Orthodontic Treatment Need and Complexity among 13-15 Year-Old Schoolchildren in Kerman, Iran

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ABSTRACT

Statement of the Problem: Effective and informed planning for orthodontic services in any population requires assessment of the orthodontic treatment need and complexity.

Purpose: The present cross-sectional study was conducted to assess these parameters using index of complexity, outcome, and need (ICON) in an Iranian schoolchildren population.

Materials and Method: In total, 600 randomly selected individuals (300 girls, 300 boys; aged 13-15 years) participated in this study. The treatment need (ICON score>43) and the grades of complexity were compared between two genders and in different age groups. Descriptive statistics and Chi-square test were applied for data analysis considering $p< 0.05$.

Results: Out of 45% of the population found in need for orthodontic treatment, there was no significant difference between the two genders, but the 15-year-old individuals needed treatment significantly more than the individuals with 13 and 14 years of age. The mean ICON score was 44.3±20.28, which showed no significant difference between the two genders. The majority of the cases (34%) were categorized in the easy compartment in terms of complexity and 18% had difficult or very difficult grades of complexity. The genders and age groups exhibited no significant difference in terms of the complexity grade.

Conclusion: Although half of the studied cases needed treatment, nearly one-fifth had difficult or very difficult complexity grade, which indicates the need for specialist care.

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Introduction

Providing appropriate orthodontic services in any given population requires assessment of the orthodontic treatment need and complexity. In this regard, the orthodontic indices have considerably helped standardization of the orthodontic care assessment [1]. Today, there is an increasing preference toward the use of numerical crite-

ria or indices for the objective scoring of malocclusions in order to determine their difficulty grades and assess the treatment outcomes [2]. The occlusal indices, such as index of orthodontic treatment need (IOTN) [3] and dental aesthetic index (DAI) [4], have been successfully used in various countries and provided valuable information about the orthodontic treatment need [5-6]. Ac-

cording to Richmond *et al.* [7], deviation of a malocclusion from the normal indicates severity of the orthodontic treatment, while complexity and difficulty synonymously imply the same concept and are used to specify the effort required to achieve normal or ideal occlusion. In addition, Cassinelli *et al.* [8] reported that complexity or difficulty is related to severity so that it increases with increased severity of malocclusion.

The index of complexity, outcome, and need (ICON) [9] has provided the possibility of assessing complexity grade of the orthodontic cases. ICON, which has been developed based on the expert opinions of 97 orthodontists from nine countries, has provided an internationally accepted method for assessing the orthodontic need, complexity, and outcome in accordance with a single measurement protocol [10-11]. This index has considerable superiority over other treatment need indices because it considers a score for aesthetics (similar to AC in IOTN) and assesses the malocclusion complexity in addition to the treatment need, which existed in previous indices. Since introduction of this index, its reliability and validity have been investigated in various ethnic groups [12-14]. Accordingly, Torkan *et al.* [15] studied the validity of this index in the Iranian population and introduced it as a valid index for assessing the treatment need among Iranians. In Iran, several studies have been conducted to assess treatment need using IOTN and DAI indices [5-6, 16-19]. However, to the best knowledge of authors, among the English papers, only a single study on orthodontic treatment need and complexity using ICON was found [20]. Since the knowledge of orthodontic treatment need and complexity can facilitate planning for orthodontic services, training programs for specialists, and national health programs, the present study was aimed to assess the orthodontic treatment need and complexity in a group of Iranian schoolchildren aged 13 to 15 years. In this age group, regarding the eruption of permanent premolars and canines, the majority of the potential orthodontic problems are diagnosable. The target population included urban schoolchildren in Kerman, Iran. Kerman city is the center of Kerman Province, the largest province in Iran, and is located in the southeastern region.

Materials and Method

This cross-sectional study has been approved by the Re-search Ethics Committee of Kerman Faculty of Dentistry, Kerman University of Medical Sciences.

The exclusion criteria included the individuals with craniofacial anomalies (clefts and syndromes), individuals with history of orthodontic treatment or undergoing orthodontic treatment during the study, individuals who were in deciduous or mixed dentition periods, and those with non-Iranian nationality. Multi- stage cluster random sampling among different geographical regions of Kerman was done, so that 600 students (300 boys and 300 girls) were included in the study. ICON is comprised of five components: the aesthetic component, maxillary crowding or spacing, presence or absence of cross bite, incisor open bite or overbite, and anteroposterior relationship in buccal segment. Each component can be assessed both on the study cast and in the patient's mouth. This index has a simple practical application, which lasts for almost one minute per person [9].

An orthodontic resident and a student of dentistry, who had been trained and calibrated by an orthodontic specialist (agreement coefficient of 90%), examined the students by a mouth mirror and orthodontic millimeter rulers. The intra-examiner reliability for both examiners was assessed by the reexamination of 30 randomly selected students with a four-week interval after the primary examination. The reproducibility scores of ICON were investigated using Spearman rank correlation coefficient ($p= 0.96$), which indicated an excellent agreement.

According to the ICON instruction, the scores of 43 and higher indicated that the individual needed orthodontic treatment. Furthermore, for treatment complexity, five grades were considered, including easy (<29), mild (29-50), moderate (51-63), difficult (64-77), and very difficult (>77) [7]. All of the collected data were analyzed using statistical package for social sciences program (Version.16, SPSS, Chicago III, USA). The descriptive statistics, including mean and standard deviation, were calculated in the data analysis. The treatment need was compared between two genders and three age groups by Chi-square test. Besides, the relationship of treatment complexity with gender and age was evaluated by chi-square test. The p-value of less than 0.05 was considered significant.

Results

The mean score of ICON was 44.3±20.28. In addition,

Table 1: Treatment need according to the ICON score and sex

Treatment need*	Score	Boys	Girls	Total
No need for treatment	≤ 43	168(%56)	162(%54)	330(%55)
Treatment need	> 43	132(%44)	138(%46)	270(%45)
Total		300	300	600

*Chi square test, *p*< 0.05

Table 2: Treatment need according to the ICON score and age

Treatment need*	Score	13 years	14 years	15 years	Total
No need for treatment	≤ 43	118 (%59)	114 (%57)	98 (%49)	330 (%55)
Treatment need	> 43	82 (%41)	86 (%43)	102 (%51)	270 (%45)
Total		200	200	200	600

*Chi square test, *p*< 0.05

Table 3: Distribution of orthodontic the complexity according to ICON for both sexes

Complexity grade*	Score	Boys	Girls	Total
Easy	< 29	104 (%34.66)	100 (%33.33)	204 (%34)
Mild	29-50	72 (%24)	74 (%24.66)	146 (%24.33)
Moderate	51-63	76 (%25.33)	66 (%22)	142 (%23.66)
Difficult	64-77	32 (%10.66)	38 (%12.66)	70 (%11.66)
Very difficult	>77	16 (%5.33)	22 (%7.33)	38 (%6.33)
Total		300	300	600

*Chi square test, *p*< 0.05

Table 4: Distribution of orthodontic the complexity according to ICON for age groups

Complexity grade*	Score	13 years	14 years	15 years	Total
Easy	<29	66 (%33)	74 (%37)	64 (%32)	204 (%34)
Mild	29-50	54 (%27)	46 (%23)	46 (%23)	146 (%24.33)
Moderate	51-63	52 (%26)	48 (%24)	42 (%21)	142 (%23.66)
Difficult	64-77	18 (%9)	22 (%11)	30 (%15)	70 (%11.66)
Very difficult	>77	10 (%5)	10 (%5)	18 (%9)	38 (%6.33)
Total		200	200	200	600

*Chi square test, *p*< 0.05

the mean score for male and female cases was 43.26± 20.08 and 45.43±20.48, respectively that indicated no statistically significant difference between the two genders (*p*= 0.720). However, the mean score in the 15-year-old age group was significantly higher than that in the 13-year-old age group (*p*= 0.047).

In 45% of the research population, the need for orthodontic treatment was found (ICON score> 43), which indicated no significant difference between the male and female subjects (*p*= 0.716) (Table 1).

Table 2 represents the distribution of the cases in terms of the need for treatment in three age groups.

The highest need for treatment was observed in the 15-year-old age group, which exhibited a statistically significant difference from the 13- and 14-year-old age groups (*p* value of 0.039 and 0.042, respectively). Distribution of the cases in terms of treatment complexity between the two genders is summarized in Table 3.

The majority of the cases (34%) were categorized in the easy compartment; moreover, 18% of the cases had difficult and very difficult grades of complexity in total. Although higher percentage of the female individuals (20%), than the male ones (16%) was categorized in the difficult and very difficult compartments, the complexity grade exhibited no statistically significant difference between the two genders (*p*= 0.609) in general. Furthermore, no significant difference was observ-

ed between the complexity grade and age (*p*= 0.295) (Table 4).

As shown in Table 5, with an increase in the malocclusion complexity grade, the need for treatment was increased (*p*< 0.05). Among the individuals with need for treatment (45%), no one was categorized in the easy compartment in terms of the treatment complexity. Likewise, among the individuals without need for treatment, no one had malocclusion with the complexity grade of moderate, difficult, or very difficult.

Discussion

The orthodontic treatment need and complexity vary from one population to another depending on various factors, including ethnic and cultural differences, as well as awareness and attitude toward orthodontic care [21].

Table 5: Association between orthodontic treatment need and complexity *

	Very difficult	Difficult	Moderate	Mild	Easy	Total
Treatment need	38 (%6.33)	70 (%11.66)	142 (%23.66)	20 (%3.33)	0	270 (%45)
No need for treatment	0	0	0	126 (%21)	204 (%34)	330 (%55)
Total	38 (%6.33)	70 (%11.66)	142 (%23.66)	146 (%24.33)	204 (%34)	600

*Chi square test, *p*< 0.05

In the present study, the mean ICON score was obtained equal to 44.3±20.28, which was almost similar to the score obtained by Borzabadi-Farahani *et al.* [20] in another Iranian city (Isfahan) (44.60±24.83). The mean score obtained in the present study was comparable to the scores of 43.017±0.8 and 43.5±26.2 obtained in two studies in Nigeria [22] and Canada [23], respectively. Moreover, this score was very close to the scores reported in Latvia (42.05) [24], Senegal (42.31) [25], and Western Nigeria (41.93) [26]. However, Aikins *et al.* [27] reported the mean score of ICON in South-South Nigeria slightly less than other studies (i.e. 39.7±25.3). As these investigators mentioned, lower mean ICON score of their study in comparison to other studies may be due to evaluation of a larger sample size and thus a wider range of malocclusion, wider age range of the population rather than other studies (12 to 18 years old) as well as ethnic differences.

In the present study, there was no gender-related significant difference in the mean scores of ICON, which consistent with the findings of most of the investigated studies in Iran [20], Nigeria [22], Senegal [25], and Latvia [24]. However, in the study conducted by Aikins *et al.* [27] in Nigeria, the reported mean score of ICON among the male individuals was significantly higher than that among the female ones.

In the present study, the mean score of ICON among the 15-year-old individuals was significantly higher than that among the 13-year-old ones. This was in contrast to the findings of Karim *et al.* [23] and Utomi *et al.* [22] The higher mean score of ICON among the 15-year-old individuals in the present study might be justified by the fact that the complexity of the orthodontic problems is increased with increased age. The skeletal growth pattern especially in vertical aspect persists by the end of second decade of life in skeletal malocclusions, furthermore differential growth of mandible leads to dental crowding about 20 years old.

Less than half of the study population (45%) was in need for orthodontic treatment in accordance with the ICON, which was rather comparable with the value obtained in another study conducted in Iran (46.6%) [20]. The scores obtained in other studies in India (44.4%) [28], Western Nigeria (42%) [26], Senegal (44.1%) [25] and Canada (43.7%) Although the studies conducted in China [29], South- South Nigeria [27] and Latvia [24]

have reported lower values (26.9%, 38.1%, 35.3%, respectively). Those conducted on the patients referring to the orthodontic clinics have reported much higher values of need for orthodontic treatment compared to other studies, among which the scores of 82.1% in Nigeria [30], 94% in Greece [31], and 86% in USA [32] can be mentioned. Indeed, such an issue may be expectable since these studies have been conducted on the patients with recognized needs for treatment that made them refer to orthodontists. In addition to the differences of sample sizes and age groups in different studies, the ethnic variations were among the factors affecting the differences in the findings and results of the studies. According to Utomi *et al.*, [22] the prevalence of crowding among the Caucasians was higher than that among the Nigerians.

In the present study, no significant difference was observed between the two genders in terms of treatment need, which was consistent with the findings of the studies conducted in Iran [20], Senegal [25], Latvia [24], and Canada [23]. However, in Aikins *et al.* study in Nigeria [27], the male individuals had a significantly higher need for treatment. Furthermore, in the present study, the orthodontic treatment need increased with increase in age, which might be due to the worsening of the untreated malocclusions with increased age and establishment of permanent occlusion. Aikins *et al.* study [27] yielded similar results, but the study conducted by Utomi *et al.* [22] showed no significant relationship between age and treatment need.

Regarding the treatment complexity, less than one-fifth of the examined cases was categorized in difficult and very difficult compartments (18%), which was close to the values obtained in the studies in Nigeria (16.7% and 21.6%) [22, 27] and less than the value obtained among the 11- to 14-year-old Iranian students (26%) [20]. However, the values obtained by the studies conducted in Western Nigeria [26] and Latvia [24], were much lower (9.9% and 10% respectively). As expected, in the clinic-based studies, these values are very higher due to the referral of the orthodontic patients with certain recognized needs for orthodontic treatment (74%, 61%, and 60% in Sweden, Greece, and USA, respectively) [31-33]. It seems that in addition to the differences of sample sizes, age groups, as well as ethnic diversity in different studies, the difference in amount of

orthodontic treatment during childhood is another effective factor influencing the observed differences between various studies. For example, in Borzabadi-Farahani *et al.* study in Iran [20], 1.1% of the study population was undergoing the orthodontic treatment, while in Aikins *et al.* investigation [27]; no child received the orthodontic treatment.

In the present study, 23.66% of the cases were categorized in the moderately complex compartment, which was higher than 15.1% in another study in Iran [20], 14.1% in Latvia [24] and 14.7% [22] and 16.1% [26] in Western Nigeria. This value was close to the values obtained in the clinic-based studies in Greece (23%) [31] and USA (22%) [32].

The cases with easy and mild complexity constituted 58.33% of the total cases, which was similar to the value of 58.5% in the study conducted in the center of Iran [20], but it was lower than the values of the studies conducted in Nigeria (75% [26], 70.9% [27] and 68.6% [22]) and Latvia (76%) [24]. The clinic-based studies on orthodontic patients in Greece [31] and USA [32] have reported the values of 16% and 18% for this category, respectively. Similar to the studies conducted in Iran [20], Canada [23], and Nigeria [22] the present study also did not show any significant relationship between the complexity grade with gender and age. However, Aikins *et al.* [27] reported that the very difficult treatments were significantly higher among the male individuals than the female ones.

As shown in the epidemiological and clinic-based studies on orthodontic patients, the present study represented a significant relationship between orthodontic treatment need and complexity so that, with increased grade of complexity, the need for orthodontic treatment was increased as well [22, 26]. The importance of this issue lies in the fact that complexity of the orthodontic cases in a certain region implies the level of specialism required for the appropriate treatment for the patients. Cassinelli *et al.* [8] expressed that the increased severity of the primary malocclusion resulted in the increased complexity or difficulty of achieving the ideal occlusion. The studies conducted by Richmond *et al.*, [7] and Onyeaso, and BeGole [21] showed that the pretreatment ICON score can serve as a good indicator of the treatment difficulty level.

At last, it should be mentioned that one of the main limitations of this study was the student's low participation rate, so we tried to get their attention by preparing some gifts.

Conclusion

The overall orthodontic treatment need among the 13- to 15-year-old students in Kerman was 45%. In terms of treatment complexity, the majority of the cases (58.33%) were categorized in the easy and mild compartments, while less than one-fifth of the cases were categorized in the difficult and very difficult compartments. The findings indicated no difference between the two genders in terms of treatment need and complexity grade. Furthermore, the need for treatment was significantly increased with increase in age, but no significant difference was observed between the two genders. In addition, the increased complexity led to the increased need for treatment.

Conflict of Interest

The authors declare that they have no conflict of interest.

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