



ORIGINAL ARTICLE

Agreement between orthodontist and patient perception using Index of Orthodontic Treatment Need



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KEYWORDS

Self perception;
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IOTN-AC;
IOTN-DHC

Abstract Objectives: The primary objective of the study was to assess the agreement between orthodontist and patient perception regarding the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC) at pre-orthodontic treatment levels. The secondary objective was to determine how well the subjective assessment of malocclusion (IOTN-AC) correlated with the normative Dental Health Component of the IOTN (IOTN-DC).

Materials and methods: A cross-sectional analytical study was conducted on patients between the ages of 16 and 25, presenting for initiation of orthodontic treatment with no history of prior orthodontic treatment. The mean age of the total sample population was 19.50 ± 3.15 years. The mean age of the males was 19.05 ± 3.09 years and for females it was 19.75 ± 3.18 years. The sample consisted of 41 males and 80 females. Patients were shown their pretreatment monochrome intraoral frontal photographs to rate according to the IOTN-AC. Simultaneously, the orthodontist reviewed the photographs with each patient. The IOTN-DHC of pretreatment casts was also recorded by the orthodontist. The frequency of specific traits that had led to increased severity of malocclusion was also identified. All readings were recorded manually on a data collection form. The data were assessed using the chi-square test, Spearman's correlation and Cohen's kappa test. Intra- and inter-examiner reliability was assessed using Spearman's correlation.

Results: A significant positive relationship ($p < 0.05$) was observed between orthodontist and patient perception ($r = 0.516$), orthodontist perception and the normative need ($r = 0.430$), and between the patient perception and the normative need ($r = 0.252$). A statistically significant level of agreement was observed between orthodontist and patient perception ($\text{kappa} = 0.339$,

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$p \leq 0.001$, 95% CI, 0.207–0.470) and between orthodontist perception and the normative need ($\kappa = 0.331$, $p \leq 0.001$, 95% CI, 0.197–0.424). A weak and insignificant level of agreement was observed between patient perception and normative treatment need ($\kappa = 0.107$, 95% CI, 0.02–0.187).

Conclusions: Patient understanding of their treatment need or aesthetic classification may not always be as accurate as that of orthodontists. This may be a cause for concern when an orthodontist finds a certain condition to be severe, and a patient who does not agree may limit their treatment needs.

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1. Introduction

As a prerequisite to orthodontic treatment, patient functional and aesthetic needs are taken into consideration. Several indices have been developed over the years to quantify these needs (Borzabadi-Farahani, 2011); however, each method has its limitations. The Handicapping Labio-lingual Deviation Index (HLD) (Draker, 1960) is unable to record missing and impacted teeth, or spacing and transverse discrepancies. The Dental Aesthetic Index (DAI) (Cons et al., 1986) reflects malocclusion severity as per the North American culture, aesthetic and psychosocial value, but does not assess occlusal anomalies such as buccal cross-bite, impacted teeth, deep overbite, mesio-distal discrepancy, and severity of arch length discrepancy. The Index of Complexity, Outcome and Need (ICON) (Daniel and Richmond, 2000) is highly weighted towards aesthetics; hence, it is more subjective than objective in its assessment.

The Index of Orthodontic Treatment Need (IOTN) was introduced by Brook and Shaw (1989) to form a valid and reproducible index of orthodontic treatment priority. The index consists of two components, the Aesthetic Component and the Dental Health Component. The IOTN-AC is the subjective component of the index, and comprises a set of 10 intra-oral frontal photographs to be rated from 1 to 10, with 1 being the most attractive to 10 being the least attractive. The IOTN-AC provides a measurable, visual assessment regarding the patient perception of their presenting malocclusion and their treatment needs. The IOTN-DHC was derived from the index of treatment priority used by the Swedish Dental Board (Linder-Aronson, 1974). The IOTN-DHC is the objective component of the IOTN index. It consists of 5 grades of treatment need, ranging from 1 (none) to 5 (very great) (Shaw et al., 1995). It records the severity of the malocclusion using specific traits: missing or unerupted teeth, overjet, crossbites, displaced contact points, or overbite. Correction of these traits contributes towards more stable occlusions (Brook and Shaw, 1989). A study conducted by Fida (2000) using IOTN found that 40% of children in Pakistan between 12 and 14 years of age were in need of orthodontic treatment. Similarly, Bashir and Waheed (2002) determined that IOTN recorded orthodontic treatment need priority in 60% of Pakistani population, thus establishing its effectiveness.

The properties of the IOTN have been extensively compared with other treatment need indices. Beglin et al. (2001) compared the reliability and the validity of the IOTN with those of the DAI and the Handicapping Labiolingual Deviation with the California Modification (HLD Cal Mod). They found the IOTN to be the most accurate index (98%)

in comparison to DAI (95%) or the HLD Cal Mod (94%) (Draker, 1960). According to a study conducted by Mandall et al. (2005), the sensitivity of the IOTN-AC was 40.7% and its specificity 90.9%, whereas the sensitivity of the IOTN-DHC was found to be 38.4% and its specificity to be 90.4%. Cardoso et al. (2011) assessed the validity and reproducibility of the IOTN-DHC as compared to the DAI, and concluded that although both the indices had good reproducibility and validity [Intra class coefficient (ICC), DAI (0.89)], the IOTN-DHC required less time for assessment ($p \leq 0.001$). Kerosuo et al. (2004) found that the self-perception of Arab high school students demonstrated 77% agreement with the IOTN-AC and 53% agreement with the IOTN-DHC, thus indicating that the IOTN-AC can be used to reflect a patient self-perceived treatment need. However, most treatment need indices are unable to assess the prognosis of untreated malocclusions and associated symptoms (Borzabadi-Farahani, 2012a,b).

Esthetic treatment requires that the clinician and patient mutually agree upon the severity of the presenting condition or complaint. Such harmony of perception enhances patient understanding and aids communication between clinicians and patients, improving compliance levels from these patients. The influence of self-esteem on self-perception cannot be denied.

Several studies have indicated that patients overestimate their pretreatment conditions more than clinicians (Hamdan, 2004; Hassan, 2006). Although Albarakati (2007) found no significant difference between the opinions of the patient and the orthodontist ($p < 0.05$), a study conducted by Dogan et al. (2010) showed that an orthodontist may overestimate the severity of conditions to a greater extent (11.5%) than patients (6.7%). A significant correlation between the DHC and the orthodontist-rated AC of IOTN was also observed, ($r = 0.625$, $p < 0.001$) indicating that the orthodontist's ability to perceive the patient's presenting conditions is much more accurate and comprehensive than that of the patient (Dogan et al., 2010) in view of the orthodontist's clinical skills. A discrepancy in perception between orthodontist and patient increases expectations and demands from each side, which may eventually deter individuals from seeking treatment.

This study of dental aesthetics therefore aims to compare patient self-perception with orthodontic assessment. Perception, being a subjective phenomenon, will be correlated with the objective IOTN-DHC to assess which group is better able to perceive the severity of the patient condition. Understanding the aesthetic needs of patients enables orthodontists to meet patients' expectations and eventually improves clinical practice.

2. Materials and methods

This research was funded by the University Research Council upon recommendation of Grant Review Committee at the Aga Khan University Hospital (URC Project ID 10GS030SUR). A clearance from the Ethics Review Committee at the Aga Khan University was obtained prior to the commencement of this research project (1831). A cross-sectional analytical study was conducted in the Dental Section, Department of Surgery, on patients from September 2011 to February 2012 prior to initiation of orthodontic treatment. The sample size for this study was 121 subjects (41 males and 80 females). The age range of the subjects was 16–25 years. The mean age of the total sample size was 19.50 ± 3.15 years. The mean age of the male subjects was 19.05 ± 3.09 years and for female subjects it was 19.75 ± 3.18 years. Patient self-perception was measured by having patients rate their condition based on the IOTN-AC scale. Interviews were not conducted to evaluate patient perceptions in this study. Patients were shown their pretreatment monochrome intra-oral frontal photographs in their follow-up appointment for banding and bonding, after the orthodontic records had been taken in the previous appointment. The intra-oral frontal photographs had been

taken by the orthodontic residents at the Dental Clinic; the principal investigator edited them for uniformity in magnification, size and colour (from colour photographs to monochrome) using Microsoft Office Picture Manager® (Aga Khan University Hospital, Karachi, Pakistan). Printouts of the photographs were shown to the patients' chair-side and were scored in accordance to the standard IOTN-AC (Fig. 1). The orthodontist also scored the conditions, at chair-side, simultaneously with the patients. The patients were informed to announce when they were ready to score their conditions, so that both patient and orthodontist could simultaneously write down their scores on separate data forms. The IOTN-DHC was assessed by the orthodontist using the IOTN ruler (Fig. 2) on pretreatment study cast models (Fig. 3) to determine the highest numerical value for severity of malocclusion. The ruler was further interpreted on the Dental Health Scale (Fig. 4) to identify the trait which increased the severity of malocclusion. The hierarchy of traits in order of decreasing severity includes: missing or unerupted teeth; overjet; cross-bites; displaced contact points; and overbite (Fig. 5a–d). In order to rule out measurement error, and the measure intra- and inter-examiner reliability, 30 records were randomly selected for review by the principal investigator and by a

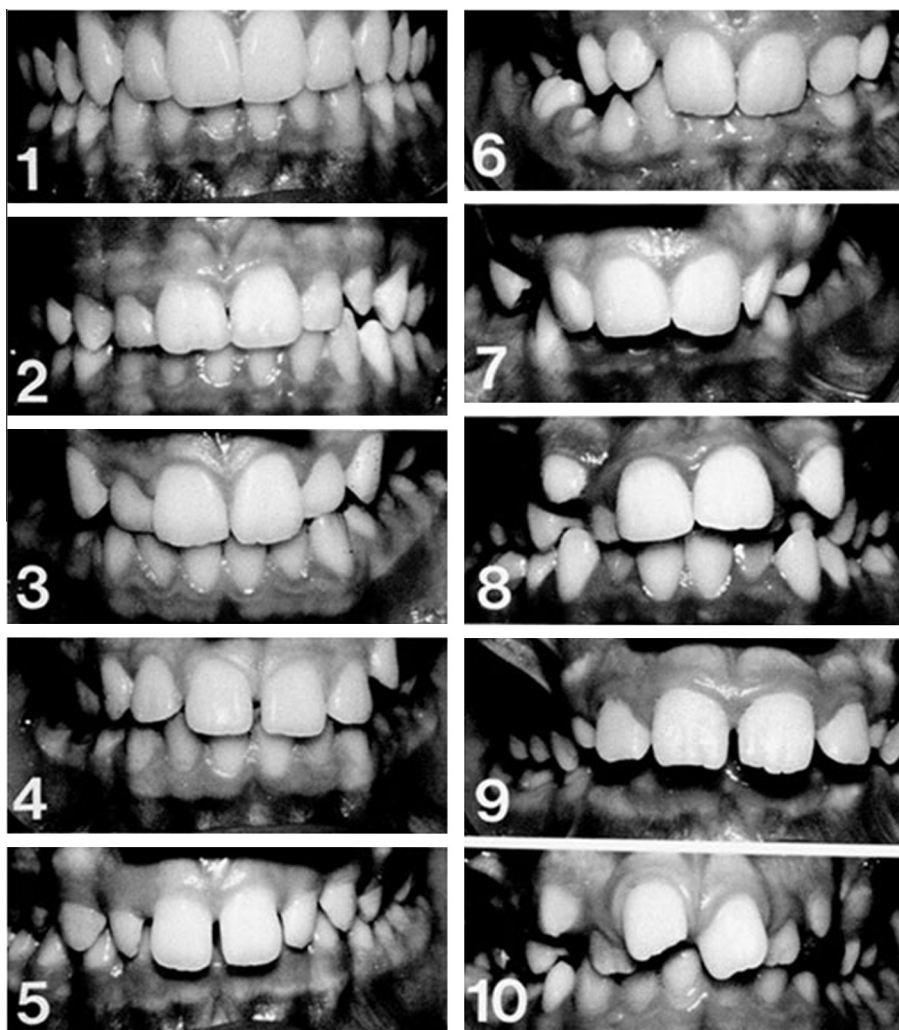


Figure 1 Aesthetic Component of the Index of Orthodontic Treatment Need.

0	3 i	4	5	5 Defect of CLP 5 Non-eruption of teeth 5 Extensive hypodontia 4 Less extensive hypodontia	3 O.B. with NO G + P trauma 3 Crossbite 1.2 mm discrepancy 2 O.B. > _____ 2 Dev. From full interdig 2 Crossbite < 1 mm discrepancy	Displacement open bite V 4 3 2 1
2	2 c			4 Crossbite >2 mm discrepancy 4 Scissors bite 4 O.B. with G + P trauma	IOTN Manchester (clinical)	
3		4				
4	ms - 5					

Figure 2 Index of Orthodontic Treatment Need-Ruler.



Figure 3 Pretreatment study cast model.

second examiner. All the AC and DHC scores were recorded on a data collection form (Fig. 6).

2.1. Statistical analysis

Data were analysed with SPSS Version 19.0 (SPSS Inc., Chicago, IL). Patients recorded their own age, gender, and IOTN-AC score. The orthodontist also recorded the IOTN-AC, IOTN-DHC and the specific trait leading to increased severity of malocclusion.

Three sample groups were formed based on treatment need for IOTN-AC (Mild [Grade 1–4]; Moderate [Grade 5–7]; Severe [Grade 8–10]) and IOTN-DHC (Mild [Grade 1–2]; Moderate [Grade 3]; Severe [Grade 4–5]). Traits, as per mentioned above, were identified and noted using the alphabetic code**. Descriptive statistics were calculated for age, gender, IOTN-AC and IOTN-DHC. The mean and standard deviation of the patients' age range was also determined.

The chi-square test was used to assess the difference between orthodontist and patient perception, self-perception of IOTN-AC, and orthodontist perception of normative treatment need. Spearman's correlation was used to determine the relationship between perception of the orthodontist and that

of the patient perception; self-perception and normative treatment need; and the agreement between orthodontist perception and normative treatment need. Cohen's kappa test (Borzabadi-Farahani and Borzabadi-Farahani, 2011; Borzabadi-Farahani et al., 2012) was used to assess how well the IOTN-AC grade determined by the orthodontist agreed with that determined by the patient, as well as with the IOTN-DHC grade of each patient in each patient-determined IOTN-AC group, and with the IOTN-DHC grade of each patient in each orthodontist-determined IOTN-AC group. Spearman's correlation and Cohen's kappa statistics (Altman, 1992; Viera and Garrett, 2005). were used to evaluate intra- and inter- examiner reliability. A p value of less than or equal to 0.05 was considered statistically significant.

In order to establish the intra-examiner reliability, 30 cases were randomly selected after 1 month and re-scored by the principal investigator. Inter-examiner reliability was assessed by subjecting the data to a second examiner who was calibrated to use the IOTN index. Table 1 indicates a high level of intra- and inter-examiner reliability.

3. Results

Table 2 shows the frequency of each level of treatment need (mild, moderate, and severe) according to the IOTN-AC determined by the orthodontist and by the patient. These scores were assessed on study casts along with the IOTN-DHC. The results show that an orthodontist categorized 62.8% of patients as having mild treatment need, whereas 79.3% of the patients also perceived themselves as having mild treatment need. This is in contrast with the IOTN-DHC which identified only 30.6% of patients as having mild treatment need. As shown in Table 3, overjet (41.3%) was the most commonly observed occlusal feature, followed by crowding (26.4%). Lateral open bite (5.8%) and deep bite (5.8%) occurred with equal frequency (Table 3).

Fig. 7 shows a difference between orthodontist and patient perception of IOTN-AC. A statistically significant (p ≤ 0.001) difference was obtained between the two groups. While the orthodontist perceived 76 patients to be in mild treatment need, 96 patients perceived themselves to be in the same category. Similarly, a statistically significant difference between the orthodontist perception and the normative need was also observed. While the orthodontist perceived only 32 patients as having severe treatment need, the IOTN-DHC recorded 57 patients in the same category (p ≤ 0.001). No significant difference was obtained between the normative treatment need, as determined by IOTN-DHC, and patient self-perception (p = 0.083).

Table 4 shows how the orthodontist and patient IOTN-AC correlated with the normative values (IOTN-DHC). A significant positive relationship (p < 0.05) was observed between the orthodontist and patient perception (r = 0.516), the orthodontist perception and the normative need (r = 0.430), as well as between patient perception and the normative need (r = 0.252). Hence, this signifies that the orthodontist and patient were generally in agreement upon the severity of treatment need. An increase in the perception of the orthodontist and patient was similar to the normative treatment need; however,

Grade 1	Extremely minor malocclusions including contact point displacements less than 1 mm
Grade 2	<p>2a. increased overjet greater than 3.5 mm but less than or equal to 6mm with competent lips</p> <p>2b. reverse overjet greater than 0mm but less than or equal to 1mm</p> <p>2c. anterior or posterior crossbite with less than or equal to 1mm discrepancy between retruded contact position and intercuspal position.</p> <p>2d. contact point displacements greater than 1mm but less than or equal 2mm</p> <p>2e. anterior or posterior open bite greater than 1 mm but less than or equal to 2mm</p> <p>2f. increased overbite greater than or equal to 3.5mm without gingival contact.</p> <p>2g. pre-normal or post-normal occlusions with no other anomalies (includes up to half a unit discrepancy)</p>
Grade 3	<p>3a. increased overjet greater than 3.5mm but less than or equal to 6mm with incompetent lips</p> <p>3b. reverse overjet greater than 1 mm but less than or equal to 3.5 mm</p> <p>3c. anterior or posterior crossbites with greater than 1mm but less than or equal to 2mm discrepancy between retruded contact position and intercuspal position</p> <p>3d. contact point displacements greater than 2mm but less than or equal to 4mm</p> <p>3e. contact point displacements greater than 2mm but less than or equal to 4mm</p> <p>3f. deep overbite complete on gingival or palatal tissues but no trauma</p>
Grade 4	<p>4h. less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for a prosthesis</p> <p>4a. increased overjet greater than 6mm but less than or equal to 9mm</p> <p>4b. reverse overjet greater than 3.5mm with no masticatory or speech difficulties</p> <p>4m. reverse overjet greater than 1mm but less than 3.5mm with recorded masticatory and speech difficulties</p> <p>4c. anterior or posterior crossbites with greater than 2mm discrepancy between retruded contact position and intercuspal position.</p> <p>4l. posterior lingual crossbite with no functional occlusal contact in one or both buccal segments</p> <p>4d. severe contact point displacements greater than 4mm</p> <p>4e. extreme lateral or anterior openbites greater than 4mm</p> <p>4f. increased or complete overbite with gingival or palatal trauma.</p>
Grade 5	<p>4t. partially erupted teeth, tipped and impacted against adjacent teeth</p> <p>4x. presence of supernumerary teeth</p> <p>5l. impeded eruption of teeth (except for third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth and any pathological cause</p> <p>5h. extensive hypodontia with restorative implications (more than one tooth missing in any quadrant) requiring pre-restorative orthodontics</p> <p>5a. increased overjet greater than 9mm</p> <p>5m. reverse overjet greater than 3.5mm with reported masticatory and speech difficulties</p> <p>5p. defects of cleft lip and palate and other craniofacial anomalies.</p> <p>5s. submerged deciduous teeth</p>

Figure 4 Index of Orthodontic Treatment Need-Dental Health Scale.

compared to patient perception, the orthodontist perception correlated more strongly to the normative treatment need. A statistically significant fair **level of agreement was observed between orthodontist and patient perception ($\kappa = 0.339$, $p \leq 0.001$, 95% CI, 0.207–0.470) and between orthodontist perception and normative need ($\kappa = 0.331$, $p \leq 0.001$, 95% CI, 0.197–0.424). A weak and insignificant level of agreement was observed between the normative treatment need and patient self-perception of IOTN-AC ($\kappa = 0.107$, 95% CI, 0.02–0.187). These results indicate that patient understanding of their treatment need (or aesthetic classification) may not always be as accurate as that of orthodontists.

4. Discussion and conclusion

The present work, a clinical study conducted on patients presenting for initiation of treatment, focused on the level of agreement between orthodontist and patient perception of treatment need. It is expected that patients presenting to the clinic are aware of their condition, hence the desire to seek orthodontic treatment. However, it is imperative to know if they perceive their malocclusion to be of the same severity as would be determined by an orthodontist. Better understanding between clinician and patient improves the design of the

treatment plan and creates better patient compliance. As a result, orthodontist and patient are better able to work as a team, and this consequently improves the practice of orthodontics.

4.1. Assessment of treatment need

Assessment of orthodontic treatment need showed that patient self-perception and orthodontist perception of the presenting patients categorized most patients as having mild treatment need (Patient-determined IOTN-AC, 79.3% Mild; Orthodontist-determined IOTN-AC, 62.8% Mild). This is in stark contrast with the normative treatment need, where the IOTN-DHC score placed most of the patients in the category of severe treatment need (47.1%). The patient and orthodontist both conducted their assessments in the first appointment. However, after the complete diagnosis, the clinician perception is liable to alter, which is a cause for concern because a presenting patient is unaware of the actual clinical severity of the malocclusion. For a clinician to agree with a patient perception in the first appointment, and provide a provisional treatment plan without a more thorough analysis, will

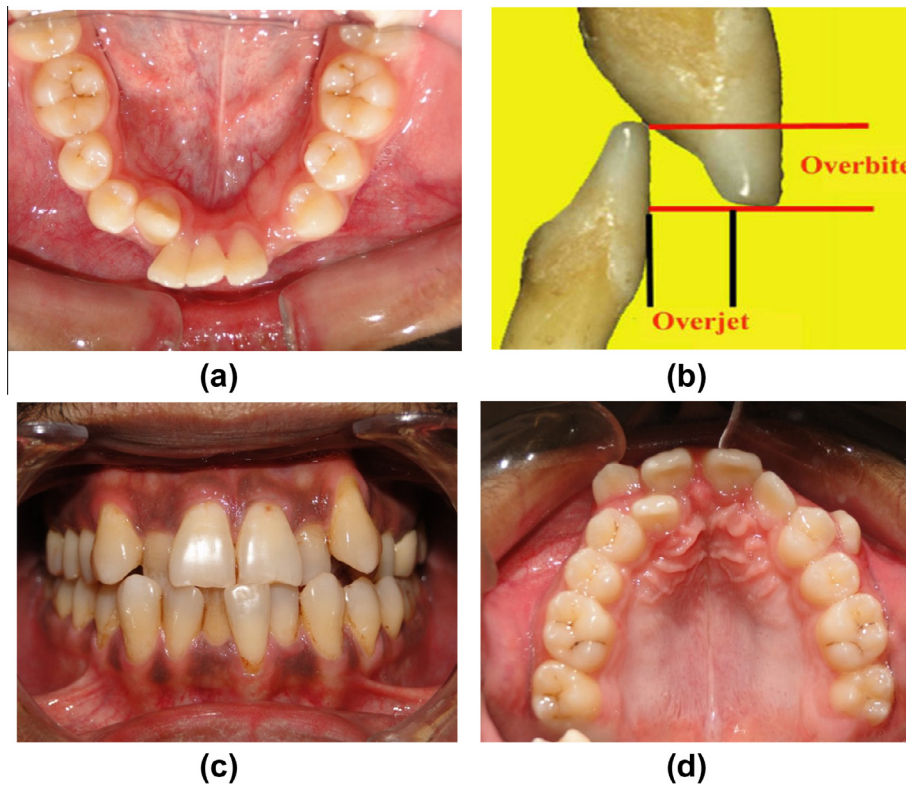


Figure 5 Occlusal traits. (a) Missing and un-erupted teeth (b) Overjet and overbite (c) Crossbites (d) Displaced contact points.

Serial #:- _____	Patient's orthodontic file #:- _____
Age (Y/M):- _____	Gender: - _____
Patient's scores:-	
Pre Tx AC Score: - _____	
Orthodontist's scores:-	
Pre Tx AC score:- _____	
Missing/unerupted teeth:- _____	
Overjet:- _____	
Crossbites:- _____	
Displaced Contact Points:- _____	
Overbite:- _____	
Pre Tx DHC score:- _____	

Figure 6 Data collection form.

strengthen the patient pre-existing opinion of their condition. Hence, after a detailed case study, when a definitive treatment plan is provided to the patient, they may opt for a compromised treatment plan instead of the ideal treatment plan. This increases the likelihood that the long-term stability of the treatment may be compromised due to relapse, thus generating discontent on the patient's part. Therefore, it is essential for

the orthodontist to hold comprehensive sessions with the patient to convey definitive and ideal treatment plans after explaining the actual severity of the patient's clinical condition. [Aikins et al. \(2012\)](#) found self perception to be IOTN-AC Grade 1-4 as well ($n = 82.5\%$) and the orthodontist's perceived 64.9% children in the same grade. [Migale et al. \(2009\)](#), studying 5th graders in southern Italy, found that 21.6% of children needed definite orthodontic treatment as per IOTN-DHC.

A study conducted by [Abdullah and Rock \(2002\)](#) on 5112 Malaysian children aimed to assess their treatment need using IOTN-AC scores determined by orthodontists, children, and their parents. The study did not take into account the normative treatment need. They found that while the orthodontist scored 22.8% of children in "Definite Treatment Need" (IOTN-AC 8-10), 5.8% of children and 4.8% of the parents had the same result. Hence the children and the parents perceived the children's treatment needs differently than did the orthodontists. [Birkeland et al. \(1996\)](#) found that in a sample size of 359 children with a mean age of 10.6 years, 53.2% had moderate to severe treatment need, as per the normative need, while self-perception was inclined towards mild treatment need.

The results of the present study indicate that 47.10% of patients with a mean age of 19.5 years had severe treatment need, as per the normative need. Both the orthodontist and patients, however, were inclined to perceive the patients as having only mild treatment needs. Hence, it can be concluded that the patient and orthodontist tend to perceive patient mal-occlusions as more aesthetically pleasing than the normative treatment need would indicate, irrespective of the patient's age.

Table 1 Comparison for intra and inter-examiner reliability.

Test	Intra-examiner reliability (IOTN-AC)		Intra-examiner reliability (IOTN-DHC)		Inter-examiner reliability (IOTN-AC)		Inter-examiner reliability (IOTN-DHC)	
Spearman's correlation	0.869	$p \leq 0.001^{**}$	0.931	$p \leq 0.001^{**}$	0.634	$p \leq 0.001^{**}$	0.890	$p \leq 0.001^{**}$
Cohen's Kappa	0.432	$p \leq 0.001^{**}$	0.597	$p \leq 0.001^{**}$	0.495	$p \leq 0.001^{**}$	0.681	$p \leq 0.001^{**}$

$N = 121$.

* p -value ≤ 0.05 .

** p -value ≤ 0.001 .

Table 2 Frequency of orthodontic treatment need required.

Category	IOTN-AC patient		IOTN-AC orthodontist		IOTN-DHC	
	n	%	n	%	n	%
Mild	96	79.3	76	62.8	37	30.6
Moderate	12	9.9	13	10.7	27	22.3
Severe	13	10.7	32	26.4	57	47.1
N	121	100	121	100	121	100

Table 3 Occlusal traits leading to increased severity of malocclusion.

Occlusal traits	Frequency	Percentage
Y	10	8.3
a	50	41.3
b	4	3.3
d	32	26.4
e	7	5.8
f	7	5.8
h	6	5
i	4	3.3
m	1	0.8
N	121	100

Y – occlusal trait could not be recorded as IOTN-DHC Grade 1 was noted.

Our results are in agreement with those of Abu Alhaja et al. (2005), who found that students between 13 and 17 years of age were more inclined to rate themselves as having no need of treatment. The self-perception for their treatment need groups was also statistically significant. Kolawole et al. (2008) also found that a higher percentage of children perceived their malocclusions on the attractive end of the aesthetic scale (92%) while the orthodontist found 37.6% in moderate to definite treatment need. The present study similarly found that self-perception yielded a distribution of treatment needs that was more inclined towards the mild, where 79.3% of patients perceived themselves as having mild treatment need, compared to the normative treatment need evaluation which classified 69.4% of patients in moderate to severe treatment need.

4.2. Frequency of occlusal trait

The most common occlusal trait which leads towards increased severity of malocclusion was overjet, followed by crowding

(overjet, 41.3%; crowding, 26.4%). This is in agreement with the results of a hospital-based study where patients presented with the complaints of “upper front teeth are forward” and “malaligned teeth” (Gul-E-Erum and Fida, 2008). Gul-E-Erum and Fida (2008), whose study was conducted in a similar setting, found that the most common condition was forward projecting teeth and Angle's Class II malocclusion (70.5%), which increases the prominence of the maxillary anterior segment. Bashir and Waheed, 2002; whose research was conducted in a government-hospital-based environment, also found overjet to be the most common occlusal trait. Similar findings were observed by Fida on public school children who were examined for orthodontic treatment need. In light of previous and recent evidence, we can say that increased

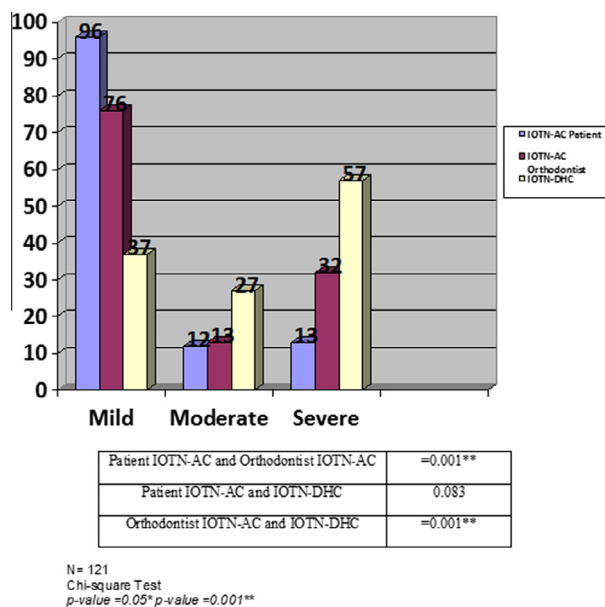


Figure 7 Difference between orthodontist and patient IOTN-AC and IOTN DHC.

Table 4 Correlation and agreement between orthodontist and patient perception and normative need.

Test	IOTN-AC patient vs. orthodontist		Patient IOTN-AC vs. IOTN-DHC		Orthodontist IOTN-AC vs. IOTN-DHC	
Spearman's correlation	0.516	≤0.001**	0.252	0.005**	0.430	≤0.001**
Cohen's Kappa	0.339	≤0.001**	0.107	0.016	0.331	≤0.001**

N = 121.
 * p-value ≤ 0.05.
 ** p-value ≤ 0.001.

overjet is the most common occlusal feature leading to severity in malocclusions in the Pakistani population.

IOTN-AC identifies overjet which is a common trait in Pakistani population, the IOTN-AC identifies overjet, which is common trait in Pakistani population. Hence, it is valid tool for use in this population. The use of photographs to determine the IOTN-AC is important for publicly funded hospital environments, where resources in the form of funds and equipment are limited; however, readers should recognize the limitations of aesthetic indices (Borzabadi-Farahani, 2012a). Nonetheless, the IOTN-AC allows better selection of patients in need of orthodontic treatment.

Our finding that increased overjet is the most common feature (41.3%) contrasts with that of Hammad and Awad (2011), who found severe crowding (27.5%) to be the most common trait leading to malocclusion. A contributing factor for the difference in the observation is that this study was conducted on orthodontic patients presenting to a clinic. Hammad and Awad (2011) studied a population of school children who may or may not have been aware of their clinical malocclusion. Hence, their findings do not support the present study.

Abdullah and Rock (2002), using IOTN-AC, found that children perceived dental crowding, deep bite and tooth size discrepancies as the least aesthetic occlusal features. Our study did not take into account the perception of the patients specifically regarding these features, however, we found that dental crowding (26.4%) and deep bite (5.8%) are among the more frequently presenting occlusal features leading to increased severity of malocclusion.

A study conducted by Borzabadi-Farahani et al. (2009), on 502 Iranian school children between the ages of 11–14 years, found that the most common occlusal feature was severe maxillary crowding (43.6%), followed by increased overbite (39.1%). While their study was conducted on school children, the present study was conducted in a clinical setting where patients presenting to the clinic were also aware of their condition.

Differences in occlusal traits among the genders have also been identified. A study conducted by Migale et al. (2009) on 5th graders, aged 10–11 years in Southern Italy, found that anterior cross bite was more frequently obtained among males (p-value-0.03).

4.3. Correlation and agreement between orthodontist and patient perception and normative need

An important finding of this study is the positive relationship and fair level of agreement between orthodontist and patient perception ($r = 0.516$, $\text{kappa} = 0.339$, $p \leq 0.001$). However, because the values of the correlation coefficient (r) were less

than 0.6, it can be concluded that the agreement between orthodontist and patient perception is not clinically relevant, as r values higher than 0.6 are often needed to indicate a strong relationship (Borzabadi-Farahani et al., 2010). Hence patients do not completely agree with the opinion of clinicians. Better communication between orthodontist and patient can help to overcome such shortcomings. Apart from providing better treatment options to patients, sharing of information with the patient about their conditions improves the practice of orthodontics by generating mutual understanding and increasing the confidence of the patient in the doctor. Better patient compliance, and a more autonomous approach of patients towards their treatment, is also obtained.

Aikins et al. (2012) also found a statistically significant yet weak correlation between orthodontist and patient perception ($r = 0.24$, p -value 0.00). The present study found a higher degree of correlation ($r = 0.516$, p -value ≤ 0.001); however, this could be due to the more advanced age of the patients in our sample. The female predominance in the sample being between the ages of 16 and 20 years also contributed towards better aesthetic perception.

A study conducted by Christopherson (2009), on a sample size of 1566 children with an age range of 8–11 years, aimed to correlate the subjective and objective treatment needs of patients with clinicians. A statistically significant and weak inverse relationship was obtained for subjective ($r = -0.177$, p -value < 0.001) and objective treatment need assessments ($r = -0.145$, p -value < 0.001). This was attributed to the complexity of patient psychology towards their malocclusions. Although the present study also found a weak correlation, it was statistically significant ($r = 0.252$, $p = 0.005$). The contrast arises because the present study took into consideration an older age group that was presumably more aware of dental aesthetics and was visiting an orthodontic clinic in pursuit of orthodontic treatment. Christopherson et al. (2009) had conducted their study on socially underprivileged school children, who although were aware of their condition, did not think that it affected their quality of life ($r = 0.111$, p -value 0.001).

Hammad and Awad (2011) conducted a study on 1464 Egyptian school children between the ages of 11 and 15 years and found a low level of agreement ($\text{kappa} = 0.22$) between the self-perceived IOTN-AC and the IOTN-DHC determined by the orthodontist. In the present study, a moderate agreement ($\text{kappa} = 0.43$, p -value 0.001) was obtained between the patient and orthodontist assessment, and this level of agreement was statistically significant.

Kolawole et al. (2008) found a low level of correlation between patient and orthodontist perception ($r = 0.252$, p -value < 0.000), where the study group comprised schoolchildren from the public and private sector with a mean age of 12.37 ± 0.95 years. This is in contrast to our study, which

obtained a better correlation between the two groups ($r = 0.516$, p -value ≤ 0.001); however, we had focused on orthodontic patients who had presented to a clinical practice with a mean age of 19.50 ± 3.15 years. Compared to children in younger age groups, patients with an increased mean age who present to the orthodontic clinic may be more conscious of their aesthetic needs.

While Kolawole et al. (2008) also incorporated a questionnaire to assess the opinions of children and their parents regarding the children's treatment needs, the present study did not do so. This is a limitation of the present study. However, although the IOTN-AC is not a precise indicator of self-evaluation in comparison to questionnaires, it can be used to reflect the subjective perception of aesthetics (Grzywacz, 2003).

A statistically weak correlation, with an insignificant level of agreement between self-perception and normative need, shows that patients are unable to comprehend their clinical conditions ($r = 0.252$, p -value = 0.005; kappa = 0.107, p -value = 0.016). Although such findings prompt efforts towards better patient doctor communication, it still shows that lack of understanding on the patient's part may not generate the level of cooperation and understanding needed for long-term orthodontic treatment. Such poor understanding on the patient's part causes them to limit their treatment objectives, hence increasing the probability of compromised treatment outcomes. A lack of patient understanding may challenge the combined efforts of the orthodontist and patient to provide better treatment outcomes.

Badran (2010) in her study found a weak, yet statistically significant correlation between the IOTN-AC of children between 14 and 16 years of age (mean age: 15 years) who were examined with IOTN-DHC. This is in accordance with the results of the present study. Correlation of the students' IOTN-AC with the score determined by the examiner also showed a statistically significant yet weak correlation ($r = 0.36$, p -value ≤ 0.001). A comparatively better correlation was obtained in the present study ($r = 0.516$, p -value ≤ 0.001). This can be attributed to the close similarity in the age groups addressed in the two studies. While Badran (2010) selected a sample size consisting of 400 schoolchildren between the ages of 14 and 16 years, the present study stratified the sample population into two age groups. Most of the patients were in Group 1 ($n = 79$) and their age range was 16–20 years, mean age 17.44 ± 1.28 years. Group 2 consisted of 42 patients in the age range of 20–25 years, mean age 23.28 ± 1.56 years. Hence, a better correlation between examiner and patient perception was obtained in the present study due to the increased age of the sample population.

A study conducted by Khan and Fida (2008) examined the association between psychosocial wellbeing and the self-rated IOTN-AC, and concluded that handicapping malocclusion has an impact on self esteem and motivation towards treatment (IOTN-AC 4–10 13.3%, mean score of psychological impact = 14.6). Better compliance levels towards orthodontic treatment can be anticipated from patients who perceive handicapping malocclusion as negatively affecting their self-esteem. However, when patients overestimate their pretreatment conditions, as compared to the evaluation of the clinicians, patients may expect unrealistic treatment outcomes (Hamdan, 2004; Hassan, 2006).

Although a positive correlation was obtained between the orthodontist perception and the normative treatment need, this is not a strong association ($r = 0.430$, p -value ≤ 0.001 ; kappa = 0.331, p -value ≤ 0.001). Due to their expertise, clinician understanding of presenting conditions is expected to be better than that of patients. Fida (2000), in a study based on a single examiner, found moderate correlation between the examiner perception and normative treatment need ($r = 0.68$, p -value = 0.001). The present study also involved a single examiner, whose results were then validated by a second examiner. Although the IOTN-AC determined by the two orthodontists shows a moderate correlation and level of agreement ($r = 0.931$, kappa = 0.597, p -value ≤ 0.001), it is imperative to note that better results could have been obtained from a group of orthodontists stratified by level of experience. The present study focused on the level of agreement between the perception of an orthodontist and those of the patients. Although a difference in perception was obtained between the patient and the orthodontist, the Cohen's kappa test indicated that the level agreement was satisfactory.

Patients' inability to understand the clinical severity of their presenting conditions is a cause for concern. It is imperative for clinicians to explain the intended treatment plan in detail to the patient, to avoid unrealistic expectations and provide satisfactory outcomes.

The present study was conducted at a single centre, with a limited sample size. Interviews were not conducted, hence, detailed insight into patients' motivations for seeking orthodontic treatment could not be ascertained. Although the impact of self esteem on perception of dental aesthetics is an important factor to consider in future research, the present study indicates that the IOTN-AC is an effective tool to obtain patient perceptions of their dental aesthetics.

The present study focused on the level of agreement between orthodontist and patient perception of dental malocclusions. Although a difference in perception was observed, Cohen's kappa test indicated that the level of agreement was satisfactory. The patients' inability to understand the clinical severity of their presenting conditions is a cause for concern. Exposure to audiovisual media has influenced an increase in awareness of better aesthetics, and desire for impeccable aesthetics, within the Pakistani population. This trend has led to an increase in the number of patients presenting for orthodontic correction. It is imperative for clinicians to explain the intended treatment plan in detail to the patient, to avoid unrealistic expectations and provide satisfactory outcomes.

Conflicts of interest

There are no conflicts of interest to the authors in the present study.

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