatment is recommended in cases of increased overjet to decrease the incidence of incisal trauma. The results revealed a moderate increase in overjet (> 3.5 - 6 mm) in 27.2% of the sample, while the increased overjet (> 6 - 9 mm) was detected in 3.8%. Severe increase in overjet (> 9 mm) was observed in 2.3% of the examined children. The total increase in overjet was recorded in 33.3% of the sample. This finding was in accordance with previous studies on Egyptians[21] (26.6%), Moroccans[12] (27.2%), Brazilians[11] (29.7%), Germans[2] (31.4%), and Iranians[28] (28.1%). Compared to our results, lower percentages of increased overjet were detected in Nigerians[15](15.6%) and Chinese[6] (19.2%), while higher values of increased overjet were recorded in Libyans[29](48.4%), Britons[32](47.7%), Rwandans[30] (44.4%), and Kuwaitis[34](42.8%). Reduced overjet (< 2 mm) was noticed in 8.8% of the sample which was close to the finding of El-Attar et al.,[21] (13%) on the Egyptian population and the result of Aikins and Onyeaso[15](15.2%) on the Nigerian one.

The prevalence of reverse overjet in the present study was 3.6% of the sample. Similar results were reported in Brazilians[11] (3.9%), Germans[2] (3.2%), Iranians[28] (4.2%) and Kuwaitis[34] (4%). Furthermore, higher prevalence of reverse overjet was found in Chinese[6] (6.8%), Anatolians[16] (10.4%), Tanzanians[35] (8.4%), and Colombians[9] (5.8%). Lower percentages of reverse overjet were detected in Indians[18] (0.4%), Libyans[29] (0.6%), Nepalese[13] (1.79%), and Jordanians[33] (1.9%).

The results showed that normal overbite was demonstrated in 45.5% of the subjects. This finding matched the results of El-Attar et al.,[21] (49.4%), Bugaighis and Karanth[29] (39.9%), and Lew et al.,[6] (46.5%) on the Egyptian, Libyan and Chinese populations respectively. However, higher ranges of normal overbite were observed in previous studies on Egyptians[17] (74.1%), Indians[18] (64.1%), Anatolians[16] (73.5%), and Omanis[20](58%). These differences were related to the variability in the

ethnic background or in the registration methods of defining the normal range of overbite.

In the current study, moderate increase (≥ 3.5 - 6 mm) and severe increase (> 6 mm) in overbite were observed in 40.4% and 9.3% of the subjects respectively. Subsequently, deep bite was found in 49.7% of the children. Similar results were recorded in former studies on Germans[2] (46.2%) and Libyans[29] (56%). Furthermore, the percentage of severe increase in overbite (> 6 mm) was consistent with similar reports on Egyptians[17] (6.5%) and Moroccans[12] (7%). Yet, some studies demonstrated lower percentages of deep overbite as conducted on Iranians[28] (34.5%), Chinese[6] (28.4%), Colombians[9] (21.6%), Anatolians[16] (18.3%), and Nepalese[13] (13.23%). The prevalence of decreased overbite (< 1 mm) was 4% in the present study. This finding differed from the result of the El-Attar et al.,[21] (23.1%) as decreased overbite in their study was recorded when the overbite was less than 2 mm.

Open bite malocclusion was found in 0.8% of the examined children in the present study. The result corresponded with former studies on Egyptians[14] (1.6%), Iranians[28] (1.6%), and Saudis[22] (1.76%). In spite of that, higher prevalence of open bite was recorded in Nigerians[15] (7.1%) and Rwandans[30] (24.3%) which might be attributed to heredity and racial differences of the African descent.[30]

Concerning crossbite, early interception is required to prevent asymmetric growth of the maxilla and mandible.[2] Regarding anterior crossbite, our results showed that the prevalence of anterior crossbite was 10.1% of the subjects. This finding was compatible with of the results of previous studies on Egyptians[21] (8.2%), Brazilians[11] (10.1%), Saudis[22] (11.76%), Iranians[28] (8.4%), and Finns[5] (8%). Nevertheless, higher prevalence of anterior crossbite was recorded in Kuwaitis[34] (20.8%), lower rates were found in Omanis[20] (5.2%), Tanzanians[5] (4%), and Libyans[29] (3.8%).

In the present study, posterior crossbite was demonstrated in 7.3% of the sample. Unilateral and bilateral posterior crossbites were observed in 5.8% and 1.5% of the subjects respectively. Similar results were detected in Egyptians[21] (9.5%), Moroccans[12] (7.1%), Germans[2] (8.2%), Chinese[6] (8.1%), Omanis[20] (6.8%), and Anatolians[16] (9.7%).

The occurrence of crowding was registered in 29% of the children in the current study. Compatible percentages were reported in the French[10] (28%) and the Saudi[22] (40.3%) populations. Although lower rates of crowding were observed in Nepalese[13] (19.75%), and Tanzanians[35] (14.1%), crowding was the most prevalent malocclusion in Rwandans[30] (71.2%), Britons[32] (61.3%), Colombians[9] (52.1%), Jordanians[33] (50.4%), and Brazilians[11] (45.5%).

In the present study, the prevalence of spacing was reported in 19.4% of the examined subjects. The current finding was consistent with the results of previous studies on Tanzanians[35] (21.9%), Colombians[9] (25.9%), and Jordanians[33] (26.7%). As compared to our result, higher prevalence of spacing was observed in Nigerians[15] (59.5%), while lower rate was recorded in Rwandans[30] (9.9%).

In the current study, maxillary midline diastema was detected in 16.7% of the children. The results showed statistically significant higher prevalence of maxillary midline diastema in the mixed dentition (24.2%) as compared to the permanent dentition (4.6%). This finding could be attributed to the existence of the ugly duckling stage in the mixed dentition in which the permanent canines exert pressure on the roots of the lateral incisors driving them medially while causing distolabial flaring of the crowns. The roots of the central incisors are also forced together, thus causing a maxillary midline diastema and distal crown flaring. With the eruption of the canines, the impingement shifts incisally thus driving the incisor crowns medially, resulting in closure of the diastema. Our result coincided with the finding of Brito et al.,[11] on the Brazilian population (16.2%) as they reported a significant increase in

the prevalence of midline diastema in the mixed dentition. The result also agreed with Bilgic et al.,[16] on the Anatolians (12.7%) and Brunelle et al., [38] in their study on the American population as they reported variable rates of prevalence of maxillary midline diastema with different age groups (19.3% in 8-11 years, 6% in 12-17 years, and 4.8% in 18-50 years). Similar result was observed by Lombardo et al.,[39] as they clarified that the prevalence of midline diastema decreased in the permanent dentition. Lower prevalence of midline diastema was reported in other studies on Egyptians[21] (6.2%), Indians[18] (0.76%), Tanzanians[5] (6%), Jordanians[33] (6.9%), and Colombians[9] (7%). This contrast was either due to differences in the registration method of diastema (larger of 1 or 2 mm) or variations in the sample age group as complete eruption of the dentition and final establishment of the occlusal relation were manifested in older subjects. Furthermore, higher percentages of midline diastema were recorded in Moroccans[12] (24%), and Saudis[22] (30%).

In our study, the results showed no statistically significant difference between males and females in any of the studied occlusal characteristics which was in accordance with previous studies.[19, 33, 34] Despite that, some studies showed gender difference in the prevalence of certain characteristics as midline diastema[11] (higher in females), increased overbite[11, 16, 18, 30] (higher in males), and increased overjet[9,18] (higher in males).

In the present study, the results revealed no statistically significant difference in the prevalence of any of the occlusal traits between the mixed and permanent dentition periods except the maxillary midline diastema (more prevalent in the mixed dentition) and the cases showed no arch length discrepancy (more prevalent in the permanent dentition). This finding was consistent with Brito et al.,[11] as they reported significantly higher prevalence of midline diastema in the mixed dentition period.

Regarding the prevalence of different occlusal characteristics, the results showed that deep bite was the most prevalent malocclusion (49.7%) followed by increased overjet (33.3%) then crowding (29%). The current finding matched the results of Tausche et al.,[2] and Narayanan et al.,[18] which showed that deep bite was the most prevalent malocclusion followed by increased overjet. However, other studies[9,11,30,32,33] revealed that crowding was the most prevalent malocclusion. Moreover, differences in the prevalence of malocclusion in comparison to other studies could be explained by variations in the assessment methods, racial differences, and diversities of the chronological age of the samples.

CONCLUSION

1- Normal occlusion was found in 22.5% of the subjects.

2- Concerning the classification of malocclusion, Class I malocclusion was the most prevalent category among children in Beni-Suef. Class II division 2 malocclusion revealed the least prevalence.

3- Regarding the occlusal traits, deep bite was the most prevalent malocclusion followed by increased overjet then crowding. Open bite was the least common malocclusion.

4- There was no statistically significant difference between males and females in any of the studied occlusal characteristics.

5- Maxillary midline diastema showed a statistically significant higher prevalence in the mixed dentition period compared to the permanent dentition.

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