Prevalence of malocclusion in north Cyprus School

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Abstract

Background. The epidemiology of the population living in a country plays an important role in the planning and implementation of dental services. Correct identification of the need for orthodontic treatment in individuals is a very complex subject and requires detailed analysis. The aim of this study was to measure the prevalence of malocclusion among randomly selected subjects aged 12-15 years attending secondary schools regardless of any socio-economic or social status in Northern Cyprus.

Methods. After the approval of the competent authorities in the Ministry of National Education and the Ministry of Health of Northern Cyprus and of the parents whose subjects were to take part in the study, the evaluation was carried out by a team of three people, two of whom are in the process of specializing in orthodontics and one doctoral student at the qualification stage. The study included a randomly selected sampling composed of 426 subjects (203 females and 223 males).

Results. The statistical evaluation of the samples collected in the study found that 20.6% of the subjects had no occurrence of occlusion, 74.4% had Class I, 21.1% had Class II (part 1, 18.8%, part 2, 2.3%) and 4.5% had Class III malocclusion. Of the 419 patients, 86 (20.2%) were in need of orthodontic treatment. Although not statistically significant, it was determined that 19.7% of female patients and 20.7% of the male patients were in need for orthodontic treatment.

Conclusions. The most common orthodontic malocclusion in Cyprus is Class I, the least common malocclusion is Class II division 2.

Background

The World Health Organization (WHO)[1] defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [48]. Malocclusion itself is not a life-threatening condition [5, 22]. However, the negative psychological effect of having a malocclusion can be a serious threat to a person's quality of life [15, 8, 44]. In addition to psychological problems, malocclusion may be the cause of abnormal oropharyngeal functions [34]. Timely orthodontic correction treatment of malocclusion can prevent the formation and development of psychological problems and functional anomalies of the oral cavity [31, 39]. The effect of malocclusions on aesthetics and / or function may vary in severity [13]. The prevalence of malocclusion in subjects varies between 39% and 93% [14, 42, 43]. Based on these criteria some researchers have chosen a single occlusal property measurement or Angle classification in their studies [4].

Many researchers have suggested different indexes to record the condition of malocclusion and the need for orthodontic treatment in community-based studies [9, 16, 30, 35, 43, 47]. The ICON[2] index (The Index of Complexity, Outcome and Need), is universally accepted in determining the need for orthodontic treatment. As the name implies, ICON is an index designed to assess not only treatment difficulties, ICON is also evaluates treatment

outcomes and treatment needs. ICON was developed as an international index based on the common opinion of the 97 orthodontists from 9 countries, including America and 8 European countries by Daniels and Richmond in 2000.

ICON index, a new orthodontic occlusal index, is said to replace IOTN[3], PAR[4] (Peer Assessment Rating and Dental Aesthetic Index) in recent years. [29, 24, 19, 27, 32, 41, 33]. The reason is that ICON, which is easier to use than PAR and IOTN, can measure the need for orthodontic treatment, outcome and difficulty, as well as the level of improvement of the anomalies with a single score, and it is shown that the index provides an easy orthodontic evaluation of a patient in general dental practice [19]. ICON index is learned more quickly, it is applied and it is highly recommended to apply in clinics in recent years as it can collect information other than the need for treatment. However some scholars believed that the relationship between ICON and PAR to be studied further [10]. The authors in a study defining the malocclusion complexity and orthodontic treatment needs of urban Iranian schoolchildren used ICON and IOTN to assess the relationship of these two indices and found out that ICON is a good substitute for IOTN, but ICON leads to a reduction in the need for orthodontic treatment [17].

The clipping value were determined for dichotomous assertion by scheduling specificity, sensitivity and overall accuracy. Thus, a total score of 43 was found as an international threshold for the need of treatment: when the ICON is higher or equal to 43 then the treatment is necessary and in some cases it is vice versa. The index is based on an “average” international orthodontic opinion (97 orthodontists from 9 countries, including America and 8 European countries) and according to the authors it might provide the means for comparing treatment thresholds in different countries and provide the basis for quality assurance standards in international orthodontics [12]. The combined decision of the orthodontists is usually called as the gold standard by which any index should be checked. In Cyprus such a study on the reliability check ICON has not been conducted yet. In the future, it is necessary to conduct a study and find out whether ICON is valid in relation to the assessment of needs, results and complexity in Cyprus and in addition to compare the results of this study as well. For instance, in a study conducted in Dutch orthodontic practice, the international threshold value of 43 for ICON turned out to be inappropriate, as there was found a higher clipping point which is 52 [50]. After the research which took place in the Southern part of China the results have showed that the international ICON clipping value did not correspond well with the Chinese orthodontist opinions for the need of orthodontics. Hence, in this study the international threshold 43 for ICON had a low sensitivity and specificity, in addition there was found a lower clipping point which compiles 29 [51]. Regarding to the need for treatment ICON found good reliability in the United States of America which actually took place after the investigation conducted in central Ohio [52]. In a research conducted in Egypt among the orthodontic patients whose goal was to investigate the reliability of the Index of Complexity, Outcome

and Need (ICON), revealed that ICON is actually can be considered as a reliable index [53]. The study will use the ICON index to assess the need for orthodontic treatment of the current child group. Many studies have been carried out with the aim of investigating the incidence of different dental anomalies, but only a small proportion of them aimed at orthodontic patients. This study was designed upon carrying out a preliminary study to evaluate the prevalence of malocclusion and orthodontic treatment among school subjects in Cyprus was conducted.

[1] The World Health Organization

[2] The Index of Complexity, Outcome and Need

[3] Index of orthodontic treatment need

[4] Peer Assessment Rating and Dental Aesthetic Index

Methods

Random secondary schools in North Cyprus were selected regardless of any socioeconomic classification. A total of 641 individuals aged 12-15 years were examined and chosen as subjects for the study. As a result of the examinations, 34 people who had been previously treated with orthodontic treatment, 11 people who were on treatment and 72 people who were found to be in dentition were not included in the study since they did not meet these eligibility criteria. 39 people enrolled on the class lists were not included in the assessment because they were not at school during the examination. 40 people refused to be examined. 19 people were excluded from the examination because of excessive crown damage and tooth loss and congenital anomalies in the molar teeth (only of teeth 14, 15, 24, 25, 34, 35, 44, 45). Since the dental development of people between 12-15 years of age cover only the permanent dentition period, the continuation of permanent first molar teeth was completed and individuals with occlusion were included in the study and the individuals in the mixed dentition period were not evaluated for the study. Based on these criteria, 223 male and 203 female subjects were determined as the subjects. All the subjects were examined while sitting on a stool in the infirmary room of the school with the aid of an oral inspection kit (mirror, sond, presel and ruler). The examination lasted approximately 15 minutes per child, following the World Health Organization (1985) guidelines. Firstly, the molar relations were determined according to Angle classification, either in this study will use the ICON index to assess the need for orthodontic treatment of the current child group. The index consists of 5 components and each component has a weight coefficient (Table 1) [12].

Component	Score						Weight
	0	1	2	3	4	5	
1 Aesthetic assessment	Score 1 to 10						7
2 Upper arch crowding	<2 mm	2.1 to 5 mm	5.1 to 9 mm	9.1 to 13 mm	13.1 to 17 mm	> 17 mm	5
Upper spacing	<2 mm	2.1 to 5 mm	5.1 to 9 mm	>9 mm		Impacted teeth	5
3 Crossbite	No crossbite	crossbite present					5
4 Incisor open bite	Edge to edge	< 1mm	1.1 to 2 mm	2.1 to 4 mm	>4 mm		4
Incisor overbite	<1/3 lower incisor coverage	1/3 to 2/3 coverage	2/3 up to fully covered	Fully covered			4
5 Buccal segment antero-posterior	Cusp to embrasure only Class I, II or III	Any cusp relation up to but not including cusp to cusp	Cusp to cusp				3

Table 1. Index of Complexity, Outcome and Need (ICON) scoring criteria.

Then, the teeth of all the subjects were examined for crossbite, overjet, openbite, deepbite of all the subjects and the findings were recorded. The necessity for treatment, the difficulty of treatment and the prevalence of malocclusions were determined based on the ICON index results. The clinical examination was carried out by two examiners (01 and 02), who had previously undergone calibration to standardize their procedures. During the examination in schools, intraocular screening was performed after subjects and teachers were given information about what malocclusions are.

Calibration of Examiners

The examiner was calibrated and trained in the use of ICON [12].

Measurement Errors

Before the study, 12 volunteer subjects were examined clinically and reexamined after a one week interval by Examiner 01 and 02. In order to ensure the accuracy and reproducibility of the records, the measurements were repeated twice by the examiners at one week interval according to the nearest 0.5 mm and the average of the two values was used after excluding major discrepancy greater than 0.5 mm [23].

Results

In order to determine the rate of orthodontic anomalies according to the Angle classification, all records were divided into 4 anomaly groups: Class I, Class II Part 1, Class II Part 2, Class III. The results are shown in Table 2. According to this, while 74.4% of all subjects had class I dental malocclusion; class II sections were calculated at 18,8%, class II part 2 were 2,3% and class III were calculated to be at 4,5%.

Table 2. Angle Classification distribution.

Angle's molar relation		N	%
	Class I	230	74,4
	Class II,Division.1	58	18,8
	Class II, Division.2	7	2,3
	Class III	14	4,5

There were no statistically significant differences between these 4 anomalies in terms of gender and as a result no differences were present in any of the orthodontic anomaly groups. However, upon general examination it was noted that more females than males belonged to class II malocclusion division I (Females 53,4%, Males 46,6%). In contrast, class II division 2 malocclusions were found to be slightly more common in males than in females (71.4% male, 28.6% female) (Table 3).

Table 3. Distribution of Angle Classification by gender.

Angle's molar relation		Gender			
		Male		Female	
		n	%	n	%
	Class I	123	53,3	107	46,7
	Class II,Division.1	27	46,6	31	53,4
	Class II, Division.2	5	71,4	2	28,6
	Class III	7	50,0	7	50,0

An objective evaluation to determine the need for orthodontic treatment concluded that 20.2% of subjects were in need of orthodontic treatment and 79.8% of subjects were not in need according to ICON index (Table 4). A total score of 43 was found as an international threshold for the need of treatment: when the ICON is higher or equal to 43 then the treatment is necessary and in some cases it is vice versa.

Table 4. Distribution of orthodontic treatment need in North Cyprus 12-15-yearolds determined with ICON.

Treatment Need		n	%
Yes (score $\geq$ 43)		86	20,2
No (score < 43)		340	79,8
Total		426	100,0

According to the ICON Index, 20.7% of the patients who required orthodontic treatment (score greater than 43) were male and 19.7% were female. Of those who did not require treatment (score less than 43), 79.3% were male and 80.3% were female (Table 5).

Table 5. Frequency and distribution table according to treatment need and gender.

Treatment Need		Gender			
		Male		Female	
		n	%	n	%
Yes (score $\geq$ 43)		46	20,7	40	19,7
No (score < 43)		177	79,3	163	80,3

All individuals were classified according to the presence of posterior cross bite, anterior cross bite, open bite, and deep bite malocclusions. The results are shown in Table 6, Table 7, and Table 8. The most common anomaly group is those with posterior cross bite (14.55%), deep bite (13.4%), open bite (0.9%) and anterior cross bite (0.9%). In general, posterior cross bite and deep bite are more common.

Table 6. Frequency and distribution table according to cross bite evaluation

Cross Bite Evaluation		n	%
Present		62	14.55
Not present		364	85.44
Total		426	100,0

Table 7. Frequency and distribution table according to Overjet evaluation

Overjet Evaluation		n	%
	Normal overjet (2±2 mm)	383	89,9
	Increased overjet (>4 mm)	39	9,2
	Negative overjet (<0 mm)	4	0,9
	Total	426	100,0

Table 8. Frequency and distribution table according to Overbite evaluation

Overbite Evaluation		n	%
	Normal closure (2±2 mm)	365	85,7
	Deep bite (>4 mm)	57	13,4
	Open bite (<0 mm)	4	,9
	Total	426	100,0

Discussion

The epidemiology of the population living in a country plays an important role in the planning and implementation of dental services. Correct identification of the need for orthodontic treatment in individuals is a very complex subject and requires detailed analysis [7].

An epidemiological study was conducted for the first time in North Cyprus and this really helped us to establish the prevalence of orthodontic malocclusions among subjects between 12 -15 years of age. A classification of malocclusion using Angle classification and the Index of Complexity, Outcome and Need (ICON) of orthodontic treatment was carried out. According to the data

obtained, the distribution of according to Angle's classification prevailed in subjects aged 12 to 15 (74.4%), this is similar to data obtained in a study conducted in Turkey (Konya) [18] which yielded a result of 76.4% in subjects between the ages 16 to 19. A study conducted in Nigeria [1] concluded that 80.3% of the subjects between the ages of 13 to 20 had class I malocclusion. These results are higher than the data obtained in a study conducted in Estonia [38] among subjects between the ages of 12-15 which yielded that 70.0% had class I prevalence of orthodontic anomalies. This is also higher than the data obtained in Italy [35], 59.5% among the subjects aged 12 years old, and 52.8% among subjects aged 16-18 years old in Hungary [20]. These findings could be due to the socio-economical development of the country; that is to say, as the socio-economical welfare of a country increases, the prevalence of abnormal occlusion decreases. Although the

development of malocclusions may be due to genetics, environmental factors may be responsible as well. Lack of oral hygiene, large amounts of sugar intake, which leads to the carious lesions of teeth and correspondingly early loss of milk teeth, little or no dental care in suburban locations, can also be factors that contribute to the development of malocclusions [28]. The finding of the study on the distribution Angle's class II malocclusion in Northern Cyprus has yielded that 21.1% of the subjects suffer from class II malocclusion. This result is similar to those obtained in Turkey (20,2%) [11], Iran (24.7%) [2], Pakistan (23.6%) [28] and in India (17,2%) [40]. These similarities can be explained most probably by their racial, geographical, ethnic, cultural food features.

4.5% of the subjects who took part in the study in North Cyprus exhibited the prevalence of Angles Class III malocclusion. Similar results were obtained in a study conducted in Oman [3] in which 4.2% of the subjects exhibited prevalence of Angles Class III malocclusion. Furthermore, 4.3% of the subjects in Italy [35], 6.1% of the subjects in Iran [2], 0.1% of the subjects in India [40] exhibited prevalence of Angles Class III malocclusion. A study carried out in China [49] yielded that 9.7% of the subjects exhibited prevalence of Angel Class III malocclusion which is significantly higher compared to those mentioned above. These statistics suggest that racial and geographical features affect the level of distribution of class III malocclusion [21, 25]. In a study conducted in India [40], Angle class III malocclusion was prevalent in 0.1% , If these results are reliable, the Indian population has the lowest distribution of this type of bite in comparison to other ethnic groups. In fact, it could be maintained that if global research were to be conducted further comparing the prevalence of class III malocclusion in different ethnic groups, it would be possible to say that Northern Cyprus could yield also the lowest prevalence. The study conducted in North Cyprus yielded that there was no significant difference in the prevalence of malocclusions between genders. The data revealed that distinguished 75.8% of the male subjects and 72.8% of the female subjects exhibited Angle class I malocclusion. A study conducted by Mevlut Celikoglu et al (2010) [11], and a study conducted by Pascal Tschil et al (1997) [45] yielded similar results of slight differences in the ratios between the genders. On the other hand, a study conducted among the Pakistani population by Rozin Nzir et al (2012) [28] showed that there was a significant difference in the distribution of malocclusion between the genders (23.7% among males and 28.8% among females).

The results of the research carried out with ICON showed that 20.2% of population in North Cyprus have a need for orthodontic treatment. Ngam et al [29] also used the ICON (Index of Complexity, Outcome and Need for Orthodontic Treatment) to determine the level of need for orthodontic treatment and found that 55.9% of the 665 Senegal school subjects who participated in the study were in need of orthodontic treatment. In another study conducted by Utomi and Onyasco in Nigeria [46] revealed that 38% of the subjects needed orthodontic treatment according to ICON. The analysis of research results in some European countries show that 36% of the subjects in Estonia [38], 35.3% in Latvia [26] and

37.4 to 48.9% in Lithuania [6] were in need of orthodontic treatment. It is actually hard to draw any conclusions about the reason for this difference in values, perhaps the reason is about the geographical features. The analysis of all this data provides the following conclusion for this study; the level of orthodontic service in the Northern Cyprus is quite high despite the fact that there are many migrants among the school subjects who come from more developed countries or just had good genetics.

Conclusions

1. The most common orthodontic malocclusion in Northern Cyprus is Class I, the least common malocclusion is Class II division 2.
2. In order to minimize the need for treatment, malocclusions that occur due to environmental factors should be prevented by providing education to subjects at an early age.
3. This study is important because it is the first study to determine the prevalence of orthodontic anomaly in North Cyprus and the need for treatment and it is thought that it will contribute to the literature by being the pioneer of future research.

Abbreviations

- WHO - The World Health Organization
- ICON - The Index of Complexity, Outcome and Need
- IOTN - Index of orthodontic treatment need
- PAR - Peer Assessment Rating and Dental Aesthetic Index

Declarations

Ethics approval and Consent to Participate

Ethical approval: "All procedures performed in studies involving human participants were in accordance with the ethical standards of the Research Centre of Near East University and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."

Consent for publication

We obtained the consent to examine children from the Ministry of Education and Culture of Cyprus before we started the research (10/03/2018 GOÖ.0.00-174 / 06-18-E.6753). The consent to participate from children was obtained verbally, it was everyone's voluntary

participation. Beforehand the permission was obtained from the directors of the schools in which the studies were conducted. The director of each school, the day before our arrival, did parent meetings where parents gave consent verbally and someone refused, most often because they have already received orthodontic treatment. Our study does not contain personal data, images or videos, etc. related to a specific person.

Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

I would like to confirm that all authors have read and agreed to submit this work to the journal, and that the manuscript is not currently presented in any other journal.

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