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Prevalence of Malocclusion and Orthodontic Treatment needs in Qena Governorate, Egypt: An Epidemiological study with reviewing similar studies in some countries

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Abstract

Background: The present study was designed and performed in an attempt to assess prevalence of malocclusion (its incidence, classes and treatment needs) and searching for possible association with potential risk indicators in one of Upper Egypt Governorates (QENA). Reviewing of previous similar work in several countries all over the world was highlighted. Methods: Total sample of 1392 subjects aged from 10 – 34 years old (698 males and 694 females) from different areas in Qena governorate.

Descriptive questionnaire was prepared and obtained from all sample's subjects, full personal data was recorded, and subjects were examined in a dental chair using dental chair light, mouth mirror, explorer, periodontal probe; entire mouth was examined in a uniform pattern.

Teeth occlusion state was determined according to criteria of Angle's classification, and Orthodontic treatment needs were recorded from subjects possessed abnormal occlusion relationships, using questionnaire applying criteria of IOTN.

***Results**: Normal occlusion was recorded in 1005 subjects (72.2 %), while 387 showed malocclusion (27.8 %); Class I type (21.2 %), Classes II type (5.3 %), and Class III type (1.3 %). There were no differences between females and males regarding prevalence of malocclusion as well as distribution of malocclusion types and abnormal bite types, and not affected by geographic location inside Qena governorate. The results showed that 31.90 % of all included subjects were in need to have orthodontic treatment Grades 4 and 5, whereas 32.43% of subjects were in Grade 3 (borderline), while 35.67 % of subjects did not require orthodontic treatment (they were below Grade 1); statistically significant differences (p < 0.05) between subjects did not require orthodontic treatment (Grades 1 and 2) and other groups required orthodontic treatment (Grade 3 and Grades 4 &5), but these two last groups did not differ significantly (p> 0.05).*

***Conclusion**: Slightly more than quarter of Qena governorate population, Egypt, had teeth malocclusion with no differences regarding gender type as well as geographic location. Regarding orthodontic treatment needs, it seems likely that nearly one third of examined subjects were in need to have treatment, one third were on borderline, while last third not in need to have treatment.*

***Keywords**: Malocclusion prevalence, Occlusion types distribution, Egypt, Orthodontic*

Introduction

Malocclusion can be defined as an abnormality in growth and development of teeth; it may adversely affect quality of life of affected individuals, impairing their social interaction and psychological well–being,(1,2) due to impaired facial esthetics, weakened functions of speech, chewing and swallowing.(3) It is not a disease, but a morphological variation that occurs worldwide, regardless of gender, ethnic group and social class;(4-8) may be associated with facial skeletal disharmony which may be a reason to seek treatment toward the improvement of body image and social acceptance.(9) Malocclusion

features the third highest prevalence among oral pathologies, secondarily to dental caries and periodontal disease.(10) Thus, epidemiologic assessment is necessary to clarify its aspect and to plan beneficial treatment.(11)Malocclusions can be assessed using various methods(12-15) but no one has gained universal acceptance. Index of Orthodontic Treatment Need (IOTN) was developed to grade malocclusion on basis of various occlusal traits significance for dental health and esthetic impairment (16) It incorporates a dental health component (DHC) based on recommendations of Swedish medical board and an esthetic component.(17) The Dental Aesthetic Index (DAI) has been recommended by WHO to gather information of malocclusion prevalence and orthodontic treatment need worldwide.(11) Angle's classification of malocclusion developed in 1890s was the corner stone in orthodontics, as it includes the first clear and simple definition of normal natural human occlusion.(18) Despite many drawbacks and many newer classifications available today, Angle's classification is still the most widely used in epidemiological studies. Its major drawback is that it had taken into account only anteroposterior deviations in sagittal plane. Thus, reliability testing of intra-/ inter-examiner errors showed relatively high figures. (19)

A systematic review and meta-analysis of 77 of studies from 2009 to 2019, declared that the worldwide prevalence of malocclusion among children and adolescents was 56% with no gender difference. Higher percentage noted in Africa (81%), in Europe (71%), in America (53%) and Asia 48%.(20) Danish children and adolescents aged 9 to 18 years showed that 14% had normal occlusion, 58% had Class I, 24% had Class II and about 4% had Class III malocclusion,4 while less normal occlusion and more Class I was noted in Norwegian children aged 7 to 8 years; normal occlusion was 1.3%, Class I was 30.1%, Class II was 21.3%, and Class III was 7.3%.21 An ethnically Chinese children 12 to 14 years of age in Australia showed that 7.1% had normal occlusion, 58.8% had Class I, (21).5% had Class II and 12.6% had Class III malocclusion. (22) The USA survey found that 50% of children group had well-aligned incisors and remaining had some degree of crowding/misalignment; severe Class II and Class III problems were seen in 4% of the population; 30% showed normal occlusion; Class I was 50 % - 55 %, Class II was 5%, and less than 1% had Class III malocclusion.(23) Brazilian schoolchildren with mixed dentition showed occlusal problems of 49.0% in deciduous dentition and 71.3% in permanent dentition.(24) In India malocclusion varies from 20 - 43 % (25) and in Jaipur (26) about 66.7% had malocclusion and only 33.3% had normal occlusion; highest was Class I (57.9%), while Cass III was the least (1.4%), prevalence of Class II division 2 (1.9%) and Class III (1.4%).

An Indian survey(27) of children in remote villages showed that malocclusion was only 14.4%; a majority of these (10.5%) were mild malocclusion, 3.7% had moderate to severe malocclusion; 80.1% of school children had little or no malocclusion requiring no or little orthodontic treatment need, 19.9% of school children had malocclusion requiring elective to mandatory orthodontic treatment. In Nagpur, Class I was 77.29%, Class II 5.04% and Class III 2.50%, and occlusal variation is independent of sex.(28) In

Jammu, subjects aged between 13-14 years 83% had malocclusion. Class I 67%, Class II div One 8%, Class II div Two 6%, and Class III 2% of sample size.(29) Hence, a definite ethnic trend in prevalence of malocclusion type in India from north to south noted; prevalence of class II in Bangalore (5%) was much lower compared to 10—15% in Delhi.27

Malocclusion in China was evaluated through a total of (31) qualified research describing 51,100 Chinese children aged 2–7 years. The pooled malocclusion prevalence was 45.50%; Class I was 26.50% Class II was 7.97%, and Class III was 12.60%. The overbite was more prominent (33.66%), with no significant difference in malocclusion by gender or urban/rural area.(30) Nigerian school children (229 males and 212 females) showed that 15.9% had normal occlusion, 80.7% had Class I and 1.1% had Class II div 1, 0.5% had Class II div 2 and 1.8% Class III malocclusion.(31) Tanzanian work on malocclusion prevalence and its association with socio-demographic characteristics, caries experience, and level of oral hygiene among 1601 schoolchildren aged between 12- to 14-years found that majority (93.6 %) showed a Class I while Class II and Class III malocclusions were reported in 4.4 and 2.0 %, respectively.(32) Kenyan school children reported that 39% had malocclusion, (33) while Sudanese children sample showed 78% with Class I followed by class II (11%) and class III (3%).34 A random sample of 200 Syrian children aged between 8 to 13 years found one third of sample had moderate to great need for orthodontic treatment, no difference in treatment need regarding the genders.(35) In Al-Najaf city, Iraq two groups (788 females & 584 males) aged 12-17 years reported that Class I was 88.04%, whereas 8.03% showed Class II Div.1, 1.31 % exhibit Class II Div. 2 and Class III was 2.3%. Class I showed maximum prevalence, followed by Class II/1 and Class III, while Class II/2 showed the lowest percentage. (36) A descriptive cross-sectional random study of adolescents Saudi Arabia reported that Class I was 52.8%, Class II was 31.8%, and Class III was 15.4%.37 Prevalence of malocclusion in Israeli population (95.9%). (38)

El-Hadary and Aboul-Azm (39) evaluated malocclusion in 600 Egyptian adult males recorded Class I in 52% while 8% and 4% of them had class II and III respectively. The occlusal variation among Egyptian adults in 501 subjects (age 14 - 24 years) found that 34.3% had normal occlusion while 65.5% showed malocclusion; classes I, II, III were 33.3%, 21%, and 11.3% respectively.(40) Prevalence of malocclusion among school children in Cairo governorates was screened in 1936 schoolchildren and found that 497 children (25.7%) had accepted occlusion while, 997 children had Class I malocclusion (51.5%), 318 children had Class II (16.4%) while 115 children had Class III and 9 children had Class IV (0.5%). The most frequent category was normal overjet (>0–3.5mm) which was found to be (71.8%). Anterior open bite (<0 mm) was found in (5.9%). There was a tendency toward decrease in the prevalence of accepted occlusion while, there was an increase in Angle Class II and III malocclusion.(41) Another Egyptian study showed that 497 children (25.7%) had accepted occlusion while, 997 children had Angle Class I malocclusion (51.5%), 318 children had Class II (16.4%), while 115 children had Class III (5.9%), and 9

children had Class IV (0.5%) of the study sample. Normal overjet (>0–3.5mm) found to be (71.8%), and anterior open bite (<0 mm) was found in (5.9%) of the total sample.(42) The present study was undertaken to shed some light on prevalence of malocclusion in one of Egyptian governorates as a part from a whole survey covering several areas in Egypt.

Subjects And Method

Sample Size Calculation:

Qena governorate is one of Egyptian governorates, located in the southern part of the country (600 km south of Cairo), it covers a stretch part of Nile valley and its capital is Qena city. Its area is 9565 km2 with population of 3302894 (representing 3.4 % from Egyptian population); it includes 9 cities with a population of 614864 and a total of 152 villages with a population of 2688030, living on only 199.4 km2. Included sample size was calculated on basis of Egyptian population consensus (2018); Egyptian population between ages of 10 – 34 years was 40603425 (representing 41.39 % from total population), while same age groups of Qena population was 1392102 (41.63 % from its population). Based on these data a total of 1392 subjects (0.1 % from these age groups (698 males and 694 females) from different cities and villages were randomly included from each area determined proportionately depending on percentage of total population (Table 1); this survey was conducted over a period of six months of the year 2019. The study protocol was reviewed and ethical clearance was obtained before the start of the study from the Ethical approval Committee of Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt. An official permission was obtained from Qena authority of health and population. The parent / guardian of the child provided the consent on behalf of the patient.

Inclusion / Exclusion Criteria: (a) Children, young adults, and adults of both genders born to Egyptian parents having an age range from 10-34 years, (b) Presence of incisors teeth and first permanent molars on the both jaws, were included, while subjects with craniofacial anomalies that affect jaw relation and dentition, facial trauma or surgery history, presence of systemic diseases that affect craniofacial growth, and previous orthodontic treatment were excluded.

Area	Population between 10-34 years	Estimated Sample Males	Estimated Sample Females	Total Sample
1. Abotesht	113132	57	56	113
2. Farshout	131220	68	64	132
3. Naga Hamamady	199012	99	100	199
4. Alwaqf	191141	95	96	191
5. Deshna	141012	70	71	141
6. Qena	221010	110	111	221

7. Qous	141142	70	72	142
8. Qoft	114103	57	58	115
9. Naqadah	136130	72	66	138
TOTAL	***1392102***	***698***	***694***	***1392***

Table 1: Demographic data of the included sample

Methods:

I. Clinical Examination:

A Questionnaire was prepared; its forum included questions concerning age, education level, socio-economic level, systemic and oral health status, habits, smoking, and tooth brushing use. A group of dentists were enrolled in well training course regarding the proper screening of the patient in dental practice to collect the questioner data from participants and to determine the state of teeth occlusion, either normal occlusion or malocclusion. Following this trained course two dentists working at each geographic location were chosen to perform that job, while the final decision regarding determination of malocclusion types as well as biting condition was carried out by one person **(**the main examiner**)**. Subjects were examined in dental chair in an upright position under good artificial illumination by a single examiner after obtaining the informed consent from them / their parents prior to clinical examination. They were instructed to occlude on posterior teeth to assess anteroposterior, vertical and transverse dental relations using latex gloves, mouth mirrors and electronic digital caliper. After that he / she were asked to open the mouth for intra-oral assessment.

Malocclusion was recorded according to Angle's classification, (18) as following:

Accepted Occlusion: categorized if molar relationship showed normal occlusion **(**mesiobuccal cusp of upper first permanent molar occluded in anterior buccal groove of lower first permanent molar**)**, average overbite 1-4mm, average overjet **(**>0 to3.5mm**)** with proper teeth alignment.

Class I Malocclusion: when mesiobuccal cusp of maxillary first permanent molar occluded with buccal groove of mandibular first molar, where the teeth were approximated in centric occlusion.

Class II Malocclusion: when lower first permanent molar was positioned distally more than one half unit **(**>3 mm**)** relative to upper first permanent molar.

Class III Malocclusion: lower first permanent molar was mesially positioned more than half unit **(**> 3mm**)** relative to upper first permanent molar.

II. Orthodontic Treatment Need:

Was assessed for subjects exhibiting any type of malocclusion applying the criteria of IOTN.17 Orthodontic treatment grades using DHC of IOTN index were recorded for each subject are assorted as

Grade 1 (no treatment need), Grade 2 (mild need), Grade 3 (moderate need), Grade 4 (severe need) and Grade 5 (extreme need). Subjects with malocclusion were asked about the reason for seeking / not seeking orthodontic treatment.

Statistical analysis

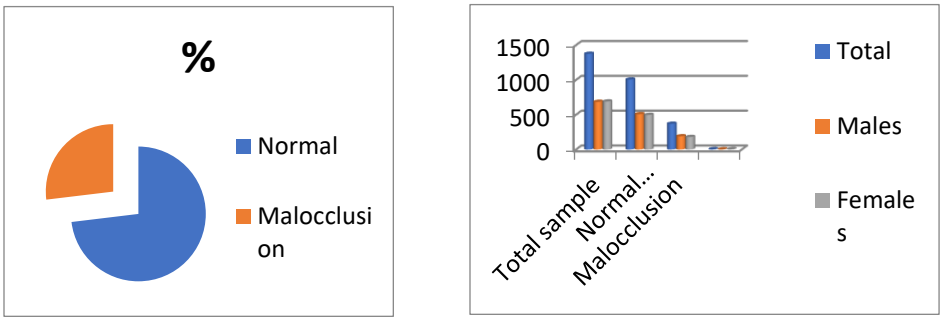
Qualitative data were presented as frequencies and percentages, Numerical data were presented as mean; standard deviation (SD). Data were analyzed using Statistical Package for Social Sciences Windows, version 15.0 (SPSS, Chicago, IL, USA). Categorical variables were analyzed using chi-square test of Pearson to determine differences in prevalence rates between genders. P value for statistical significance was set at 0.05.

Results

The distribution of occlusion types, malocclusion types, recorded from the whole included sample, according to geographic location in Quena governorate, gender type as well as age groups was presented in Table 2 and 3, and Figures 1 and 2.

	Included sample			***Normal Occlusion***			***Malocclusion***		
Area	T	M	F	T	M	F	T	M	F
1. Abotesht	113	57	56	80	40	40	33	16	17
2. Farshout	132	68	64	95	48	47	37	18	19
3. Naga Hamamady	199	99	100	160	79	81	39	19	20
4. Alwaqf	191	95	96	140	69	71	51	25	26
5. Deshna	141	70	71	90	45	45	51	26	25
6. Qena	221	110	111	160	80	80	61	31	30
7. Qous	142	70	72	100	51	49	42	21	21
8. Qoft	115	57	58	82	41	41	33	16	17
9. Naqadah	138	72	66	98	50	48	40	20	20
▪ ***Total*** ▪ ***%*** ▪ ***P***	1392	698 *50.14*	694 *49. 86*	1005 72.20	503	502	387 27.80	192	195

Table 2: Frequencies of occlusion type in studied subjects from all areas of Qena Governorate.



(A) (B)

Fig. 1: Percentage of Normal occlusion and Malocclusion **(**A**)**, and frequencies of subjects with normal occlusion and with malocclusion according to gender type **(**B**)**.

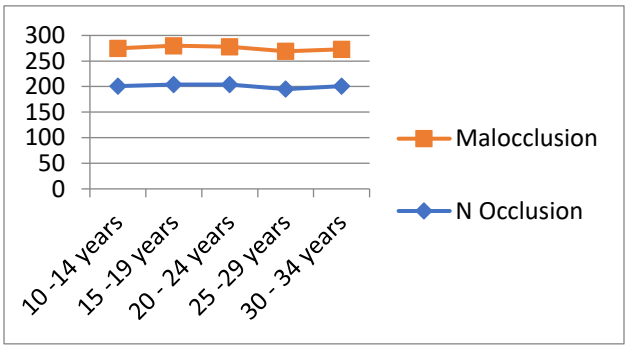


Fig. 2: Frequencies of normal occlusion and malocclusion according to age group in the total sample included in the present study; no differences were noted.

Age Group	**Normal occlusion**			**Malocclusion**			*P*
	Males	Females	Total	Males	Females	Total	
10 - 14 years	102	99	201	39	35	78	*ns*
15 - 19 years	103	101	204	40	40	80	*ns*
20 – 24 years	102	102	204	40	36	76	*ns*
25 – 29 years	99	96	195	39	39	78	*ns*
30 - 34 years	102	99	201	38	37	75	*ns*
Total of each gender	508	497	1005	192	185	387	*ns*

Table 3: Distribution of occlusion state recorded in whole sample according to the age group

Distribution of Angle's Malocclusion type according to Gender type:

A total of 295 subject had Class I malocclusion **(**21.3 %**)**; they were 148 males **(**50.17 %**)** and 147 females **(**49.83 %**)**; 75 subjects with Class II **(**Division I & II**)** malocclusion; they were 36 males **(**48 %**)** and 39 females **(**52 %**)** representing a ratio of 5.3 %, while only 17 subjects **(**9 males and 8 females**)** had Class III malocclusion, representing a ratio of 1.2 % **(**Fig. 3**)**.

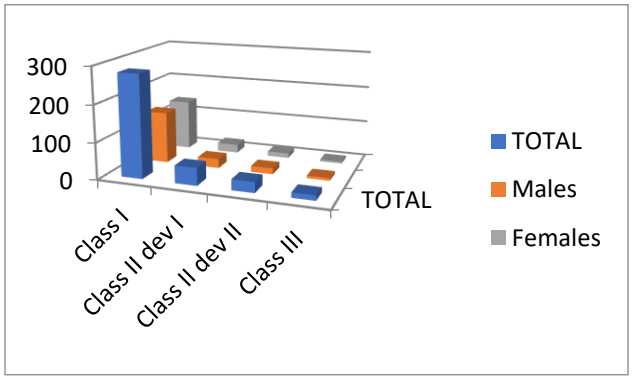


Figure 3: Distribution of malocclusion types in the whole included sample according to Gender type.

Treatment Needs Results:

The results showed that 31.90 % were in need to have orthodontic treatment Grades 4 and 5, whereas 32.43% of subjects were in Grade 3 **(**borderline**)**, while 35.67 % of subjects did not require orthodontic treatment, as they were below Grade 1 and 2 **(**Table 3**)**. The comparisons between them showed statistically significant differences **(**p ≤ 0.05**)** between subjects did not require orthodontic treatment **(**Grades 1 & 2**)** and the other groups required orthodontic treatment **(**Grade 3 and Grades 4 &5**)**, but these two last groups did not differ significantly **(**p> 0.05**)**.

Grade	Need for Treatment	Males N %	Females N %	Total N %		*Chi-square*	*P*
Grade 1 &2	No need for treatment	71 (53.78)	61 (46.22)	132	35.67	0.1672	0.9201
Grade 3	Borderline	60 (50)	60 (50)	120	32.43		
Grade 4 & 5	Definite treatment	59 (50)	59 (50)	118	31.90		
Total		*190*	*180*	*370*			

Table 3 Dental health components of IOTN grades

Discussion

Malocclusion represents a relevant oral health problem and an economic burden for either family of affected children and dental health public services. Although malocclusion development may be due to genetics, environmental factors may be responsible as well. Lack of oral hygiene, large amounts of sugar

intake, which leads to carious lesions of teeth and correspondingly early loss of deciduous teeth, little or no dental care in suburban locations, are factors that contribute to development of malocclusions. Malocclusion reaches its highest prevalence worldwide in early childhood during the deciduous dentition period (54%) and keeps unvaried in permanent dentition (54%).6, 11 Epidemiological surveys in any country provide a meaningful data and play an important role toward planning and implementation of dental services.

This is the first study to provide information about prevalence of malocclusion and orthodontic treatment needs among representative population sample from Governorate of Qena (Upper Egypt). Additionally, attention was paid to do reviewing of similar studies performed in other countries all over the world, to be able in discussing situation of malocclusion in Egypt with those in these countries. Prevalence of malocclusions as well as demand for orthodontic therapy has been studied in different ethnic groups' yielded different data with great variability of the survey manner like developmental status, clinical examination method, sample size and characteristic of different ethnic groups. (20-22)

The prevalence of malocclusion vary by country, age and sex; very few studies were carried out in Egypt to assess malocclusion prevalence.(39 – 42) the pooled global prevalence of Class I was highest (74.7 ± 15.17%), ranging from 31% (in Belgium) to 96.6% (in Nigeria), among Africans (89.44%), among Caucasians (71.61%) and Mongoloids (74.87%). Global prevalence of Class II reported a ratio of 19.56%, with a wide range from 1.6% (Nigeria) to 63% (Belgium); its lowest prevalence among Africans 6.76%, while the highest among Caucasian (22.9%). Global prevalence of Class III was the lowest (5.93 ± 4.69%); ranging from 0.7% (Israel) to 19.9% (China). A tendency to develop Class III malocclusion appears to increase upon transition from mixed to permanent dentition among Africans and Caucasians. (20)

The results of present study found that normal teeth occlusion had a ratio of 72.2%, much more than a previous Egyptian study 42 (27.5%), in Britain 43 (67.3%), in Libyans 44 (3%), Iranians 45 (4%) and Chinese 22 (7.1%). Prevalence of maloc¬clusion (27.8%) was lower than that of an Israeli population 38(95.9%); this difference could be due to different eth¬nic / environmental considerations. Class I malocclusion prevalence showed percentage of 21.35%, which was lower to that of a previous Egyptian study 42 (65.1%), Nigerian study 31 (50.0%). Angle Class II prevalence was (5.22%) in this study which is higher than that of a similar previous Egyptian study 42 (4.7%) and that of Tanzanian32 (3%), but less than reported in Kenyan populations 33 (7.9%) as well as in Turkey 46 (44.7%). Class III prevalence in present study was (1.23%) which was lower than that of previous Egyptian study 42 (2.7%) and those of Saudi Arabians37 (3%) as well as of Jordanians47 (1.4%).

Additionally, it was much lower than in Chinese population6 (19.9%), and Kenyan population33 (16.8%). An Egyptian study 39 assessed Angle's malocclusion types in sample of 600 Egyptian male adults (18

years old in average) and found that Class I was 52%, while Class II and III showed ratio of 8% and 4% respectively. The findings of the present study did not lend support to these findings; such controversy can be attributed to sample size and age groups of the included sample.

The results of this study showed that 295 subjects from a sample of 1392 (27.8%) exhibiting teeth malocclusion; Class I (21.2%), Class II (5. 3%) and (1.3%) had Class III. These results clearly declared that the most prevalent malocclusion was Class I followed by Class II, while the least prevalent malocclusion was Class III, which agree with Saudi study 37, but did not agree with that in Nigerian study and Turkish study; as they reported higher percentage of Class I malocclusion (76.5% and 74 %, respectively), as well as with an Iranian study on adolescents showed that, prevalence of Class I, Class II division 1, Class II division 2, and Class III malocclusions were 41.8%, 24.1%, 3.4%, and 7.8% respectively.

Same finding was reported from a study examined 16-year-old Jordanian school children and found that Class I was the most prevalent, followed secondly by Class II and at last Class III.47 Results, also, revealed that malocclusion was distributed, nearly, equal between the males (48 %) and the females (52 %); there was no significant difference in prevalence of malocclusions between genders, although other studies 48, 49 reported slight differences in the ratios between the genders. On the other hand, a significant difference in distribution of malocclusion between genders (23.7% among males and 28.8% among females) was reported in a Pakistani study. 50 It would be of hard task to draw any conclusion regarding reason for this difference, perhaps it may be attributed to the geographical features. Normal bite was detected in 67.6 %, a finding nearly similar to that of Saudi study found normal bite in 60.4 % of the included sample.(37)

Regarding the orthodontic treatment need determination, it was found that that 31.90 % of all included subjects were in need to have orthodontic treatment Grades 4 and 5, whereas 32.43% of subjects were in Grade 3 (borderline), while 35.67 % of subjects did not require orthodontic treatment, as they were below Grade 1 and 2 ; these findings agree with a study reported that approximately 30% of adolescent Kuwaiti females had a definitive orthodontic treatment need (Grades 4 and 5)51, and with findings of British school children sample categorized 34.8% in grades (1 or 2, no or little need respectively) and 33.2% in grade 3 (moderate need), and 32% in grades 4 or 5 (great or very great treatment need, respectively).(41) However, this disagree with a study found that 18.39% of an Iranian population were severely need treatment; 25.8% were border line while 48.1% had a slight need and 7.63% had no need for treatment, 52 as well as with other studies in Hong Kong included male dental school students using Occlusal Index found that 41.7% need early orthodontic treatment and 24.1% need comprehensive orthodontic therapy for malocclusion management,33 Dutch study found that 39% was in need to treatment while only 14% were not in need.40 Additionally, the obtained results were far away from those of a study include Nepal school children aged 12- to 15-year-old, and found that 21.59% require

extreme treatment need, 24.67% require severe treatment need, 24.07% require moderate treatment need, and 14.7% require mild treatment need, while 15.02% require no treatment need.53 Higher figures was reported by Turkish survey that **(**47% **)** of subjects had definite need for orthodontic treatment,54 although two other Turkish studies reported that 92.53% 38 and 90.4 % of student 39didn't feel the need of orthodontic treatment.

It is of interest to mention that, the responsibilities for orthodontic treatment are linked mainly on the patients / parents. Hence, the probability of seeking an orthodontic treatment has been influenced mainly by the cultural and socio-economic levels of the family, rather than by the patient's malocclusion severity. Hence, degree and priority of orthodontic treatment need among populations cannot be verified just through evaluating the malocclusion prevalence. In this respect, new policies including early children's visits to dental clinics, preventive as well as minimally invasive treatment procedures can be adopted early to validate an adequate preservation of oral health status. Further studies investigating the patient's perception / concern regarding malocclusion prevalence / severity as well as orthodontic treatment needs should be carried out toward better clarification.

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