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ORTHODONTIC TREATMENT NEEDS OF CHILDREN: COMPARISON OF THREE INDEX

Çocuklarda Ortodontik Tedavi İhtiyacı: Üç İndeksin Karşılaştırılması

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ABSTRACT

Purpose: An orthodontic treatment need index is a form of occlusal index devised initially to prioritize the need for treatment and to categorize the malocclusion and identify patients based upon treatment need. The aim of this study was to evaluate orthodontic treatment needs of children using IOTN (Index of Orthodontic Treatment Need), DAI (the Dental Aesthetic Index) and ICON (Index of Complexity, Outcome and Need) and the relationship among the three index.

Material and Methods: After ethical approval and informed consent were obtained; 100 children aged 10-12 years were examined for malocclusion, overjet, overbite, open bite and crossbite. The study models of subjects were taken and the DAI, the Dental Health Component (DHC) and the Aesthetic Component (AC) of IOTN and ICON were compared. Statistical analysis was performed by using NCSS 2007 software and regression analysis was performed between the results.

Results: The mean average scores of DAI, IOTN-DHC, IOTN-AC and ICON indices were 25.44±8.05, 2.46±0.98, 4.17±2.53 and 38.67±21.08, respectively. Statistically significant differences were found between DAI, IOTN-DHC, IOTN-AC and ICON scores ($p<0.01$).

Conclusion: DAI, IOTN and ICON were found to be significantly correlated with each other regarding the prevalence of malocclusion and orthodontic treatment need.

Keywords: *IOTN, DAI, ICON, Orthodontic treatment need, orthodontic indexes*

ÖZ

Amaç: Ortodontik tedavi ihtiyacı indeksleri, tedavi ihtiyacının önceliğinin belirlenmesi ve tedavi ihtiyacına bağlı olarak hastaların ve maloklüzyonların kategorize edilebilmesi için tasarlanan oklüzal indeks formudur. Bu araştırmanın amacı, çocuklarda ortodontik tedavi ihtiyacının IOTN (Index of Orthodontic Treatment Need), DAI (the Dental Aesthetic Index) ve ICON (Index of Complexity, Outcome and Need) indeksleri kullanılarak değerlendirilmesi ve bu üç indeks arasındaki ilişkinin belirlenmesidir.

Gereç ve Yöntem: Etik kurul onayı ve bilgilendirilmiş onam formu alındıktan sonra, yaşları 10-12 arasında değişen 100 çocuk maloklüzyon, overjet, overbite, openbite ve crossbite açısından klinik olarak muayene edilmiştir. Hastalardan alt-üst çene alçı modeler elde edilerek DAI, IOTN-AC (Aesthetic Component), IOTN-DHC (Dental Health Component) ve ICON indeksleri kullanılarak ölçümler yapılmış ve bu ölçümler karşılaştırılmıştır. İstatistiksel analizler, NCSS 2007 software programı ve regresyon analizi yöntemi kullanılarak gerçekleştirilmiştir.

Bulgular: Ortalama indeks skorları DAI, IOTN-DHC, IOTN-AC ve ICON için sırasıyla 25.44±8.05, 2.46±0.98, 4.17±2.53 ve 38.67±21.08 olarak bulunmuştur. DAI, IOTN-DHC, IOTN-AC ve ICON skorları arasında istatistiksel olarak anlamlı farklılık elde edilmiştir ($p<0.01$).

Sonuç: Ortodontik tedavi ihtiyacının ve maloklüzyonun belirlenmesinde, DAI, IOTN ve ICON arasında anlamlı bir korelasyon bulunmuştur.

Anahtar kelimeler: *IOTN, DAI, ICON, ortodontik tedavi ihtiyacı, ortodontik indeksler*

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Introduction

Malocclusion is a developmental condition, not a disease, but a representing biological diversity (1). It is clinically significant variations from the normal range of growth and morphology. In contrast to disease and pathological lesions, malocclusion may be the result of a combination of minor variations from the normal; which these combinations summates to produce a clinical problem (2). The provision of orthodontic treatment has been justified on the grounds of potentially improving dental aesthetics, dental health, occlusal functioning and psychosocial adjustment (3). Malocclusion is not an acute condition, and therefore, treatment of malocclusion has been associated with a great degree of subjectivity and distorted perceptions of treatment need (1).

Several indices have been developed to allow categorization of malocclusion according to the level of treatment need by different researchers such as Grainger's Treatment Priority Index (TPI), Salmaz's Handicapping Malocclusion Assessment, the Dental Aesthetic Index (DAI), Summer's the Occlusal Index (OI), The Index of Complexity, Outcome, and Need (ICON), Index of Orthodontic Treatment Need (IOTN) and The Peer Assessment Rating (PAR) (1, 2). An orthodontic treatment need index is a form of occlusal index devised initially to prioritize the need for treatment to categorize the malocclusion and identify patients based upon treatment need (1). The Dental Aesthetic Index (DAI) was accepted by the World Health Organization (WHO) as an international cross-cultural index in the assessment of orthodontic treatment need which has been widely used since its development in 1976 (4, 5).

The Dental Aesthetic Index (DAI) is an orthodontic index that links clinical and aesthetic components mathematically to produce a single score. This score reflects the malocclusion severity (1). The DAI outlines criteria for the assessment of dentofacial anomalies including missing teeth, crowding, spacing, diastema, overjet, reverse overjet, open bite and molar relationship (6). Several studies showed that the DAI is a valid and reliable index. An advantage of the DAI is the use of threshold scores to equate with the needs for orthodontic services. This threshold limits changes based on available resources and funding. Different cut-off points for the DAI have been proposed to prioritize orthodontic care needs (1).

The Index of Complexity, Outcome, and Need (ICON) is a more recent index developed with the intent of providing a single index for assessing treatment inputs and outcomes (orthodontic quality control) (5). The ICON is a multifunctional index; it includes both an index of treatment need and treatment outcome assessment. This index also including the esthetic component of the index of orthodontic treatment need, crossbite, upper arch crowding or spacing, overbite or open bite, and buccal segment anteroposterior relationship treatment outcome, complexity, and degree of improvement for the ICON (7). Besides, the ICON assesses the malocclusion complexity, and therefore, it offers significant advantages over other index of treatment need. The need for treatment does not necessarily equate to the complexity of treatment, and there is a need to assess the complexity of treatment. Assessing the complexity of malocclusion helps to: (I) identify the most proper setting in which the patient receives treatment, (II) to inform the patient of treatment likely success, and finally (III) to identify cases that are

more difficult and are likely to take longer to treat (1). The validity and reliability of DAI and ICON have been reported in the literature widely (5).

The Index of Orthodontic Treatment Need (IOTN) is an index that combines both an aesthetic component (AC) and a dental health component (DHC). There is no attempt to combine these two components therefore both components are recorded separately. In most cases the DHC is used to differentiate between "need" and "no need". Even the AC alone is unsuitable for screening treatment need but it's a strong indicator of patient satisfaction. A dental–facial attractiveness scale has also been proposed to provide an objective assessment of relative dental–facial attractiveness independent of functional impairment, with some correlation between dental and facial aesthetics (1, 4, 8-10).

These three commonly used American and European orthodontic treatment need indexes have been selected since they are appropriate and easy indexes for evaluating the early orthodontic treatment need by pediatric dentists and also general dentist. Some other researchers have also been investigated comparison of these three indexes with each other. There are a few studies to comparison with each other about these three indexes.

The aim of this study was to determine orthodontic treatment needs of children using with IOTN (Index of Orthodontic Treatment Need), DAI (Dental Aesthetic Index) and ICON (Index of Complexity, Outcome and Need) index and to compare each index with the other, depending on this, to evaluate the clinical significance and practical usability by pediatric dentists for decisions about orthodontic redirection.

Material and Methods

This study was carried out in the University of Istanbul, Department of Pedodontics. A random sample of 100 pre-treatment study models was taken from 10-12 years of children who submitted our department for their treatment. Before the models were taken the informed consent were obtained from children's parents and ethical approval were taken from university board.

Children were examined for age, gender, malocclusion, over jet, overbite, open bite and crossbite. The study casts were measured with digital calipers. Subjects were used to compare the DAI, the Dental Health Component (DHC) and the Aesthetic Component (AC) of IOTN and ICON. One calibrated pediatric dentist examined 100 patients' casts according to the index rules.

The DAI was performed according to the World Health Organization (WHO), 1997 (11). The DAI involves the measurement of 10 components of malocclusion and the application of a regression equation involving the 10 components, their actual and rounded weights and a constant as a 11th component.

All the 10 components were measured below:

1. Missing visible teeth, incisors, canines, and premolars: The number of missing incisors, canines, and premolars in both the upper and lower arches are recorded. If spaces are closed; the tooth is not counted as missing. If a missing tooth is replaced by a fixed prosthesis; it is not counted as missing. If a primary tooth is still in position and its successor not yet erupted, it is not counted as missing. When a case in the mixed dentition is scored; the space from a recently exfoliated tooth is not scored as missing if it appeared that the permanent replacement would soon erupt. For this reason, radio-

graphs were taken in order to obtain a score in the mixed dentition.

2. Crowding in the incisal segments of the arch: The number of incisal segments (each incisal segment consisting of four incisors) with crowding is recorded as 0, 1, or 2.

0= no segments crowded; 1= 1 segment crowded; 2= 2 segments crowded. The incisal segment is not marked as crowded if the four incisors were correctly aligned, but either of the canines were displaced.

3. Spacing in the incisal segment of the arch: If one or more incisor teeth had proximal surfaces without any interdental contact; the segment is recorded as having space. The number of incisal segments in both arches with spacing is recorded as 0, 1, or 2. The scoring was identical to that of crowding.

4. Diastema: This is the space in millimeters between the two maxillary central incisors.

5. Largest anterior irregularity for upper teeth: Irregularities are either displacements from, or rotations out of, normal alignment. The greatest irregularity between adjacent teeth is measured, in millimeters, from labial surface to labial surface. If there is sufficient space for all four incisors in normal alignment but some are rotated; the segment is not recorded as crowded but the largest irregularity is recorded.

6. Largest anterior irregularity in the lower arch: The measurement principles are the same as the upper.

7. Anterior maxillary overjet: With the teeth in centric occlusion, the maximum overjet is recorded to the nearest millimeter from the labio-incisal edge of the most prominent upper incisor to the labial surface of the corresponding lower incisor, holding the ruler parallel to the occlusal plane.

8. Anterior mandibular overjet (reverse overjet): Measurement is in the same manner as for maxillary overjet. A mandibular overjet is not marked if a lower incisor is rotated so that one part of the incisal edge is in crossbite but another part is not.

9. Vertical anterior open bite: If there is a lack of vertical overlap between any of the opposing pairs of incisors, it is measured to the nearest millimeter. The largest open bite is recorded.

10. Antero-posterior molar relationship: This assessment is most often based on the relationship of the first permanent molars but, if they are missing or misshapen, the relationship of the canines and premolars is assessed. The right and left sides are assessed in occlusion and the largest deviation from normal is recorded. A score of 0, 1, or 2 is obtained.

0= Angle Class I molar relationship,

1= Angle half unit Class II or III molar relationship, and

2 = Whole unit Angle Class II or III molar relationship.

To calculate DAI score a formula has been used as: 6x (missing incisors, canines and premolars) + 1x (crowding) + 1x (spacing) + 3x (diastema) + 1x (largest maxillary irregularity) + 1x (largest mandibular irregularity) + 2x (anterior maxillary overjet) + 4x (anterior mandiular overjet) + 4x (anterior openbite) + 3x (antero-posterior molar relationship) + 13 (constant) (2, 12, 13).

According to resulting sum of the DAI score, severity level and treatment need were determined. DAI scores of 25 and below represent normal or minor malocclusion with no treatment needed; 26-30 represent definite malocclusion with a treatment option considered elective; 31-35 represent severe malocclusion with treatment indicated as highly desirable; scores of 36 and higher represent very severe malocclusion with treatment considered mandatory (2).

The ICON consists of five components:

the Aesthetic Component (AC), upper and lower crowding/spacing assessment, presence of a crossbite, degree of incisor open bite/overbite, and fit of the teeth in the buccal segment in terms of the anteroposterior relationship. Each component can be measured on study casts as well as on patients. Then the ICON components were calculated according to this formula: 7x (The Aesthetic Component) + 5x (upper and lower crowding/spacing assessment) + 5x (crossbite) + 4x (anterior vertical relationship) + 3x (sagital relationship of the buccal segment). According to ICON score range, complexity grade was determined. The score range less than 29, treatment need is easy, 29-50 mild, 51-63 moderate, 64-77 difficult, higher than 77 very difficult (7, 14-16).

IOTN incorporates two components, the dental health component (DHC) and the aesthetic component (AC). The AC consists of a scale of 10 photographs showing different levels of anterior teeth displaying varying degrees of malocclusion, and were asked to indicate which photograph most closely resembled their own dentition? Grade 1 represents the most and grade 10 the least attractive arrangements of the anterior teeth. The aesthetic component grading can be split into three main groups: grades 1–4: no need for treatment; grades 5–7: moderate/borderline need for treatment; and grades 8–10: need for orthodontic treatment. The DHC records the various occlusal traits of a malocclusion. There are five grades ranging from grade 1 ‘no need for treatment’, grade 2 ‘little treatment need’, grade 3 ‘borderline need’, grade 4 ‘treatment required’, grade 5 ‘very great need’. There are two ways of recording the DHC. The first is to record the grade only and the second is to record the initiating feature (10, 17, 18).

All statistical analyses were done using the Statistical Package for Social Sciences (SPSS) for windows release 15.0. In addition to descriptive statistics (mean, median, SD), Spearman’s rho correlation analysis were applied for association with parameters. Mc Nemar test and the kappa coefficient was calculated to compare the data. P values of less than 0.05 were considered as statistically significant.

Results

The present study consisted of 45 male and 55 female patients were included. Twenty nine patients were 10, 32 patients were 11 and 39 patients were 12 years old. Eighteen normal, 17 long, 3 short facial form; 29 open, 71 close lip posture; 97 normal, 3 macroglossic tongue posture were determined in patients (Figure 1).

56% patients had Class I, 25% patients Class II div. 1, 5% patients Class II div.2, 14% patients had Class III malocclusions. Depending on the malocclusion, overbite, overjet, open bite and crossbite were observed in 66%, 70.7%, 72% and 71% of the subjects respectively (Figure 2).

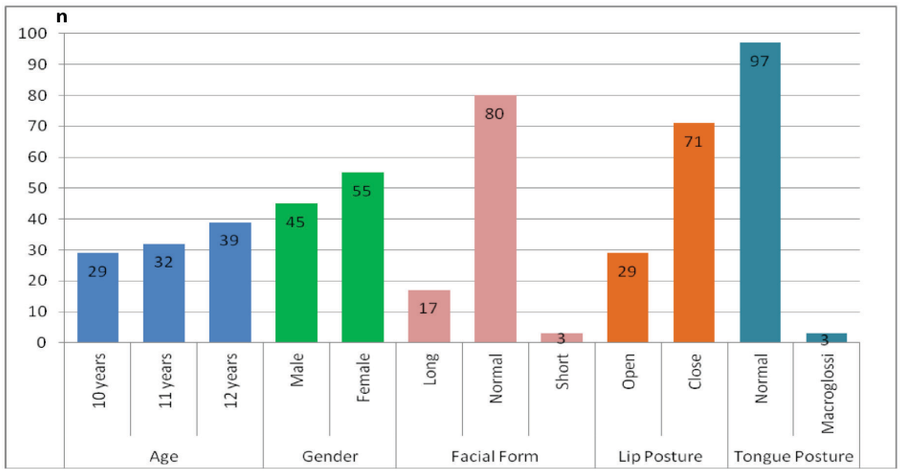

Figure 1. Distribution of age, gender, facial form, lip and tongue posture.

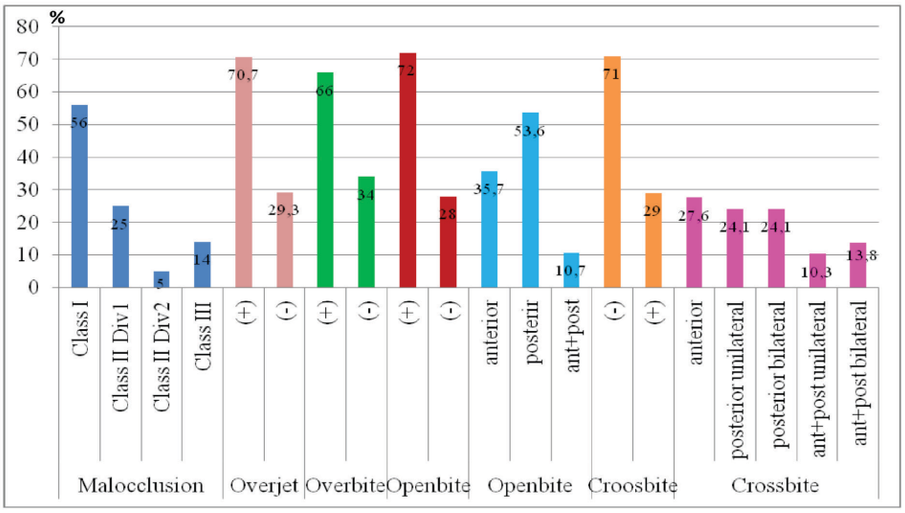

Figure 2. Distribution of malocclusion, overjet, overbite, openbite and crossbite.

The mean average scores of DAI, ICON, IOTN-AC and IOTN-DHC index were 25.44±8.05, 38.67±21.08, 4.17±2.53 and 2.46±0.98 respectively (Table 1).

Table 1. Minimum, maximum, mean and median scores of the index.

	Min – Max	Mean±SD	Median
DAI	14 – 67	25.44±8.05	25
ICON	7 – 98	38.67±21.08	32
IOTN-AC	1 – 10	4.17±2.53	3
IOTN-DHC	1 – 4	2.46±0.98	2

There was no significant difference between DAI/ICON, DAI/IOTN-AC, ICON/IOTN-DHC, IOTN-AC/IOTN-DHC according to short facial form (p=0.333). There was no significant difference observed between DAI/IOTN-DHC, ICON/IOTN-DHC, IOTN-AC/IOTN-DHC according to long facial form (p<0.01). There was no significant difference between DAI/ICON, DAI/IOTN-DHC, ICON/IOTN-AC, IOTN-AC/IOTN-DHC according to macroglossic tongue posture (p=0.667). There was no significant difference between IOTN-AC/IOTN-DHC according to overjet (p=0.057). Other parameters were found significantly associated between index (p<0.05, p<0.01) (Table 2).

Table 2. Comparison of the three index according to parameters.

		DAI / ICON		DAI / IOTN-AC		DAI / IOTN-DHC		ICON / IOTN-AC		ICON / IOTN-DHC		IOTN-AC / IOTN-DHC	
		r	*p*	r	*p*	r	*p*	r	*p*	r	*p*	r	*p*
Age	**10**	0.608	***0.001*** **	0.507	***0.005*** **	0.555	***0.002*** **	0.940	***0.001*** **	0.477	***0.009*** **	0.388	***0.037*** *
	11	0.552	***0.001*** **	0.540	***0.001*** **	0.509	***0.003*** **	0.939	***0.001*** **	0.593	***0.001*** **	0.523	***0.002*** **
	12	0.697	***0.001*** **	0.685	***0.001*** **	0.587	***0.001*** **	0.929	***0.001*** **	0.647	***0.001*** **	0.561	***0.001*** **
Gender	**Male**	0.747	***0.001*** **	0.737	***0.001*** **	0.597	***0.001*** **	0.961	***0.001*** **	0.619	***0.001*** **	0.524	***0.001*** **
	Female	0.478	***0.001*** **	0.447	***0.001*** **	0.530	***0.001*** **	0.875	***0.001*** **	0.494	***0.001*** **	0.415	***0.002*** **
Facial form	**Long**	0.478	***0.050*** *	0.490	***0.046*** *	0.289	***0.261***	0.952	***0.001*** **	0.383	***0.129***	0.382	***0.130***
	Normal	0.644	***0.001*** **	0.609	***0.001*** **	0.573	***0.001*** **	0.933	***0.001*** **	0.607	***0.001*** **	0.497	***0.001*** **
	Short	0.866	***0.333***	0.866	***0.333***	1.000	***0.001*** **	1.000	***0.001*** **	0.866	***0.333***	0.866	***0.333***
Lip posture	**Open**	0.499	***0.006*** **	0.495	***0.006*** **	0.466	***0.011*** *	0.932	***0.001*** **	0.519	***0.004*** **	0.483	***0.008*** **
	Close	0.624	***0.001*** **	0.583	***0.001*** **	0.582	***0.001*** **	0.935	***0.001*** **	0.577	***0.001*** **	0.464	***0.001*** **
Tongue posture	**Normal**	0.622	***0.001*** **	0.582	***0.001*** **	0.555	***0.001*** **	0.933	***0.001*** **	0.558	***0.001*** **	0.462	***0.001*** **
	Macroglossia	0.500	***0.667***	1.000	***0.001*** **	0.500	***0.667***	0.500	***0.667***	1.000	***0.001*** **	0.500	***0.667***
Occlusion	**Class I**	0.612	***0.001*** **	0.497	***0.001*** **	0.528	***0.001*** **	0.916	***0.001*** **	0.462	***0.001*** **	0.247	***0.067***
	Class II	0.683	***0.001*** **	0.668	***0.001*** **	0.598	***0.003*** **	0.947	***0.001*** **	0.752	***0.001*** **	0.775	***0.001*** **
	Class III	0.620	***0.018*** *	0.714	***0.004*** **	0.588	***0.027*** *	0.928	***0.001*** **	0.606	***0.022*** *	0.587	***0.027*** *
Overjet	+	0.672	***0.001*** **	0.665	***0.001*** **	0.581	***0.001*** **	0.939	***0.001*** **	0.614	***0.001*** **	0.538	***0.001*** **
	-	0.567	***0.001*** **	0.530	***0.003*** **	0.512	***0.005*** **	0.948	***0.001*** **	0.430	***0.020*** *	0.357	***0.057***
Overbite	+	0.649	***0.001*** **	0.639	***0.001*** **	0.558	***0.001*** **	0.924	***0.001*** **	0.624	***0.001*** **	0.520	***0.001*** **
	-	0.645	***0.001*** **	0.620	***0.001*** **	0.512	***0.002*** **	0.949	***0.001*** **	0.498	***0.003*** **	0.414	***0.017*** *
Openbite	+	0.627	***0.001*** **	0.620	***0.001*** **	0.623	***0.001*** **	0.948	***0.001*** **	0.513	***0.005*** **	0.443	***0.018*** *
	-	0.616	***0.001*** **	0.561	***0.001*** **	0.521	***0.001*** **	0.923	***0.001*** **	0.591	***0.001*** **	0.481	***0.001*** **
Crossbite	+	0.491	***0.007*** **	0.483	***0.008*** **	0.644	***0.001*** **	0.945	***0.001*** **	0.622	***0.001*** **	0.605	***0.001*** **
	-	0.644	***0.001*** **	0.593	***0.001*** **	0.519	***0.001*** **	0.917	***0.001*** **	0.501	***0.001*** **	0.352	***0.003*** **

Spearman's rho correlation analysis * $p<0.05$ ** $p<0.01$

The statistically significant association was found between DAI and ICON; ICON and IOTN-AC; ICON and IOTN-DHC scores according to treatment need ($p < 0.01$) (Table 3).

Table 3. Comparison of index according to treatment need.

n (%)	No treatment need	Treatment need	*p*
	n (%)		
DAI	89 (%89.0)	11 (%11.0)	***0.001****
ICON	68 (%68.0)	32 (%32.0)	
DAI	89 (%89.0)	11 (%11.0)	***0.064***
IOTN-AC	80 (%80.0)	20 (%20.0)	
DAI	89 (%89.0)	11 (%11.0)	***0.263***
IOTN-DHC	83 (%83.0)	17 (%17.0)	
ICON	68 (%68.0)	32 (%32.0)	***0.001****
IOTN-AC	80 (%80.0)	20 (%20.0)	
ICON	68 (%68.0)	32 (%32.0)	***0.006****
IOTN-DHC	83 (%83.0)	17 (%17.0)	
IOTN-AC	80 (%80.0)	20 (%20.0)	***0.629***
IOTN-DHC	83 (%83.0)	17 (%17.0)	

Mc Nemar Test *** p<0.01*

There was a statistically positive relationship between all index with each other ($p<0.01$) (Table 4).

Table 4. Association of three index.

		DAI	ICON	IOTN-AC	IOTN-DHC
DAI	r		0.54	0.518	0.533
	p		***0.001****	***0.001****	***0.001****
ICON	r	0.54		0.967	0.553
	p	***0.001****		***0.001****	***0.001****
IOTN-AC	r	0.518	0.967		0.499
	p	***0.001****	***0.001****		***0.001****
IOTN-DHC	r	0.533	0.553	0.499	
	p	***0.001****	***0.001****	***0.001****	

Spearman's rho correlation analysis ** p<0.01*

Discussion

The diagnosis and treatment of orthodontic anomalies are performed with multidisciplinary approach. Pediatric dentist and orthodontics and in collaboration for the diagnosis and the treatment of orthodontic anomalies. Pediatric dentist makes preventive or uncomplicated minor orthodontic treatments and leads to orthodontist for more complex situations. Thus, delay in the treatment and possible further malocclusions in future are prevented (4).

Today, one of the important point for dentists is to determine treatment needs of patients. Attitude and knowledge of the dentists and the individual are important for this formation process. While the real treatment need is specified by dentists, the perceived treatment need is specified by individuals. Since, both of requirements may not be same every time, orthodontic index should use for detection of real orthodontic treatment need (9).

Because of the increasing importance of esthetic considerations and dental appearance, people are strongly motivated to seek orthodontic treatment (12). Historically, orthodontic diagnosis has been taught and practiced as a descriptive, qualitative subject. However, in response to an external need for information on the prevalence of malocclusions and for a method to objectively quantify the severity of the various features of malocclusion, several index have been proposed. These index measure the severity of malocclusion objectively; either as a deviation from normal/ideal occlusion or in terms of perceived treatment needs (14).

There are many index and measures available for assessing malocclusion but no consensus on which should be used. According to Bellot-Arcis et al.(19) DAI and IOTN were more often used in cross-sectional studies and while IOTN is used above all in child and adolescent populations, DAI is employed in the adolescent/adult group.

Onyeaso aimed to assess the relationship between the DAI and the ICON on the orthodontic treatment need and complexity in a group of Nigerian patients and reported that ICON and DAI showed favorable agreement when used to assess treatment needs through the use of the casts. In Onyeaso's study, the mean ICON and DAI scores were 67.38 and 42.27 and there was a significant correlation between the pre-treatment ICON scores and the DAI scores (5). In an another study Fox and Chapple (20), reported positive correlations between the ICON and DAI scores. In this study, the mean ICON and DAI scores for the samples were 38.67 and 25.44 and there was a significant association between ICON and DAI scores.

Koochek et al. (21) examined the relationship between ICON and the subjective opinions of patients attending for routine dental care. They found significant differences in ICON scores between the younger (11-14 years) and older groups (30-40 years), females and males. Bernabe and Flores-Mir (12) has also reported that there was no difference between the DAI scores according to gender. In a parallel manner, in this study there were no differences found between age and index and gender and index.

The support of the DAI, as a cross-cultural index by the WHO is its relative simplicity and high reliability and therefore a widely used index. Several studies have suggested that the DAI can be universally applied without the need for modifications or adaptations to different ethnic or cultural settings. Bernabe and Flores-Mir (12) selected DAI for the study by combining both the objective occlusal and the subjective esthetic aspects

of the occlusion. And they reported that the mean DAI score was 28.87 points. The mean DAI score recorded in this study comparable to (25.44) the record of Bernabe et al.

There was considerable intra- and inter-examiner variability when assessing dental attractiveness, need for orthodontic treatment and the level of need for orthodontic treatment. No specific index criteria was given to examiners for assessing orthodontic treatment need and dental attractiveness in this investigation. The IOTN was developed to measure the treatment need by recording the worst malocclusion feature. It was not designed to measure treatment outcome in a very detailed way. It is unlikely that one index alone can meet all criteria for prioritizing orthodontic patients and can measure treatment outcome in an accurate and simple manner (17). However, the IOTN index has been shown to have good reliability, suggesting that, in the absence of an index or scale it may be difficult to assess the need for orthodontic treatment in a reproducible manner (9). The IOTN AC self-rating involves grading of the severity of one's own malocclusion which is related to varying degrees of treatment need (8).

As children grow and interact with various environments, they begin to develop differentiated self-concepts that are specific to different areas of their life. Malocclusion assessment methods differ not only in the choice of the morphological or functional criteria used but also in the mode of evaluation, which can be performed on study casts (22). In earlier studies, the level of agreement between practitioners in determining treatment need was higher than in determining either treatment complexity or outcome (7).

The ICON is the only index designed to evaluate complexity, treatment need, and treatment outcome and has relatively lower predictive accuracy for the treatment outcome than for treatment need judgments' (7). It was reported that, this is due to the much lower level of inter-examiner agreement in decisions of treatment acceptability (3). The ICON is a relatively new index and being to used more widely. It has been shown to be a reliable and valid index for assessing orthodontic treatment need (3, 5, 13, 14). Interestingly, the need for orthodontic treatment determined by the ICON score is related to the individual's subjective assessments of satisfaction of appearance and the perception of need to straighten their teeth. The needs of boys and girls were not found to be different but their self-perceived needs were different, with girls feeling more in need of treatment than boys (6, 16).

Fox and Chapple reported positive correlations between the ICON and DAI scores; they concluded the ICON could be a substitute for IOTN (AC) and IOTN (DHC) (20). Recently, in another study it was concluded that the ICON could replace the DAI in the assessment of pre-treatment orthodontic need in the US (5). Large differences between the mean DAI scores of Iranians and those of Americans and Australians may be associated with the ethnic variation. Different studies have also shown that Asian populations generally have dental appearances that require more orthodontic treatment (18).

Conclusion

As a result, the data of this study has demonstrated that DAI, IOTN and ICON were commonly used to assess the malocclusion and were found to be significantly correlated with each other regarding the prevalence of malocclusion and orthodontic treatment need. According to the comparison of DAI,

IOTN and ICON, the DAI can be used easily in different communities and populations. Nonetheless, further work is required to construct an ideal index for comprehensively evaluating the need for orthodontic treatment.

This study showed that the three index can have similar results on evaluating orthodontic treatment needs of children. In clinical practice, DAI might use easier by pediatric dentists and general dentist than the other index. However these three index are highly correlated each other and so that more reliable results can be obtained when used all of them.

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