

## Comparing the Quantitative and Qualitative Components of IOTN Index in Determining the Orthodontic Treatment Need in Ahvaz, Iran

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### Abstract

**Background:** This study aimed to compare the quantitative and qualitative components of IOTN index in determining the orthodontic treatment needed in High school students in Ahvaz, Iran.

**Methods:** This cross-sectional study was performed on 356 students aged 15-18 years. The samples were selected by cluster stratified method and the information was collected using IOTN index and clinical examinations. Statistical data were obtained using the descriptive analysis and chi-square test ( $P < 0.05$ ).

**Results:** The findings showed that 51.94% of males and 80.5% of females had no or little treatment need, 17.94% of males and 3% of females had moderate and 30.12% of males and 16.5% of females had severe or extreme treatment needs. Regarding the aesthetic component of (AC), based on the student's point of view, 76.5% of males and 98.8% of females had no or little need, 15.2% of males and 1.3% of females had moderate need and 8.3% of males and 0% of females had severe or extreme treatment need. According to the dentist's opinion, 93.6% of males and 90% of females had no or little need, 5.1% of males and 4.5% of females had moderate needs, 1.3% of males and 5.5% of females had definite needs for treatment. Comparing the DHC and the AC showed that the DHC-based orthodontic treatment need is higher.

**Conclusion:** Occlusion-based judgment is more accurate and less complex. Aesthetic-based judgment is descriptive, indefinite, and individualized, and depends on a variety of social, psychological, cultural, and ethnic factors, and is more complex. Therefore, in order to achieve a better quality of life, it is recommended to consider the aesthetic and appearance-related factors based on the patient's opinion.

**Key Words:** IOTN index, Malocclusion, Orthodontic treatment need, Students.

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## 1- INTRODUCTION

In determining the orthodontic treatment need, in addition to alignment and occlusion of the teeth, aesthetic and psychosocial considerations are also effective (1). Aligned teeth and a beautiful smile lead to confident social interactions. Misaligned and protruding teeth have negative effects. It is of interest that these effects don't have a direct association with the severity of the problem. More than a disease, malocclusion is a deviation from normative beauty in society, and the main expectation of its treatment is, first, the improvement of an individual's physical appearance. The second expectation is functional improvement of the individuals. In several studies, people's dissatisfaction with their appearance and the demand for a better appearance have been the primary motivation for seeking treatment. At present, due to the role of appearance and beauty in psychological problems, attention has been paid to patients' opinions in the orthodontic treatment plan to solve this problem and increase their quality of life. There are several factors involved in motivating patients to make decisions about orthodontic treatment, and these factors vary in different communities regarding socioeconomic and gender-related criteria in facial aesthetic perspectives (2-5).

Among the indices to assess the orthodontic treatment need are the Index of Orthodontic Treatment Need (IOTN), which was introduced in 1985 by Shaw. The index, which divides patients into five grades, from "no need for treatment" to "treatment required" has two components:

- a) Dental Health Component (DHC), which is a quantitative index related to occlusion and dental alignment.
- b) Aesthetic Component (AC), which is a qualitative index characterized by comparing the appearance of teeth with a standard photograph (6).

This index has been widely used to determine orthodontic treatment needs in different populations; in recent years, the UK's national health system has made it mandatory to use eligible people for treatment. The issue of individual conception in the treatment of orthodontics has become an important factor (7, 8). Therefore, the aesthetic component of the IOTN index is a patient-centered index, which seeks to combine the attractiveness and beauty of the individual with clinical criteria. The aim of this study was to determine the orthodontic treatment need based on IOTN index among female and male high school students in Ahvaz, and compare the relationship between DHC and AC and also to compare the opinion of students and dentists in determining the orthodontic treatment need based on AC.

## 2- MATERIALS AND METHODS

### 2-1. Design and sampling

This cross-sectional and descriptive study was performed on 356 high school students aged 15 to 18 in Ahvaz. The mean age of the participants was  $16.33 \pm 0.79$ . Cluster Stratified sampling was performed in four educational districts of Ahvaz. For this purpose, in each district, one males' high school and one females' high school were selected by accident and all students aged over 15 entered the study if they consented and cooperated. A total of 200 female students with an average age of  $16.44 \pm 0.74$  years and 156 male students with an average age of  $16.19 \pm 0.83$  years were enrolled in the study.

### 2-2. Inclusion and Exclusion criteria

The students who had never received any orthodontic treatment or weren't at that time undergoing orthodontic treatment and those who were in the period of permanent dentition were included in the study. Students who were physically or mentally disabled were excluded from the study.

### 2-3. Materials and Procedure

For examination a disposable mirror, tongue blade, examination gloves, and a metal ruler to measure in millimeters were used. The IOTN index was also used to determine the orthodontic treatment needed. The index consists of DHC (dental health component) and AC (aesthetic component).

Each student was placed in one of the 5 grades of need for treatment using a DHC. Grades 1 and 2 indicate no and little need for treatment, grade 3 shows a moderate need for treatment, and grades 4 and 5

indicate a severe and extreme orthodontic treatment need. Ten standard colored photographs of AC (**Fig. 1**) were then shown to them, and they were asked to select the most similar photo to their dental system. The student's opinion was recorded on a special sheet. After that, AC was determined and recorded according to the opinion of the dentist. The AC (Aesthetic component) consists of 10 scores in which 1, 2, 3, and 4 show little or no need for treatment, scores of 5, 6, and 7 indicate a moderate need for treatment, and scores of 8, 9, and 10 indicate definite need for treatment (6).



**Fig. 1:** Standard photography

In order to determine the reliability of the two examiners the malocclusion of 10 students of the research samples were examined, and the Cohen's kappa coefficient was equal to 0.9.

### 2-4. Data Analysis

In this study, descriptive analyses were used to determine the distribution of the students in different grades of IOTN index. Chi-square test was used to determine the

correlation between the variables. The statistical analyses were performed using SPSS software ver. 22 (SPSS, Inc., Chicago, IL, USA) and at a significance level of  $P < 0.05$ .

### 3- RESULTS

The study involved 200 female students aged 15-18 with an average age of  $16.44 \pm 0.74$  and 156 male students aged 15-18 with an average age of  $16.19 \pm 0.83$ .

The following results were obtained in the students' examination based on the DHC component (**Table 1**).

The Chi-square statistical test shows a significant difference in the treatment

needs between males and females. The definite treatment needed based on the DHC in males, is significantly higher than females ( $P < 0.0001$ ) (**Table 1**).

**Table-1:** Comparing the orthodontic treatment needs based on the DHC component of the IOTN index by gender

Variable	Females		Males	
	Percent	Number	Percent	Number
orthodontic treatment need				
No need or little	80.5	161	51.94	81
Moderate	3	6	17.94	28
Severe or extreme	16.5	33	30.12	47
Total	100	200	100	156

According to AC, the following results were obtained based on the students' and dentist's views (**Tables 2 and 3**).

The Chi-square test did not show a significant difference between the males and females regarding the treatment need, although in females, the definite treatment

need was more than 4 times higher than that in males ( $P = 0.10$ ) (**Table 2**).

The chi-square test showed a significant difference between the treatment needed among males and females from a dentist's point of view. The treatment needed in females is significantly higher than that in males ( $P = 0.001$ ) (**Table 3**).

**Table-2:** Comparing the orthodontic treatment need in both males and females from the students' point of view (AC)

Variable	Females		Males	
	Percent	Number	Percent	Number
orthodontic treatment need				
No or little need	90	180	93.6	146
Moderate	4.5	9	5.1	8
Severe or extreme	5.5	11	1.3	2
total	100	200	100	156

**Table-3:** Comparison of the treatment need in males and females from the dentist's perspective (AC)

Variable	Females		Males	
	Percent	Number	Percent	Number
orthodontic treatment need				
No need or little	71.5	143	93.58	146
Moderate	11	22	5.12	8
Severe or extreme	17.5	35	1.3	2
total	100	200	100	156

Comparing the treatment needs based on DHC and AC, and also comparing the dentists' and students' perspective based on AC, the following results were obtained (Tables 4 and 5).

According to the chi-square test, there was a significant difference between DHC and AC based on the students' views ( $P < 0.002$ ) (Table 4) and the dentists' views ( $P < 0.006$ ) (Table 5).

**Table-4:** Comparing the orthodontic treatment need in males and females based on DHC with students' perspective based on AC

Variable	Total		Females		Males	
	Student N (%)	DHC N (%)	Student N (%)	DHC N (%)	Student N (%)	DHC N (%)
No need or little	326(91.6)	242(68)	180(90)	161(80.5)	146(93.6)	81(51.9)
Moderate	17(4.8)	34(9.6)	9(4.5)	6(3)	8(5.1)	28(17.9)
Severe or extreme	13(3.7)	11(5.5)	11(5.5)	33(16.5)	2(1.3)	47(30.1)
total	356(100)	356(100)	200(100)	200(100)	156(100)	156(100)
P value	0.0001		0.002		<0.0001	

**Table-5:** Comparing the treatment need in males and females based on DHC with dentist's perspective based on AC

Variable	Total		Females		Males	
	AC N (%)	DHC N (%)	AC N (%)	DHC N (%)	AC N (%)	DHC N (%)
No need or little	289 (81.2)	242 (68)	143 (71.5)	161 (80.5)	146 (93.6)	81 (51.9)
Moderate	30 (8.4)	34 (9.6)	22 (11)	6 (3)	8 (5.1)	28 (17.9)
Severe or extreme	37 (10.4)	80 (22.5)	35 (17.5)	33 (16.5)	2 (1.3)	47 (30.1)
Total	356 (100)	356 (100)	200 (100)	200 (100)	156 (100)	156 (100)
P value	<0.0001		0.006		<0.0001	

#### 4- DISCUSSION

In examining the occlusion of the samples based on dental health component (DHC) of IOTN index, the findings of this study showed that 51.94% of male students and 80.5% of female students had no need or little need, 17.94% of males and 3% of females had moderate need and 30.12% of males and 16.5% of females had severe or extreme orthodontic treatment need (in both gender, overall, 67.9% had no need or little need, 9.6% had moderate need and 22.5% had severe or extreme orthodontic treatment need). In Iran, Faizbakhsh et al. (2013) assessed the orthodontic treatment needs of 14-18-year-old students in public schools in Isfahan in

2009-2010 based on the IOTN index. They stated that 56.9% of males and 51.8% of females had no need or little need, 22.5% of males and 23.8% of females had moderate need; and 20.6% of males and 24.3% of females had severe or extreme treatment needs (10, 11). In a study by Bhardwaj et al. (2011) on 622 16-17-year-old Indian students, the orthodontic treatment needed was reported to be 20.43% (12). Ertes-fernandez et al. (2010) in Morocco, in a study on 248 12-year-old adolescents, reported that 18.1% of them needed orthodontic treatment (13).

A study by Miguel et al. (2009) on 1182, 12-year-old Brazilian adolescents reported an orthodontic treatment need of 26%

based on DHC (14). Manzanera et al. (2009) in Spain reported that the orthodontic treatment needed in the age group of 12 years was 23.5%, and in the age group of 15-16 years, it was 18.5% (15). In a study by Ucuncu et al. (2001) in Turkey, which examined 250 students aged 11-14 years, the orthodontic treatment needed based on IOTN was reported to be 38.8% (16). This need was reported by Hassan et al., in Saudi Arabia, to be 76.6% (17). Kerosuo et al., in Kuwait, reported a treatment need of 28.1% (18) and Bernabé et al. in Peru, 29.9% (19). The findings of these studies have similarities and differences compared to our study; and the differences can be related to differences in sample size, sample age, working method, and sum of extreme, severe and moderate needs, or their separate reports and such. In the study of the treatment need based on the AC of the IOTN index from the perspective of students, it was shown that 76.5% of males and 98.8% of females had no need or little need, 15.2% of males and 1.3% of females had moderate and 8.3% of males and no female had extreme or severe orthodontic treatment need.

Additionally, Feyzbakhsh et al. (2013) obtained different results for treatment needs based on the AC from the students' point of view compared to DHC. They showed that the need for treatment based on the AC index were found to be lower than those diagnosed based on the DHC (10, 11). The findings are similar to the results of a study by Kolawole et al. (2009) in Nigeria, reporting that 8% of 8-14 year-old students had a treatment need based on AC (20). The results of the study of kerosuo (18) and Hamdan in Jordan (21), Oshagh et al. in Shiraz (22), and many other studies are also matched with those of the present study (23-25).

According to DHC, in individuals with cI I canine and molar relationships, with no rotations and teeth crowding, if one or two

teeth are missing, they have severe or extreme orthodontic treatment needs; whereas according to AC, they may have no treatment need. For example, in a case where the upper front teeth are perfectly straight with no need for treatment, the lower front teeth may have 4 mm or more of crowding, and require moderate or severe need for treatment according to DHC. In many cases, class II and III molar relationships may be seen unilaterally and the appearance of the teeth may not have a problem. According to DHC, this may put the individual at little need for treatment, but according to AC, no treatment may be needed. Generally, when comparing the DHC and the AC, it is found that the orthodontic treatment needed is higher based on the DHC. The need criteria in DHC is the degree of deviation from ideal or normal occlusion and disruption of oral function, which, in examining the occlusal characteristics, is examined more accurately and in more details; and has less complexity. But, in determining the orthodontic treatment needed based on the AC, several factors such as racial, ethnic, religious, cultural, and psychosocial considerations are effective; and therefore, it has a higher complexity (10, 11, 21).

Moreover, based on the AC of the IOTN index, our findings showed that according to the dentist's view, 93.6% of males and 90% of females had no or little treatment need, 5.1% of males and 4.5% of females had moderate need; and 1.3% of males and 5.5% of females had definite treatment needs. These results indicate that there is a statistically significant difference between a person's conception of their appearance and the results of dental examination. Faizbakhsh et al. (2013) in Isfahan (Iran) (10, 11), Hamdan et al. (2005) (21) and Abu Alhaija et al. (2005) in Jordan (26), Mandall et al. (1995) in the United Kingdom (UK) (27) obtained similar results. Differences in the orthodontic treatment needed in the perspective of

dentists and students, based on AC, depend on various factors, including individual differences, demographic characteristics of samples, definition and recognition of beauty, differences in evaluation and evaluators. In addition, the students' expectations of themselves and their peers, as well as their academic, social, and sports achievements can affect their conceptions. Also, individuals' different perceptions and attitudes about issues regarding beauty and appearance can have effects on their orthodontic treatment needs (2, 28, 29). Pictures of the AC are not well adapted to a person's dental condition, and matching it to the dental condition of most people requires great attention. Moreover, open-bite, reverse overjet, and local spacing of the anterior teeth are not included in these pictures and patients with these malocclusions are not given a specific number (30).

In general, similarities and differences between our results and those of the previous studies, regarding DHC, can be a result of different sample sizes, age groups, methods of the studies, and such. Considering AC, factors such as different attitudes of individuals from different cultures, in regard to appearance and aesthetic factors, can be of influence.

#### **4-1. Ethical considerations**

The purpose of the study was explained to the students that were selected voluntarily and randomly. They were assured that the information obtained would remain confidential. After the parents and students signed a consent form, the samples were examined by a male and a female dentist in a room with enough light (9). (IR code of ethics. AJUMS.1396.335)

#### **5- CONCLUSION**

The findings of this study revealed that based on the dental health component (DHC), more cases are suggested to be in need of orthodontic treatments, when compared to the aesthetic component

(AC). This suggests that judging by occlusion, which has quantitative and specific indicators, is easier and more accurate and less complex. Also, depending on the AC, the cases of treatment needed based on the students' opinion are more than those diagnosed by the dentist's viewpoint. AC-based Judgments are descriptive, indefinite, and individualized; and depend on various psychosocial, cultural, and ethnic factors and so are more complex.

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#### **7- CONFLICTS OF INTEREST**

None.

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