EGYPTIAN DENTAL JOURNAL
VOL. 66, 2007:2014, OCTOBER, 2020
PRINT ISSN 0070-9484 • ONLINE ISSN 2090-2360
ORTHODONTICS, PEDIATRIC AND PREVENTIVE DENTISTRY
www.eda-egypt.org • Codex : 58/2010 • DOI : 10.21608/edj.2020.38030.1195

MALOCCLUSION AND ORTHODONTIC TREATMENT NEEDS AMONG TANTA SECONDARY SCHOOL STUDENTS

Ahmed Ibrahim El Dosoky* *and* Mohamed Hassan El Bayomy*

ABSTRACT

Objective: To determine the prevalence and severity of malocclusion and orthodontic treatment needs among Tanta secondary school students and to analyze the relationship with gender and type of school.

Methods: The study followed the World Health Organization recommendations for oral health surveys. Stratification of the sample was performed according to the district, type of school, and gender. The sample comprised 668 school students (290 males and 378 females) using the indexed age of 15 years. Mean, standard deviation, minimum, and maximum of DAI scores were calculated. Also, data were analyzed with regard to gender and school type using the chi-square test.

Results: 78.7% of the examined students had normal occlusion with no treatment indicated. Meanwhile, students with definite, severe, and handicapping malocclusion in need of elective, highly desirable, and mandatory orthodontic treatment accounted for 14.1%, 4.2%, and 3% respectively. The mean DAI score of all the examined students was 22. There were no statistically significant associations between gender or school type and the severity of the malocclusion ($p>0.05$).

Conclusion: the present results emphasized that the majority of secondary school students have normal occlusion while those with severe or handicapping malocclusion represent minorities.

INTRODUCTION

In recent years there has been a steady increase in the number of young adults seeking orthodontic treatment [1,2]. This led to the phenomenon of the mismatch between the growing demand for orthodontic treatment and the lack of resources needed to provide high-quality services to this population segment [3]. Therefore, rational measurement of malocclusion on a population basis is essential in assessing the resources required for orthodontic treatment services at a community level [4].

Recently, much attention has been focused on measuring the severity and prevalence of malocclusion and orthodontic treatment need world-wide. The recorded frequency of dental malocclusion among different countries has been

* Lecturer at Pediatric Dentistry, Oral Health and Preventive Department, Tanta University, Egypt.

found to vary in various literature resources from 1% up to more than 90% [5-8]. The discrepancy in the prevalence of malocclusion may be due to lack of a standard definition of what constitutes a perfect occlusion, normal occlusion, and biologic variation from the normal [9].

The Dental Aesthetic Index (DAI) has been adopted by the World Health Organization as an international cross-cultural index [10]. DAI scores are designed to reflect aesthetic and psychosocial values without the perceived bias of most other indices [11,12]. With the adoption of DAI by the WHO coupled with its simplicity and high examiner reliability, the index has gained a great international potential to assess various levels of malocclusion and orthodontic treatment needs in epidemiological studies [13-17].

In Egypt, there are few studies investigating malocclusion prevalence and orthodontic treatment needs. In Alexandria governorate, Abd-Elaziz, 1999, using WHO methodology, reported a malocclusion prevalence of 20.8% and 27% among the 12 and 15-year-old students respectively [18]. Another study conducted by Shoukry, 2005among secondary school students in Alexandria using DAI revealed that the mean DAI score was 23.05. The students who had normal occlusion, severe malocclusion, and very severe or handicapping malocclusion accounted for 76.2%, 5%, and 2.3% respectively [19].

Further information on the prevalence of malocclusion in other governorates of Egypt is still needed. This would help to assess the orthodontic treatment needs and to plane for the appropriate treatment for target groups. It will also provide baseline information that can be followed up and monitored over the coming years. Therefore, the present study aimed to assess the prevalence and severity of malocclusion and orthodontic treatment needs among Tanta secondary school students and to investigate their relation to sex and type of school

SUBJECTS AND METHODS

This cross-sectional study was performed in the period between October 2018 and May 2019 based on the WHO document of Oral Health Survey, 2013[20]. The sample size was calculated by the epi info software program with a 5% margin of error, at 95% confidence level, and a design effect in the power analysis 2. The calculated sample was 668 school students (290 boys and 378 girls) using the indexed age of 15 years who were collected from Tanta secondary schools after obtaining approval from authorities.

Sample selection:

Tanta city is divided into two geographical districts: East district and west district. East district contains 17 secondary schools (12 public and 5 private schools). West district contains 19 secondary schools (13 public and 6 private schools). A stratified cluster random sample was selected according to the pathfinder survey methodology [20]. Stratification was performed by the district, type of school, and gender.

The total numbers of secondary schools included in this work were eight schools. Four schools were selected randomly from each district as follows:

- Two public male school
- Two public female school
- Two private male school
- Two private female school

Three classrooms of each public and private school were selected randomly. Students who had orthodontic treatment or were currently wearing orthodontic appliances were not included in this study.

As shown in table (I), the sample consisted of 290 males (43%) and 378 females (57%). Public school students accounted for 73% (488 students), while the number of students selected from the east district was 322 representing 48% of the sample.

Ethical considerations:

Approval for this study was obtained from the research ethics committee, Faculty of Dentistry, Tanta University. Formal letters were directed to the authorities of the ministry of education and directors of the selected schools. The purpose of the study was explained to the participants and informed consents were obtained from them and their parents to be involved in the research according the guide lines on human research published by research ethics committee.

TABLE (I): Secondary school students according to gender, school type and residence

Character	Number	Percentage
Male	290	43%
Female	378	57%
Public	488	73%
Private	180	27%
East district	322	48%
West district	346	52%
Total	668	100%

Clinical examination:

Clinical examination was performed during the school hours and the students were informed about their rights to participate in the study.

Examinations were performed inside the classrooms, under daylight, with students seating in classroom chairs in a position receiving maximum illumination. Artificial light source was only used when the natural light was not enough by seating the student away from natural light to avoid variation in illumination. Two calibrated examiners performed all examinations, using plane mouth mirror, CPI probe, disposable paper towels, cotton for cleaning the teeth, disposable latex gloves, and 2% glutaraldehyde for both disinfection and sterilization.

Assessment of malocclusion and orthodontic treatment need:

Malocclusion was assessed using the DAI [10]. The DAI components and their weightings are summarized in table (II). The DAI score for each student was obtained from summed products of the components with their respective weightings "regression equation" plus the addition of a constant. Based on DAI scores, the severity of malocclusion and orthodontic treatment need were prioritized to the predefined four categories of no or minor malocclusion with no or slight orthodontic need (DAI≤25), definite malocclusion with elective treatment need (DAI: 26-30), severe malocclusion with highly desirable treatment need (DAI: 31-35) and very severe or handicapping malocclusion with mandatory orthodontic treatment (DAI ≥36).

TABLE (II): The standard DAI regression equation.

DAI components	Recorded weight
Number of missing visible teeth (incisors, canines, and premolar teeth in maxillary and mandibular arches)	6
Crowding in the incisal segment; 0 = no segment crowded, 1 = one segment crowded, 2 = two segments crowded.	1
Spacing in the incisal segment: 0 = no spacing, 1 = one segment spaced, 2 = two segments spaced.	1
Midline diastema in millimeters	3
Largest anterior irregularity on the maxilla in millimeters	1
Largest anterior irregularity on the mandible in millimeters	1
Anterior maxillary overjet in millimeters	2
Anterior mandibular overjet in millimeters	4
Vertical mandibular open bite in millimeters	4
Antero-posterior molar relation, largest deviation from normal either left or right: 0 = normal, 1 = 1\2 cusp either mesial or distal, 2 = one full cusp or more either mesial or distal	3
Constant	13
Total	DAI score

Data reliability:

Intr-examiner reliability was assessed before the start of the study (Kappa 0.84). Duplicate examinations, also, were performed at the start, about halfway, and at the end of the survey to emphasize the inter-examiner consistency throughout the whole survey.

Statistical analysis:

Data collection, presentation, and analysis were performed by using SPSS (Statistical Package for the Social Sciences), IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. Mean, standard deviation, minimum, maximum, and chi-square test were used according to the need**.** The level of significance used was 5%

RESULTS

Table (III) shows the distribution of the mean Dental Aesthetic Index scores, minimum and maximum scores, and the frequency of the various DAI severity groups in the study sample. Students who had normal occlusion or minor malocclusion with no treatment indicated accounted for 78.7%. On the other hand, students with definite, severe, and handicapping malocclusion in need of elective, highly desirable, and mandatory orthodontic treatment accounted for 14.1%, 4.2%, and 3% respectively. The mean DAI scores of the students with normal occlusion, definite malocclusion, severe malocclusion, and handicapping malocclusion were 18.7, 28, 32.6, and 41 respectively. Collectively, 142 students (21.3%) had some form of malocclusion and were in need of orthodontic treatment, while the mean DAI score of all the examined students was 22.03.

Association between gender and malocclusion severity is shown in table (IV). Male students who had normal occlusion, definite, severe, and handicapping malocclusion represented 81.4%, 12.4%, 3.4%, and 2.8% of the total male sample respectively. On the other hand, the corresponding values for female students were 76.7%, 15.3%,

TABLE (III): DAI scores for the various levels of malocclusion and orthodontic treatment needs

DAI score group	Mean (S.D)	Minimum	Maximum	Number
≤25 (normal or minor malocclusion with no or slight treatment need)	18.7 (3.2)	13	22	526 (78.7 %)
26-30 (definite malocclusion with treatment elective)	28 (1.48)	26	30	94 (14.1%)
31-35 (severe malocclusion with treatment highly desirable)	32.6 (0.9)	31	34	28 (4.2 %)
≥36 (very severe or handicapping malocclusion with treatment considered mandatory)	41 (1.8)	36	59	20 (3 %)
Total	22.03 (4.7)	13	59	668 (100 %)

TABLE (IV): Association between gender and DAI score groups

Gender	DAI score groups				
	≤25	26-30	31-35	≥36	Total
Males	236 (81.4 %)	36 (12.4 %)	10 (3.4%)	8 (2.8 %)	290 (100%)
Females	290 (76.7%)	58 (15.3%)	18 (4.8%)	12 (3.2%)	378 (100%)
X^2	1.11				
P - value	0.77				

TABLE (V): Association between the type of school and DAI score groups

Type of school	DAI score groups				
	≤25	26-30	31-35	≥36	Total
Public	376 (77 %)	74 (15.2 %)	22 (4.5 %)	16 (3.3 %)	488 (100 %)
Private	150 (83.3 %)	20 (11.1%)	6 (3.3 %)	4 (2.2 %)	180 (100 %)
X^2	1.56				
P - value	0.66				

Fig. (1) Various levels of malocclusion and orthodontic treatment needs 2nd comment: Selecting public and private schools to represent the social and the economic status of children is has limited validity.

4.8%, and 3.2% respectively. There was no statistically significant association between sex and the level of malocclusion ($X^2 = 1.11$, p= 0.77).

Regarding the type of school, the percentages of public-school students who had normal occlusion, definite malocclusion, severe malocclusion, and handicapping malocclusion were found to be 77%, 15.2%, 4.5%, and 3.3% of the public-school students respectively. While the corresponding percentages of the students enrolled in private schools were 83.3 %, 11.1 %, 3.3 %, and 2.2 % respectively. (Table V). The association between type of school and the severity of malocclusion was not statistically significant ($X^2 = 1.56$, p= 0.66).

DISCUSSION

The large expansion of orthodontic practice and increasing demand for orthodontic care globally highlights the need for providing oral health care planners with adequate information about the prevalence of malocclusion and orthodontic treatment needs [21-23]. This is especially important at the age when occlusion has established and that represents the majority of the candidates of orthodontic care [24].

Dental Aesthetic Index (DAI) used in this study as an instrument for ranking the severity of malocclusion and prioritizing treatment relevant to the severity of the case has a documented reliability and validity and has been widely used in epidemiological studies [13-16]. DAI is designed to assess the relative social acceptability of dental appearance based upon public perception of the dental aesthetic in all countries without adjusting it for each country [3]. Therefore, it has become a universally accepted method for reliably assessing occlusion and objectively comparing the malocclusion in different populations [17].

In this study, a representative sample was attempted by following the pathfinder survey methodology as guided by WHO, 2013 including non-orthodontically treated students of both sexes at different types of secondary schools and different geographic locations in Tanta city. The examiner had to pass an inter-observer calibration test before the start of the study which resulted in satisfactory conformity (kappa= 0.84) and the risk of methodological misjudgment was consequently considered to be small.

Many studies have described the distribution of malocclusion in diverse populations. However, the lack of similarly-defined criteria in previous studies [25-28] jeopardizes the direct comparison with the results of the present work. Compared with the data from western countries using the same index, the 21.3% prevalence of malocclusion recorded in this study was lower than that reported among Italian and Brazilian schoolchildren of the same age group (63% and 62% respectively) [29,30]. Also, the mean DAI reported by Jhonson and Harkness, 2000[31] and Baca et al., 2004[32] in New Zealand and Spain (28.3 and 25.6 respectively) were higher than the mean DAI of 22 reported in the current work. Likewise, the orthodontic treatment needs in previous studies were substantially higher than the present one. Because ethnic and racial differences of malocclusion pattern has been repeatedly documented [33,34], these differences in malocclusion figures are not unexpected.

In Egypt, differences in registration methods and indices used could, in part, explain the higher prevalence of malocclusion among Egyptian children recorded during the last years compared to this study. Tow earlier studies using Angel's classification reported that 67% and 74% of Egyptian children have some form of malocclusion [35,36]. Also, El-Mangoury and Mustafa, 1985 and Afifi and Hafez, 1993 recorded, according to Angl,s classification, a malocclusion prevalence of 65.5% and 68% among Cairo and Matrouh schoolchildren respectively[37,38]. This disparity of results may, also, be attributed to the different survey sampling methodology and the different times of survey conduction.

On the other hand, the results of this study nearly approximated that of the oral health survey of secondary school students performed in Alexandria governorate from 2003 to 2005 which revealed a high prevalence of normal occlusion (76.2%) with a mean DAI of 23.05 [19]. The close approximation of the results obtained by these two surveys performed in two governorates in Egypt may be due to the approximate time of conduction. Additionally, both surveys were designed according to the national pathfinder survey methodology with a rigid adherence to the WHO criteria of DAI.

In the present work, no significant difference in malocclusion prevalence or orthodontic treatment need was found between males and females ($p>0.05$). This was consistent with the results of some studies conducted in Egypt during the last years that reported no gender difference regarding the distribution of all types of malocclusion [38, 19, 39]. However, this was not consistent with El-Mangoury and Moustafa, 1985[37] and Abdel-Aziz, 1999[18] who reported that malocclusion was significantly higher among females.

Also, this study revealed no significant effect of the type of school, as a determinant of social background, on the prevalence of malocclusion. This contradicted the findings of Ansai et al., 1993[40] and Shoukry, 2005[19] who suggested that oral habits, caries level, and premature extraction, that cause reduced arch space and increase malocclusion prevalence, are strongly associated with socioeconomic status. The non-significant correlation between the type of school and malocclusion prevalence noted in this work may be attributed to the fact that the variation of socio-economic status in Tanta city, which is a rural city, is not great enough to show a significant difference in the malocclusion level.

In the present work, despite using an index of high comparability as well as the homogeneity of the sample, some limitations have to be considered in interpreting the results. First, depending on chronological, rather than dental age, that may vary in between males and females of the same age, might have reduced the like hood of detecting gender differences in malocclusion prevalence in the present study. Another limitation could arise from the fact that the subjective needs, as well as cultural context that may be crucial for an in-depth estimate of the orthodontic needs of the students, were not investigated. However, it is hoped that the findings of this study will be useful for oral health services planners to determine the priority for orthodontic treatment to the population segment in need of them as a part of the comprehensive dental care.

In conclusion, this study emphasized that the majority of secondary school students have normal occlusion while those with severe or handicapping malocclusion are minorities with no gender or school type-dependent differences.

REFERENCES

1. Lauc T. Orofacial analysis on the Adriatic island: an epidemiological study on malocclusions on Hvar Island. European Journal of Orthodontics. 2003, 25:273-278.
2. Gunatissa CN, Pathirage SL, Ratnayaka N. The prevalence of malocclusion and orthodontic treatment need among 15-year-old school children in Galle district in Sri Lanka: An epidemiological study. APOS Trends Orthod. 2016; 6:256-60.
3. Agarwal A, Mathur R. An Overview of Orthodontic Indices. World J Dent. 2012; 3 (1): 77-86.
4. Behbehani F, Artun J, Al-Jame B, Kerouso H. Prevalence and severity of malocclusion in adolescent Kuwaitis. Med Princ Pract. 2005, 14:390-395.
5. Kumar CP, Brig SM, Kotwal CA, Mitra CR. Prevalence of malocclusion and orthodontic treatment need in schoolchildren - An epidemiological study. Medical journal Armed forces India. 2013: 69: 369-374.
6. Alatrach AB, Saleh FK and Osman E. Prevalence of Malocclusion and Orthodontic Treatment Need in A Sample of Syrian Children. European Scientific Journal 2014, 10 (30): 230-248.
7. Sanadhya S, Chadha M, Chaturvedi MK, Chaudhary M, Lerra S, Meena MK et al.,: Prevalence of malocclusion and orthodontic treatment needs among 12–15-year-old schoolchildren of fishermen of Kutch coast, Gujarat, India. Int Marit Health. 2014; 65, 3: 106–113
8. Sushanth VH, Krishna M, Suresh Babu AM, Prashant GM, Madan Kumar PD, Shivakumar M. Prevalence of Malocclusion and Orthodontic Treatment Needs among 12 -13 Year Old School Going Children in Chennai City, Tamilnadu, India. Int J Oral Health Med Res 2015;2(2):32-38
9. Bilgic F, Gelgor IE, Celebi AA. Malocclusion prevalence and orthodontic treatment need in central Anatolian adolescents compared to European and other nations' adolescents. Dental Press J Orthod. 2015;20(6):75-81.
10. World Health Organization: WHO Basic Oral Health Survey, 4th edition Geneva, 1997.
11. Danyluc K, Lavelle C, Hassard T. Potential application of the dental aesthetic index to prioritize the orthodontic service needs in a publicly funded dental program. Am J Orthod Dentofacial Orthop. 1999, 116:279-286.
12. Jhonson M, Harkness M. Prevalence of malocclusion and orthodontic treatment need in 10-year-old New Zealand children. Aust Orth J. 2000, 16:1-8.
13. Alhuwaizi AF& Rasheed TA. Assessment of orthodontic treatment needs of Iraqi Kurdish teenagers using the Dental Aesthetic Index. Eastern Mediterranean Health Journal, 2009. 15, No. 6: 1535-1541.
14. Poonacha1 KS, Deshpande SD, Shigli AL. Dental aesthetic index: Applicability in Indian population: A retrospective study. Journal of Indian Society of Pedodontics and Preventive Dentistry, 2010,28, No. 1: 13-17.
15. Chauhan D, Sachdev V, Chauhan T, Gupta KK. A study of malocclusion and orthodontic treatment needs according to dental aesthetic index among school children of a hilly state of India. J Int Soc Prev Community Dent. 2013 ; 3(1):32-37.
16. Tak M, Nagarajappa R, Sharda AJ, Asawa K, Tak A, Jalihal S, Kakatkar G. Prevalence of malocclusion and orthodontic treatment needs among 12-15 years old school children of Udaipur, India. Eur J Dent. 2013; 7(Suppl 1): S45–S53.
17. Danaee SM, Fijan S, Mohammadi N, Zadeh RZ. Evaluation of relationship between orthodontic treatment need according Dental Aesthetic Index (DAI) and student's

perception in 11-14 year old students in the city of Shiraz. Int J Res Med Sci. 2015;3(5):1056-1060.

18. Abd-Elaziz EW. Oral health survey in the governorate of Alexandria. 1999, PhD, thesis, Faculty of Dentistry, Alexandria University
19. Shoukry M. Prevalence of malocclusion and some oral health conditions among first year secondary school students in Alexandria. 2005, PhD, thesis, Faculty of Dentistry, Alexandria University
20. World Health Organization: WHO Basic Oral Health Survey, 5th edition Geneva, 2013.
21. Fabio C, Lamberto M, Michele D. Prevalence and distribution by gender of occlusal characteristics in a sample of Italian secondary school students: across sectional study. European Journal of Orthodontics. 2005, 27(6):601-606.
22. Chukwudi O, Fwacs E, Begole R. Orthodontic treatment need in an accredited graduate orthodontic center in North America: A pilot study. Journal of Contemporary Dental Practice. 2006, 2(1):1-8.
23. Al-Azemi, R., & Artun, J. Orthodontic treatment need in adolescent Kuwaitis: prevalence, severity and manpower requirements. Med Princ Pract.2010; 19(5), 348-354.
24. Singh S, Sharma A, Sandhu N, Mehta K. The prevalence of malocclusion and orthodontic treatment needs in school going children of Nalagarh, Himachal Pradesh, India. Indian J Dent Res 2016;27:317-22
25. Perinetti G, Cordella C, Pellegrini F, Esposito P. The prevalence of malocclusal traits and their correlations in mixed dentition children: results from the Italian OHSAR survey. Oral Health & Preventive Dentistry. 2008:6(2):119_129.
26. Komazaki Y, Fujiwara T, Ogawa T, Sato M, Suzuki K, Yamagata Z, Moriyama K. Prevalence and gender comparison of malocclusion among Japanese adolescents: a population-based study. Journal of the World Federation of Orthodontists. 2012:1(2):e67_e72
27. DaCosta OO, Aikins EA, Isiekwe GI, Adediran VE. Malocclusion and early orthodontic treatment requirements in the mixed dentitions of a population of Nigerian children. Journal of Orthodontic Science.2016: 5(3):81_86
28. Zhou X, Zhang Y, Wang Y, Zhang H, Chen L, Liu Y. Prevalence of Malocclusion in 3- to 5-year-old children in Shanghai, China. International Journal of Environmental Research and Public Health . 2017:14(3):328
29. Perillo L, Masucci C, Ferro F, Apicella D, Baccetti T. Prevalence of orthodontic treatment need in southern Italian schoolchildren. European Journal of Orthodontics. 2010:32(1):49_53
30. Traeberta E, Martinsb LG, Pereirac KC, Silva SX, Lunardellie SE, Lunardellie AN. Malocclusion in Brazilian Schoolchildren: High Prevalence and Low Impact. Oral Health Prev Dent 2018; 16: 163–167.
31. Jhonson M, Harkness M. Prevalence of malocclusion and orthodontic treatment need in 10-year-old New Zealand children. Aust Orth J. 2000, 16:1-8.
32. Baca A, Bravo M, Baca P. Malocclusion and orthodontic treatment need in a group of Spanish adolescents using the Dental Aesthetic Index. Int Dent J. 2004, 54(3):138-142.
33. Laganà G, Masucci C, Fabi F, Bollero P, Cozza P. Prevalence of malocclusions, oral habits and orthodontic treatment need in a 7- to 15-year-old schoolchildren population in Tirana. Prog Orthod. 2013;14:12.
34. Dimberg L, Lennartsson B, Arnrup K, Bondemark L. Prevalence and change of malocclusions from primary to early permanent dentition: A longitudinal study. Angle Orthod. 2015;85:728–734.
35. El-Hadary ME, Aboul-Azm SF. Malocclusion in male young adults. Tanta Med J. 1977, 5:337-346.
36. Abdel Kader W. The prevalence of malocclusion in a group of Egyptian children. 1980, MS Thesis, Faculty of Oral and Dental Medicine, Cairo University.
37. El-Mangoury NH, Moustafa YA. Occlusal variations among Egyptians. Cairo Dent J. 1985, 1:117-124.
38. Afifi H, Hafez SA. Malocclusion in a group of adolescents of the Tribe of Awlad Ali. Cairo Dent J. 1993, 225-234.
39. Hammad SM & Awad SM. Orthodontic treatment need in Egyptian schoolchildren. Pediatric Dental Journal. 2011,21 (1): 39-43.
40. Ansai.T, Miyazaki H, Katoh Y. Prevalence of malocclusion in high school students in Japan according to the Dental Aesthetic Index. Community Dent Oral Epidemiol. 1993, 21:303-305.