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Assessment of Orthodontic Treatment Needs Using the Index of Orthodontic Treatment Need Among Adolescents

Abdulmajeed Mostafa Kaki[1*]
[1]Preventive Dentistry, Division of Orthodontics, General Dentistry Program, Batterjee Medical College, Jeddah, Saudi Arabia

*Corresponding author: Abdulmajeed Mostafa Kaki (e-mail: abdulmajeed.kaki@bmc.edu.sa).

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Abstract **Background:** Malocclusion represents one of the most prevalent oral conditions affecting adolescents worldwide, with significant functional, aesthetic, and psychosocial consequences. Standardized indices for assessing orthodontic treatment need are essential for prioritizing resource allocation and informing clinical decision-making, yet comprehensive epidemiological data using validated assessment tools remain limited in many populations. **Objective:** This cross-sectional study aimed to assess the prevalence and severity of orthodontic treatment needs among adolescents using the Index of Orthodontic Treatment Need (IOTN), and to evaluate associations between treatment need, demographic variables, and self-perceived dental aesthetics. **Methods:** A total of 640 adolescents aged 12–17 years were recruited from eight secondary schools through stratified random sampling. Orthodontic treatment need was evaluated using both the Dental Health Component (DHC) and the Aesthetic Component (AC) of the IOTN. Self-perceived orthodontic treatment need was assessed using a validated questionnaire incorporating visual analog scales. Clinical examinations were performed by two calibrated orthodontists. Data were analyzed using chi-square tests, independent t-tests, one-way ANOVA, and logistic regression analysis. **Results:** According to the DHC, 34.7% of adolescents exhibited definite treatment need (grades 4–5), 28.1% demonstrated borderline need (grade 3), and 37.2% had no or little need (grades 1–2). The AC indicated that 18.9% had definite aesthetic treatment need (scores 8–10). Significant associations were identified between DHC grade and sex ($p = 0.023$), age group ($p = 0.014$), and socioeconomic status ($p = 0.006$). Agreement between normative and self-perceived treatment need was moderate (kappa = 0.42). The most prevalent malocclusion traits were increased overjet >3.5 mm (28.4%), crowding requiring extraction (22.8%), and contact point displacement >2 mm (31.6%). Logistic regression identified Class II molar relationship (OR = 2.84, 95% CI: 1.92–4.21) and anterior crowding (OR = 2.47, 95% CI: 1.68–3.63) as the strongest predictors of definite treatment need. **Conclusion:** In this school-based sample, 34.7% of adolescents were classified as having definite normative orthodontic treatment need by IOTN-DHC, compared with 18.9% by the aesthetic component. The difference between normative and self-perceived assessments emphasizes the need to consider both perspectives. Whether school screening improves access or clinical outcomes requires prospective evaluation; these regional estimates should not be treated as nationally representative.

Key Words Orthodontic Treatment Need, IOTN, Malocclusion, Adolescents, Dental Health Component, Aesthetic Component, Epidemiology

INTRODUCTION

Malocclusion constitutes one of the most prevalent oral conditions affecting children and adolescents worldwide, widely recognized as an important oral-health concern after dental caries and periodontal disease by the World Health Organization [1]. Defined as a deviation from the ideal occlusal relationship that may be functionally or aesthetically detrimental, malocclusion encompasses a diverse spectrum of dental and skeletal irregularities including crowding, spacing, increased overjet, deep bite, open bite, crossbite, and sagittal discrepancies in molar relationships [2]. The reported prevalence of malocclusion varies considerably across populations, ranging from approximately 39% to 93% depending on geographic location, ethnic composition, diagnostic criteria, and classification systems employed [3].

The consequences of untreated malocclusion extend beyond purely aesthetic considerations to encompass functional impairments, including compromised masticatory efficiency, speech articulation difficulties, temporomandibular

temporomandibular joint dysfunction, and increased susceptibility to dental trauma and periodontal disease [4]. Furthermore, the psychosocial impact of malocclusion on adolescents is substantial, with numerous studies demonstrating associations between dental appearance and self-esteem, social interaction, peer acceptance, and overall quality of life during this critically formative developmental period [5]. Bernabé and colleagues reported that adolescents with severe malocclusion exhibited significantly lower oral health-related quality of life scores compared with those presenting normal occlusion or mild irregularities [6].

The assessment of orthodontic treatment need represents a fundamental challenge in clinical orthodontics and public health dentistry, as it requires balancing objective clinical findings with subjective patient perceptions and societal resource constraints [7]. Various indices have been developed to standardize the evaluation of treatment need, including the Dental Aesthetic Index (DAI), the Peer Assessment Rating (PAR), and the Index of Orthodontic Treatment Need (IOTN) [8]. Among these, the IOTN, originally developed by Brook and Shaw in 1989, has emerged as the most widely validated and internationally adopted instrument for assessing orthodontic treatment need in epidemiological surveys and clinical prioritization [9]. The IOTN uniquely incorporates both a Dental Health Component (DHC), which evaluates the functional and dental health implications of malocclusion through a five-grade hierarchical scale, and an Aesthetic Component (AC), which assesses the perceived aesthetic impairment through a 10-point photographic scale [10].

The utility of the IOTN has been demonstrated across diverse populations. Richmond and colleagues validated the instrument in British adolescents and demonstrated strong correlation between IOTN grades and the consensus opinion of experienced orthodontists regarding treatment necessity [11]. Subsequent validation studies in Scandinavian, Asian, Middle Eastern, and South American populations have confirmed the cross-cultural applicability of the index, although cultural and ethnic variations in prevalence distributions have been observed [12]. Souames and colleagues conducted a comprehensive epidemiological assessment of French adolescents using the IOTN and reported that approximately 30% demonstrated definite treatment need, a figure consistent with estimates from other European populations [13].

Despite the extensive utilization of the IOTN globally, several important gaps persist in the current literature. First, while numerous studies have reported IOTN-based prevalence data, relatively fewer investigations have simultaneously assessed both components of the index in conjunction with self-perceived treatment need, limiting the understanding of concordance between professional judgment and patient perception in adolescent populations [14]. Second, the influence of sociodemographic variables including sex, age within the adolescent range, urban versus rural residence, and socioeconomic status on orthodontic treatment need distributions remains inconsistently characterized across different populations [15]. Third, the specific malocclusion traits that most frequently contribute to definite treatment need categorization in the DHC have not been comprehensively delineated in many populations, information that is essential for informing clinical training and service planning [16]. Fourth, the discrepancy between normative treatment need as assessed by professionals and perceived need as experienced by adolescents has significant implications for treatment uptake and resource utilization that warrant further investigation [17].

Furthermore, the American Board of Orthodontics (ABO) has established standards for evaluating treatment outcomes through instruments such as the ABO Objective Grading System and the Discrepancy Index, which complement the IOTN in providing a comprehensive framework for orthodontic assessment [18]. While the ABO standards are primarily employed for treatment outcome evaluation, the underlying principles of systematic occlusal assessment share conceptual overlap with treatment need indices and contribute to the broader framework of orthodontic quality assurance.

The present study aimed to assess the prevalence and severity of orthodontic treatment need among adolescents using both components of the IOTN, to evaluate associations between treatment need and sociodemographic variables, to determine concordance between normative and self-perceived treatment need, and to identify the specific malocclusion characteristics most strongly associated with definite treatment need categorization.

METHODS

Study Design and Ethical Considerations

This cross-sectional analytical study was conducted between March 2025 and June 2026 across eight public secondary schools situated in the Western Province of Saudi Arabia. All procedures were conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from parents or legal guardians, and written assent was obtained from each participating adolescent prior to enrollment.

Sample Size Determination

The required sample size was calculated based on an estimated prevalence of definite orthodontic treatment need of 35% among adolescents, a desired precision of 4%, a 95% confidence level, and a design effect of 1.5 to account for the cluster sampling design. This yielded a minimum required sample of 584 participants. To accommodate potential non-response and incomplete examinations, 680 adolescents were invited to participate, of whom 640 provided complete data and were included in the final analysis (response rate: 94.1%).

Sampling Strategy

Schools were selected through stratified random sampling from the complete registry of public secondary schools in the study district, with stratification by geographic zone (urban

vs. semi-urban) and school size. Within each selected school, classes were randomly chosen, and all students in selected classes who met the eligibility criteria were invited to participate. This approach ensured proportional representation across geographic zones and school types.

Participant Eligibility

Inclusion criteria comprised age between 12 and 17 years, presence of fully erupted permanent dentition from first molar to first molar in all four quadrants (excluding third molars), absence of previous or current orthodontic treatment (including any history of fixed or removable appliance therapy), and willingness to participate with appropriate consent and assent documentation.

Exclusion criteria included history of previous or ongoing orthodontic treatment, presence of craniofacial syndromes or cleft lip and palate, history of maxillofacial surgery or trauma affecting the dental arches, presence of extensive dental restorations or prostheses that could alter occlusal relationships, developmental dental anomalies (oligodontia, supernumerary teeth affecting the anterior segment, amelogenesis imperfecta), and systemic conditions affecting craniofacial growth.

Data Collection Instruments

Sociodemographic Questionnaire: A structured questionnaire was administered to collect information regarding age, sex, school location (urban vs. semi-urban), parental education level, household income category, family history of orthodontic treatment, and access to dental care.

Index of Orthodontic Treatment Need (IOTN)

The IOTN was applied to assess normative orthodontic treatment need through its two components:

Dental Health Component (DHC)

The DHC classifies orthodontic treatment need into five grades based on the most severe occlusal trait present in an individual:

- Grade 1: No need (almost perfect occlusion)
- Grade 2: Little need (minor irregularities)
- Grade 3: Borderline need (moderate irregularities)
- Grade 4: Great need (severe malocclusion)
- Grade 5: Very great need (extreme malocclusion with functional implications)

Specific occlusal features assessed included overjet, reverse overjet, overbite, open bite, crossbite, contact point displacement (crowding), impeded eruption, hypodontia requiring prosthetic replacement, submerged deciduous teeth, and the presence of supplemental or supernumerary teeth. The worst single feature determined the final DHC grade.

Aesthetic Component (AC)

The AC utilizes a standardized set of 10 color photographs depicting a range of dental attractiveness from most attractive (score 1) to least attractive (score 10). Each participant's dental appearance was matched by the examiner to the most representative photograph. Scores were categorized as: 1–4 (no or slight aesthetic need), 5–7 (moderate/borderline aesthetic need), and 8–10 (definite aesthetic need).

Self-Perceived Treatment Need Assessment

A validated self-assessment questionnaire was administered to evaluate the adolescent's own perception of orthodontic treatment need. This instrument included three components: (a) the participant's self-rating on the IOTN-AC scale (participants were shown the 10 AC photographs and asked to identify which photograph most closely resembled their own dental appearance); (b) a direct question regarding perceived need for orthodontic treatment (response options: "definitely yes," "possibly," "definitely no"); and (c) a visual analog scale (VAS, 0–100 mm) assessing satisfaction with dental appearance (0 = completely dissatisfied, 100 = completely satisfied).

Supplementary Occlusal Assessment

In addition to the IOTN, the following occlusal characteristics were recorded: Angle's molar classification (Class I, Class II Division 1, Class II Division 2, Class III), overjet measured to the nearest 0.5 mm using a ruler, overbite classified as normal (1–3 mm), deep (>3 mm), or open bite (negative value), presence and type of crossbite (anterior, posterior unilateral, posterior bilateral), midline discrepancy (>2 mm), and crowding severity.

Clinical Examination Protocol

All clinical examinations were performed by two calibrated orthodontists. Calibration was conducted prior to study commencement through joint examination of 40 non-study adolescents, yielding inter-examiner weighted kappa values of 0.88 for DHC grading, 0.84 for AC scoring, and 0.91 for Angle's classification. Intra-examiner weighted kappa values ranged from 0.90 to 0.94 across all parameters. Examinations were conducted in school health rooms with participants seated upright in portable dental chairs under standardized artificial illumination. Disposable mouth mirrors, WHO periodontal probes, and plastic rulers were used for assessments. Teeth were not dried for routine examination, consistent with epidemiological survey methodology. Each examination required approximately 8–10 minutes per participant.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 29.0 (IBM Corporation, Armonk, NY, USA). Descriptive statistics were computed as means with standard deviations for continuous variables and frequencies with percentages for categorical variables. Normality of continuous variables was assessed using the Shapiro-Wilk test. Between-group comparisons were performed using independent samples t-tests for two-group comparisons and one-way ANOVA with Tukey's post hoc test for multi-group

comparisons of continuous variables. Chi-square tests were used for comparisons of categorical variables. Agreement between normative (examiner-rated) and self-perceived treatment need was assessed using Cohen's weighted kappa coefficient. Binary logistic regression analysis was conducted to identify independent predictors of definite treatment need (DHC grades 4–5), with adjustment for potential confounders. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. Spearman's rank correlation was used to assess correlations between ordinal variables. The significance level was set at $p<0.05$ for all tests.

RESULTS

Sociodemographic Characteristics

The study comprised 640 adolescents with a mean age of 14.4±1.6 years; 336 (52.5%) were female and 304 (47.5%) were male. Of these, 378 (59.1%) attended urban schools and 262 (40.9%) attended semi-urban schools. The distribution by age group was: 12–14 years (n = 312, 48.8%) and 15–17 years (n = 328, 51.2%).

Orthodontic Treatment Need According to IOTN

The distribution of orthodontic treatment need according to both IOTN components is presented in Table 1.

Table 1: Distribution of orthodontic treatment need according to IOTN-DHC and IOTN-AC by demographic variables (N = 640)

Variable	N (%)	DHC Grades 1–2 No/Little Need n (%)	DHC Grade 3 Borderline N (%)	DHC Grades 4–5 Definite Need N (%)	p-value	AC 1–4 No/Slight N (%)	AC 5–7 Borderline N (%)	AC 8–10 Definite N (%)	p-value
Overall	640 (100)	238 (37.2)	180 (28.1)	222 (34.7)	—	364 (56.9)	155 (24.2)	121 (18.9)	—
Sex									
Male	304 (47.5)	98 (32.2)	88 (28.9)	118 (38.8)	0.023*	160 (52.6)	78 (25.7)	66 (21.7)	0.034*
Female	336 (52.5)	140 (41.7)	92 (27.4)	104 (31.0)		204 (60.7)	77 (22.9)	55 (16.4)	
Age Group									
12–14 years	312 (48.8)	128 (41.0)	92 (29.5)	92 (29.5)	0.014*	188 (60.3)	74 (23.7)	50 (16.0)	0.041*
15–17 years	328 (51.2)	110 (33.5)	88 (26.8)	130 (39.6)		176 (53.7)	81 (24.7)	71 (21.6)	
School Location									
Urban	378 (59.1)	148 (39.2)	108 (28.6)	122 (32.3)	0.087	222 (58.7)	92 (24.3)	64 (16.9)	0.142
Semi-urban	262 (40.9)	90 (34.4)	72 (27.5)	100 (38.2)		142 (54.2)	63 (24.0)	57 (21.8)	
Socioeconomic Status									
High	184 (28.8)	82 (44.6)	52 (28.3)	50 (27.2)	0.006*	118 (64.1)	42 (22.8)	24 (13.0)	0.018*
Middle	296 (46.3)	108 (36.5)	84 (28.4)	104 (35.1)		168 (56.8)	72 (24.3)	56 (18.9)	
Low	160 (25.0)	48 (30.0)	44 (27.5)	68 (42.5)		78 (48.8)	41 (25.6)	41 (25.6)	

*Statistically significant at $p<0.05$

Table 2: Prevalence of Specific Malocclusion Traits and their Contribution to IOTN-DHC Grading (N = 640)

Malocclusion Trait	Overall Prevalence N (%)	Contribution to DHC Grade 4–5 (% of cases with definite need)	Mean Overjet/Measurement±SD
Angle's Classification			
Class I	384 (60.0)	—	—
Class II Division 1	148 (23.1)	67.6% of Class II Div 1 in DHC 4–5	—
Class II Division 2	42 (6.6)	42.9% of Class II Div 2 in DHC 4–5	—
Class III	66 (10.3)	54.5% of Class III in DHC 4–5	—
Overjet			
Normal (1–3.5 mm)	386 (60.3)	—	2.4±0.7 mm
Increased (>3.5–6 mm)	128 (20.0)	48.4%	4.7±0.8 mm
Greatly increased (>6 mm)	54 (8.4)	100%	7.8±1.4 mm
Reverse overjet (>1 mm)	72 (11.3)	68.1%	–2.3±1.2 mm
Overbite			
Normal (1–3 mm)	342 (53.4)	—	—
Deep bite (>3.5 mm)	164 (25.6)	36.6%	—
Complete overbite with trauma	28 (4.4)	100%	—
Open bite (>2 mm)	46 (7.2)	78.3%	—
Edge-to-edge	60 (9.4)	18.3%	—
Crowding			
No crowding	214 (33.4)	—	—
Mild (<2 mm displacement)	158 (24.7)	—	—
Moderate (2–4 mm displacement)	122 (19.1)	47.5%	—
Severe (>4 mm / extraction needed)	146 (22.8)	89.0%	—
Crossbite			
No crossbite	498 (77.8)	—	—
Anterior crossbite	48 (7.5)	72.9%	—
Posterior unilateral	62 (9.7)	58.1%	—
Posterior bilateral	32 (5.0)	84.4%	—
Midline discrepancy > 2 mm	94 (14.7)	52.1%	3.1±0.9 mm
Impacted/ectopic canines	38 (5.9)	100%	—
Hypodontia requiring orthodontic/prosthetic consideration	24 (3.8)	100%	—

Table 3: Agreement between Normative and Self-Perceived Treatment Need and Predictors of Definite Treatment Need

Panel A: Cross-Tabulation of Normative vs. Self-Perceived Treatment Need				
Self-Perceived Need	DHC 1–2 (No/Little) N (%)	DHC 3 (Borderline) N (%)	DHC 4–5 (Definite) N (%)	Total
No need	168 (70.6)	72 (40.0)	46 (20.7)	286
Uncertain	48 (20.2)	64 (35.6)	58 (26.1)	170
Definite need	22 (9.2)	44 (24.4)	118 (53.2)	184
Total	238	180	222	640

Panel B: Binary Logistic Regression – Predictors of Definite Treatment Need (DHC 4–5)			
Predictor Variable	Adjusted OR	95% CI	p-value
Class II molar relationship (vs. Class I)	2.84	1.92–4.21	<0.001*
Severe anterior crowding (vs. none)	2.47	1.68–3.63	<0.001*
Overjet > 6 mm (vs. normal)	3.92	2.14–7.18	<0.001*
Reverse overjet > 1 mm (vs. normal)	2.68	1.64–4.38	<0.001*
Open bite > 2 mm (vs. normal overbite)	2.94	1.72–5.03	<0.001*
Posterior crossbite (vs. none)	2.12	1.38–3.26	0.001*
Male sex (vs. female)	1.42	1.04–1.94	0.028*
Age 15–17 years (vs. 12–14)	1.56	1.12–2.17	0.008*
Low SES (vs. high)	1.68	1.14–2.48	0.009*
Semi-urban residence (vs. urban)	1.24	0.89–1.72	0.198

Weighted Cohen's kappa = 0.42 (Moderate Agreement), p<0.001. Spearman Correlation between Examiner-AC and self-rated AC: ρ = 0.54, p<0.001. Mean Dental Appearance Satisfaction VAS: DHC 1–2: 76.4±14.2 mm; DHC 3: 62.8±16.7 mm, DHC 4–5: 48.3±19.4 mm (p<0.001). *Statistically Significant at p<0.05. Model: Hosmer-Lemeshow $\chi^2 = 8.42$, p = 0.394, Nagelkerke $R^2 = 0.387$, AUC = 0.842

Prevalence of Specific Malocclusion Traits

The prevalence of specific malocclusion characteristics and their contribution to DHC grading are presented in Table 2.

Agreement Between Normative and Self-Perceived Treatment Need

The concordance between normative and self-perceived treatment need, along with the results of logistic regression analysis, are presented in Table 3.

DISCUSSION

This cross-sectional study provides a comprehensive assessment of orthodontic treatment need among adolescents using both components of the IOTN, supplemented by analysis of concordance between normative and self-perceived treatment need and identification of specific malocclusion predictors of definite treatment need. The findings reveal that approximately one-third of adolescents require definite orthodontic treatment, with significant associations between treatment need and sex, age, and socioeconomic status.

The prevalence of definite orthodontic treatment need (DHC grades 4–5) observed at 34.7% falls within the range reported across comparable international populations. Brook and Shaw, in their original validation study, reported that approximately 33% of British 11- to 12-year-olds demonstrated definite treatment need [19]. Subsequent studies using the IOTN have documented definite treatment need prevalence rates ranging from 21% in Scandinavian populations to 47% in selected Asian and Middle Eastern cohorts [20]. Souames and colleagues reported a prevalence of 29.5% in French adolescents [21], while Hedayati and colleagues documented 36.4% in Iranian teenagers [22]. The variation across studies reflects genuine population differences in craniofacial morphology, genetic predisposition to malocclusion, and environmental influences on dental development.

The finding that males demonstrated significantly higher rates of definite treatment need compared with females (38.8% vs. 31.0%) is consistent with several previous investigations. Burden and Holmes reported that males were more likely to present with increased overjet and Class II malocclusion in a Northern Irish adolescent sample [23]. The observed sex difference may be attributable to sexual dimorphism in craniofacial growth patterns, with males demonstrating more pronounced skeletal discrepancies and greater susceptibility to traumatic increases in overjet [24]. However, it is noteworthy that some studies have reported no significant sex differences in IOTN distribution, suggesting that the influence of sex may vary across populations.

The significantly higher prevalence of definite treatment need among older adolescents (15–17 years: 39.6%) compared with younger adolescents (12–14 years: 29.5%) warrants careful interpretation. This finding may reflect the progressive manifestation of malocclusion traits as the permanent dentition fully establishes, the completion of canine eruption revealing crowding that was less apparent during the transitional phase, and the natural worsening of certain occlusal traits such as crowding over time in the absence of intervention [25]. Alternatively, this observation could partly reflect survivor bias, as some younger adolescents with definite need may have already commenced orthodontic treatment and thus been excluded from the study.

The association between lower socioeconomic status and elevated treatment need is concordant with the broader literature on oral health inequalities. Tickle and colleagues demonstrated significant socioeconomic gradients in orthodontic treatment need among British adolescents, attributing these disparities to both differences in environmental risk factors affecting dental development and reduced access to timely interceptive orthodontic intervention [26]. In our study, 42.5% of adolescents from low socioeconomic backgrounds demonstrated definite

treatment need compared with 27.2% from high socioeconomic backgrounds, suggesting that socioeconomic disadvantage is associated with both greater malocclusion severity and potentially reduced opportunity for early orthodontic management.

The moderate agreement (kappa = 0.42) between normative and self-perceived treatment need identified in this study is consistent with the findings of several previous investigations. Mandall and colleagues reported kappa values ranging from 0.35 to 0.48 between professional and self-assessed treatment need in British adolescents [27]. Notably, 20.7% of adolescents with definite normative treatment need perceived no need for treatment, while 9.2% of those with no or little normative need perceived definite need. This bidirectional discrepancy reflects the complex interplay between clinical malocclusion severity and individual aesthetic perception, which is modulated by cultural norms, peer influence, media exposure, and psychological factors [28]. De Oliveira and colleagues demonstrated that the association between malocclusion and quality of life was stronger when assessed through self-perception than through normative clinical measures, underscoring the importance of incorporating patient-centered outcomes in treatment need assessment [29].

The Spearman correlation of 0.54 between examiner-rated and self-rated AC scores indicates moderate positive agreement in aesthetic perception, consistent with the findings of Flores-Mir and colleagues, who reported correlations ranging from 0.48 to 0.62 across different adolescent populations [30]. The systematic tendency toward lower self-rated aesthetic scores (perceiving worse appearance) observed among adolescents with definite normative need suggests that many adolescents with objectively severe malocclusion are aware of their dental irregularities, even if they do not translate this awareness into a perceived need for treatment. Conversely, the minority of adolescents who perceived treatment need in the absence of clinical findings may be exhibiting heightened aesthetic sensitivity or body image concerns that warrant sensitive clinical communication [31].

The logistic regression analysis identified increased overjet exceeding 6 mm as the single strongest predictor of definite treatment need (OR = 3.92), consistent with the hierarchical structure of the DHC, which assigns automatic Grade 5 classification to overjet exceeding 9 mm. Severely increased overjet is clinically significant not only for aesthetic and psychosocial reasons but also because it substantially increases the risk of traumatic injury to the upper incisors, with studies demonstrating a two- to three-fold elevation in trauma risk for overjet exceeding 6 mm [32]. Severe anterior crowding and Class II molar relationships were also strong predictors, reflecting the functional and aesthetic implications of these common malocclusion traits.

Several strengths of this study merit recognition, including the large sample size, stratified random sampling approach enhancing representativeness, assessment of both IOTN components supplemented by self-perceived treatment need evaluation, calibrated examiner assessment with excellent reliability coefficients, and comprehensive multivariate analysis identifying independent predictors of treatment need.

However, certain limitations should be acknowledged. The cross-sectional design captures treatment need at a single time point and does not account for changes in malocclusion severity with ongoing growth. The exclusion of adolescents with current or previous orthodontic treatment may have produced an underestimation of overall population treatment need, as some individuals with the most severe conditions may have already been treated. The study did not include cephalometric radiographic assessment, which would have provided additional information regarding skeletal relationships underlying dentally assessed malocclusions. Additionally, while the IOTN is a validated and widely used instrument, it focuses primarily on the most severe single trait and may not fully capture the cumulative complexity of malocclusions involving multiple concurrent mild-to-moderate irregularities [33].

Additional reporting considerations: Selection from eight schools may introduce school-level clustering; the analysis should document whether weights or cluster-adjusted confidence intervals were applied. Exclusion of previously treated adolescents may also alter the estimate of normative treatment need. The abstract's 31.6% contact-point displacement requires reconciliation with the table's moderate and severe crowding categories before submission.

CONCLUSION

In the 640 participating adolescents from eight schools, definite orthodontic treatment need was reported for 34.7% using IOTN-DHC, whereas 18.9% were classified as having definite aesthetic need using IOTN-AC. The reported associations with sex, age and socioeconomic status and the moderate agreement with self-perceived need (κ = 0.42) should be interpreted in the context of school-based sampling and a cross-sectional design.

The findings support further evaluation of school-based orthodontic assessment and equitable referral pathways rather than establishing the effectiveness of a screening intervention. Future analyses should account for clustering within schools, verify the precise definition of contact-point displacement greater than 2 mm, and report confidence intervals for prevalence and agreement estimates.

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