

Original Article

ASSESSMENT OF ORTHODONTIC TREATMENT NEED IN ADOLESCENT POPULATION USING INDEX OF ORTHODONTIC TREATMENT NEED (IOTN): A MULTI-CENTRE CROSS-SECTIONAL STUDY

Shahzonia Tariq¹, Amra Minhas Abid¹, Muhammad Hasnain¹, Waheed Ullah Khan¹, Asma Najibullah Khan², Rabia Sadia³

¹Department of Orthodontics, Dental College HITEC-IMS, Taxila

²Department of Orthodontics, HBS medical and dental college, Islamabad

³Department of Orthodontics, KRL General Hospital, G-9/1, Islamabad

ABSTRACT

Objectives: To assess orthodontic treatment need in adolescent population using index of orthodontic treatment need (IOTN).

Materials and Methods: This multicentre cross-sectional study comprised 60 adolescents in total. Eligible participants were individuals aged 12 to 18 years with no previous orthodontic treatment and showed willingness to participate. Adolescents with craniofacial anomalies, syndromes, or medical conditions affecting facial development were excluded from the study. Both the dental health component (DHC) and the aesthetic component (AC) of IOTN were used to evaluate the necessity for orthodontic treatment. The frequency of adolescents that need orthodontic treatment was assessed in relation to both IOTN components. Chi-square test was used to assess association between orthodontic treatment need and other variables (gender and age). A p-value of <0.05 was considered statistically significant.

Results: 46.7% of adolescent population need orthodontic treatment according to DHC while 23% need orthodontic treatment according to AC of IOTN. The result of chi-square test indicated that there was no statistically significant association of gender and age with IOTN grades.

Conclusion: A significant proportion of adolescent population required orthodontic treatment. Therefore, the routine dental checkups should include early orthodontic examinations and interventions to improve dental function and psychosocial well-being by promptly addressing malocclusions.

Key words: Adolescent, cross-sectional studies, dental health, index of orthodontic treatment need

Cite as: Tariq S, Abid AM, Hasnain M, KhanWU, Khan AN, Sadia R. Assessment of orthodontic treatment need in adolescent population using index of orthodontic treatment need (iotn): A multi-centre cross-sectional study. Journal of Khyber College of Dentistry Dec 2025, Vol. 15, No. 4. <http://doi.org/10.33279/jkcd.v15i04.832>

INTRODUCTION

Orthodontic treatment is necessary to enhance an individual's oral health, dental aesthetics and

Correspondence:

Shahzonia Tariq

Assistant Professor

Department of Orthodontics, Dental College HITEC-IMS, Taxila, Punjab

Email: shahzoniatarig.dental@hitec-ims.edu.pk.

Date Submitted: July 2025

Date Revised: October 2025

Date Accepted: November 2025

overall quality of life¹. Adolescents frequently suffer from malocclusion with varying degree of severity that has an impact on the oral health of an individual². Management of this malocclusion at an early stage is essential since untreated cases can result in functional difficulties such as speech problems, poor mastication, and psychological distress resulting from poor dental aesthetics³. Therefore, determining if an adolescent needs orthodontic treatment is essential to ensure timely intervention and to avoid

long-term consequences.

The Index of Orthodontic Treatment Need (IOTN) is a commonly used tool for assessing the need of an orthodontic treatment⁴. The IOTN is an evidence-based and a comprehensive index designed to classify patients according to the degree of malocclusion and the necessity of orthodontic treatment⁵. Developed in 1989 by Brook and Shaw⁶ it is widely used in both for epidemiological studies and in clinical settings⁷. It has two main components: the Aesthetic Component (AC) that measures the malocclusion's aesthetic impact and the Dental Health Component (DHC), that evaluates the functional and health-related aspects of malocclusion⁸. These two components of IOTN provide a structured and an objective method of determining the priority of an orthodontic treatment for individuals, especially in growing populations where early detection of orthodontic treatment needs is crucial⁹.

Because the facial skeleton and dental structures develop significantly during adolescence, this is a critical time for an orthodontic treatment. More severe dental and skeletal problems can be avoided in adulthood by detecting malocclusions early in adolescence and determining the need for orthodontic treatment¹⁰. Researches have shown that early orthodontic therapy enhance self-esteem and social interactions among adolescents in addition to improving dental function. Therefore, the assessment of treatment need in this population is a crucial component of orthodontic care¹¹.

The aim of this study is to assess the orthodontic treatment needs of an adolescent population that will aid in development of preventive plans in orthodontics as early treatment of dental malocclusions is crucial since it will lessen their severity in the future and help researchers to identify the types of dental malocclusions that may be present in the adolescent population. Additionally, the findings of this study will be helpful to emphasize the importance of incorporating regular orthodontic assessments into adolescent's routine dental check-ups.

MATERIALS AND METHODS

From May 2024 to October 2024, a six-month descriptive multi-centre cross-sectional study was carried out in the department of Orthodontics of two institutes that are Dental College HITEC-IMS,

Taxila and KRL General Hospital, Islamabad. Ethical approval was obtained from both the institutional review boards (Ref: Dental/HITEC/IRB/85 and KRL-HI-PUB-ERC/O-24/20) and written informed consent was obtained from each participant. A total of sixty adolescents were taken through non-probability consecutive sampling technique. Using WHO Calculator, this Sample size was calculated with a 95% confidence interval, anticipated population proportion of 0.04¹² and an absolute precision of 0.05. Adolescents in the age range of 12 to 18 years with no previous orthodontic treatment and showed willingness to participate in the study were included while adolescents with craniofacial anomalies, syndromes, or medical conditions affecting facial development were excluded from the study. The patients were divided into two groups based on the age that is group 1 with the age range of 12-14 years and group 2 with the age range of 15-18 years. Data collection was carried out by a trained orthodontist to ensure consistency in the assessment. The Index of Orthodontic treatment need (IOTN) was used as the primary tool to assess orthodontic treatment need. The Aesthetic Component (AC) and the Dental Health Component (DHC) are the two parts of this index. The AC was assessed using a standardized photographic scale consisting of 10 graded images (Figure 1) where participants were asked to match their dental appearance with the image that best represented their own dentition. Score from 1 to 4 indicated no or slight need for orthodontic treatment, scoring of 5 to 7 indicated borderline or moderate treatment need while score from 8 to 10 represented definite need of orthodontic treatment¹³. The DHC was evaluated through clinical examination in a well-lit setting using a dental mirror, probe, and millimetre ruler to accurately measure occlusal relationships, such as overjet, crossbite, openbite, overbite, missing teeth, and contact point displacement (Figure 2), focusing on the severity of malocclusion using the standard five-point scale from Grade 5 (extreme need for treatment) to Grade 1 (no need for treatment) Adolescents that fell into grade 4 or 5 need definite orthodontic treatment.

Data analysis was done using SPSS version 27. Descriptive statistics (frequencies and percentages) were calculated to describe the distribution of gender and orthodontic treatment need according to the IOTN. The mean \pm standard deviation was used

to determine the patient's age. The prevalence of orthodontic treatment need was determined based on both the DHC and AC components. The relationship between the need of orthodontic treatment and variables like gender and age were evaluated using inferential statistics, such as the chi-square test. Statistical significance was defined as a p-value of less than 0.05.

RESULT

The mean age of the participants in this study was 14.54 ± 1.65 years. Out of 60 participants, 34 (57%) were females and 26 (43%) were males. The frequency and percentage of adolescent patients according to IOTN grades were shown in Table 1 and the prevalence of different type of malocclusions that required orthodontic treatment were shown in Figure 3. The results of chi-square test indicated that there was no statistically significant association of IOTN grades with gender and age. The lack of a gender-based difference implies that treatment needs should be evaluated equally for adolescents who

identify as male and female.

DISCUSSION

This study used IOTN as a primary tool to evaluate the necessity for orthodontic treatment in adolescents, with an emphasis on both the dental health and aesthetic components. According to our research, a significant proportion of the adolescents required orthodontic treatment, with 35% of them fell into Grade 4 (severe treatment need) of the Dental Health Component (DHC) and 11.7% in grade 5 necessitating extreme need of treatment. This prevalence is consistent with previous research, showing that a significant percentage of adolescent's experience malocclusions that require timely intervention to avoid long-term psychological and functional impact¹⁵.

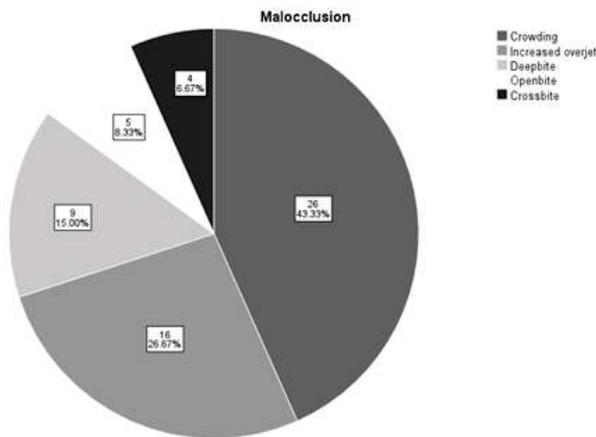


Fig 3: Prevalence of different type of malocclusions in Adolescents that required Orthodontic treatment

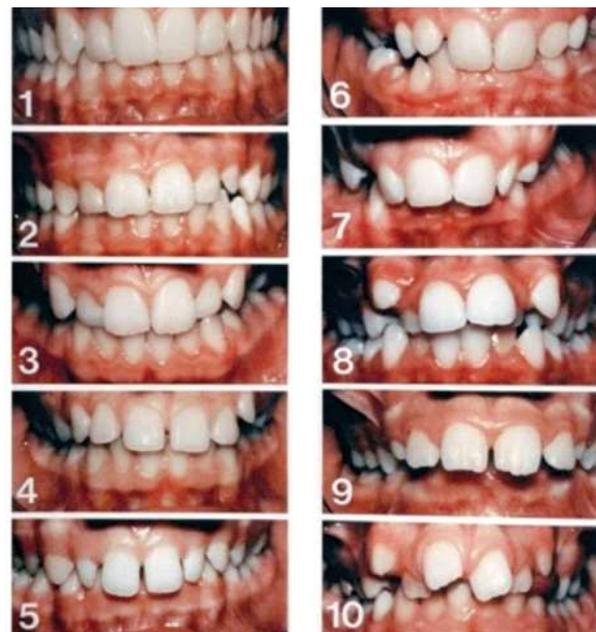


Fig 1: Aesthetic component of IOTN¹⁴

Table 1: Descriptive and Inferential statistics according to dental health and aesthetic components of the Index of Orthodontic Treatment Need

IOTN (DHC) Category	Grade	Gender		Total N (%)	Gender (p value)	Age (p value)
		Male, N (%)	Female, N (%)			
No/Little treatment need	1-2	5 (8.3)	11 (18.3)	16 (26.7)	0.632	0.598
Borderline treatment need	3	8 (13.3)	8 (13.3)	16 (26.7)		
Definite treatment need	4-5	13 (21.6)	15 (25)	28 (46.7)		
IOTN (AC) Category						
No/slight treatment need	1-4	6 (10)	10 (16.7)	16 (26.7)	0.939	0.646
Borderline treatment need	5-7	13 (21.6)	17 (28.3)	30 (50)		
Definite treatment need	8-9	7 (11.6)	7 (11.6)	14 (23.3)		

According to the results of the Aesthetic Component (AC) of the IOTN, 23% of individuals had a definite need of orthodontic treatment, while 50% of participants had a moderate to borderline need. These results are consistent with previous researches that indicates that the adolescents frequently seek orthodontic treatment due to their aesthetic concerns, even in cases when their dental health needs may be moderate¹⁶. This emphasizes how crucial it is to plan orthodontic interventions with both functional and aesthetic considerations in mind, since both can have an important impact on an adolescent's social interactions and their self-esteem.

In contrast to our study, a significant proportion of children either didn't need orthodontic treatment or there was a very little need. These results were supported by values of 91.93% that required no need or little need by AC, while 55.73% had a no/slight need according to DHC¹⁷.

This study also investigated the differences

between gender and age groups in orthodontic treatment need. The chi-square test, however, did not find a statistically significant association of IOTN grades with either gender or age. This finding is similar with the results of other studies that have found no significant gender-related differences in orthodontic treatment need¹⁸ suggesting that malocclusion affects both females and males similarly. This is in contrast to the previous study that showed that as compares to males, the malocclusion might have significantly more psychosocial impact on females¹⁹. Even though gender inequalities do not exist, individual differences in treatment needs must be taken into account because patient-specific factors including oral health behaviors and patterns of face growth can affect the outcomes.

The use of the IOTN in this study proved to be an effective method for assessing the needs of orthodontic treatment in the adolescent population. The combination of the both the components of IOTN; AC and DHC, allowed us to perform a comprehen-

Table 1. Dental health component of the Index of Orthodontic Treatment Need

<i>Grade 1—None</i>
Other variations in occlusion including displacements less than or equal to 1 mm.
<i>Grade 2—Little</i>
Increased overjet greater than 3.5 mm but less than or equal to 6 mm with lips competent at rest.
Reverse overjet greater than 0 mm but less than or equal to 1 mm.
Increased overbite greater than 3.5 mm with no gingival contact.
Anterior or posterior crossbite with less than or equal to 1 mm displacement between retruded contact position and intercuspal position
Small lateral or anterior open bites greater than 1 mm but less than or equal to 2 mm.
Prenormal or postnormal occlusions with no other anomalies.
Mild displacement of teeth greater than 1 mm but less than or equal to 2 mm.
<i>Grade 3—Moderate</i>
Increased overjet greater than 3.5 mm but less than or equal to 6 mm with incompetent lips at rest.
Reverse overjet greater than 1 mm but less than or equal to 3.5 mm.
Increased and complete overbite with gingival contact but without indentations or signs of trauma.
Anterior or posterior crossbite with less than or equal to 2 mm but greater than 1 mm displacement between retruded contact position and intercuspal position.
Moderate lateral or anterior openbite greater than 2 mm but less than or equal to 4 mm.
Moderate displacement of teeth greater than 2 mm but less than or equal to 4 mm.
<i>Grade 4—Great</i>
Increased overjet greater than 6 mm but less than or equal to 9 mm.
Reverse overjet greater than 3.5 mm with no reported masticatory or speech difficulties.
Reverse overjet greater than 1 mm but less than or equal to 3.5 mm with reported masticatory or speech difficulties.
Anterior or posterior crossbites with greater than 2 mm displacement between retruded contact position and intercuspal position.
Posterior lingual crossbites with no occlusal contact in one or both buccal segments.
Severe displacement of teeth greater than 4 mm.
Extreme lateral or anterior open bite greater than 4 mm.
Increased and complete overbite causing notable indentations on the palate or labial gingivae.
Patient referred by colleague for collaborative care, e.g., periodontal, restorative, or TMJ considerations.
Less extensive hypodontia requiring prerestorative orthodontics or orthodontic space closure to obviate the need for prosthesis (not more than one tooth missing in any quadrant).
<i>Grade 5—Very great</i>
Defects of cleft lip and/or cleft palate.
Increased overjet greater than 9 mm.
Reverse overjet greater than 3.5 mm with reported masticatory or speech difficulties.
Impeded eruption of teeth (with the exception of third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth, and any other pathologic cause.
Extensive hypodontia with restorative implications (more than one tooth missing in any quadrant) requiring prerestorative orthodontics.

Fig 1: Dental health component of IOTN⁶

sive evaluation of an individual, taking into account not only the oral health but also the psychosocial aspects of a malocclusion. Similar to our study, IOTN was found to be a reliable tool for clinical and epidemiological research²⁰. This emphasizes how helpful the index is in determining which patients need orthodontic treatment and how to prioritize cases in clinical settings. Further studies may build upon this work by examining the effects of early intervention on long-term outcomes in a diverse adolescent population.

LIMITATIONS

One limitation of this study is the use of non-probability convenience sampling, which may not fully represent the broader population of dental practitioners. Additionally, the self-reported nature of the questionnaire could introduce response bias, as participants might overestimate their knowledge or application of laser technology. The study's reliance on WhatsApp groups and emails for participant recruitment may have limited the diversity of respondents, particularly those less active in such digital platforms. Furthermore, the study focused only on Pakistani nationals, potentially limiting the generalizability of the findings to other regions. Lastly, the use of a pre-existing questionnaire may not have fully captured all relevant aspects of laser technology use in endodontics.

CONCLUSION

In conclusion, a significant proportion of adolescent population required orthodontic treatment (About 46.7% according to dental health component while 23% need orthodontic treatment by aesthetic component of IOTN). No statistically significant age or gender differences were found. Routine dental checkups should include early orthodontic examinations and interventions to improve dental function and psychosocial well-being by promptly addressing malocclusions.

REFERENCES

1. Oppitz LR, Rodríguez MG, Schneider NÁ, Salvação SML, da Paixão Custódio C, Fregoneze AP, et al. Aesthetic and functional advantages of early orthodontic treatment in a child with Asperger's Syndrome: case report. *Res Soc Dev.* 2021;10(15):e187101522722. <https://doi.org/10.33448/rsd-v10i15.22722>
2. De Ridder L, Aleksieva A, Willems G, Declerck D, Cadenas de Llano-Pérula M. Prevalence of orthodontic malocclusions in healthy children and adolescents: a systematic review. *Int J Environ Res Public Health.* 2022;19(12):7446. <https://doi.org/10.3390/ijerph19127446>
3. Freitas HV, Alves CMC, Pereira ALP, Hugo FN, Thomaz EBAF. Alterations of oral functions and dental malocclusions in adolescents: a cross-sectional population-based study. *Cien Saude Colet.* 2021;26(suppl 3):5261-72. <https://doi.org/10.1590/1413-812320212611.3.07992020>
4. Jenny J, Cons NC. Comparing and contrasting two orthodontic indices, the Index of Orthodontic Treatment Need and the Dental Aesthetic Index. *Am J Orthod Dentofacial Orthop.* 1996;110(4):410-6. [https://doi.org/10.1016/s0889-5406\(96\)70044-6](https://doi.org/10.1016/s0889-5406(96)70044-6)
5. Bouskandar SY, Al Muraikhi L, Hodge TM, Barber SK. UK dental students' ability and confidence in applying the Index of Orthodontic Treatment Need and determining appropriate orthodontic referral. *Eur J Dent Educ.* 2023;27(3):489-96. <https://doi.org/10.1111/eje.12832>
6. Brook PH, Shaw WC. The development of an index of orthodontic treatment priority. *Eur J Orthod.* 1989;11(3):309-20.
7. Kirschneck C, Kuhr K, Ohm C, Frenzel Baudisch N, Jordan AR. Comparison of orthodontic treatment need and malocclusion prevalence according to KIG, ICON, and mIOTN in German 8-to 9-year-old children of the Sixth German Oral Health Study (DMS 6). *J Orofac Orthop.* 2023;84(Suppl 1):26-35. <https://doi.org/10.1007/s00056-023-00446-6>
8. Borzabadi-Farahani A. An insight into four orthodontic treatment need indices. *Prog Orthod.* 2011;12(2):132-42. <https://doi.org/10.1016/j.pio.2011.06.001>
9. Spalj S, Slaj M, Varga S, Strujic M, Slaj M. Perception of orthodontic treatment need in children and adolescents. *Eur J Orthod.* 2010;32(4):387-94. <https://doi.org/10.1093/ejo/cjp101>
10. Schneider-Moser UE, Moser L. Very early orthodontic treatment: when, why and how? *Dental Press J Orthod.* 2022;27(02):e22spe2. <https://doi.org/10.1590/2177-6709.27.2.e22spe2>
11. Hsieh T-J, Pinskaya Y, Roberts WE. Assessment of orthodontic treatment outcomes: early treatment versus late treatment. *Angle Orthod.* 2005;75(2):162-70. [https://doi.org/10.1043/0003-3219\(2005\)075%3C0158:A00TOE%3E2.0.CO;2](https://doi.org/10.1043/0003-3219(2005)075%3C0158:A00TOE%3E2.0.CO;2)
12. Azeem M, Awaisi ZH, Hassan S, Ahmad F, Ata S, Rasheed A. Orthodontic Treatment Need at Nishter Institute of Dentistry. *Pak. J. Med. Health Sci.* 2021;15(8):1903-05. <http://dx.doi.org/10.53350/pjmhs211581903>
13. Azeem M, Shakoore U, Rehman AU, Khan MI, Mehmood A. The Aesthetic component of Index of orthodontic treatment need (IOTN): A Population based

- study in two health district of Punjab, Pakistan. *J. Univ Med Dent Coll.* 2018;9(2):41-46.
14. Al Khawaja NF, Jasim ES, Alshaekli II. Evaluate the reliability and accuracy of pre and post orthodontic treatment according to the Index of Complexity Outcome and Need in Iraq. *Int J Med.* 2020;25(2):707-716.
 15. Tomić K, Buljan ZI, Zovko IČ, Jelavić R, Tomić V, Trolić IM. The Need for Orthodontic Therapy for Children and Adolescents in the Health Center Mostar According to the IOTN Index. *Ann Biomed Clin Res.* 2023;2(1):63-71. <http://dx.doi.org/10.47960/2744-2470.2023.1.2.63>
 16. Bahar AD, Sagi MS, Mohd Zuhairi FA, Wan Hassan WN, editors. Dental Aesthetics and Self-Esteem of Patients Seeking Orthodontic Treatment. *Health-care.* 2024;12(16):1576. <https://doi.org/10.3390/health-care12161576>
 17. Hedayati Z, Fattahi H, Jahromi S. The use of index of orthodontic treatment need in an Iranian population. *Journal of the Indian Society of Pedodontics and Preventive Dentistry.* 2007;25(1):10-4. <https://doi.org/10.4103/0970-4388.31982>
 18. Perillo L, Masucci C, Ferro F, Apicella D, Baccetti T. Prevalence of orthodontic treatment need in southern Italian schoolchildren. *Eur J Orthod.* 2010;32(1):49-53. <https://doi.org/10.1093/ejo/cjp050>
 19. Gassem AAB, Aldweesh AH, Alsagob EI, Alanazi AM, Hafiz AM, Aljohani RS, et al. Psychosocial Impact of Malocclusion and Self-Perceived Orthodontic Treatment Need among Young Adult Dental Patients. *European journal of dentistry.* 2023;17(3):713-9. <https://doi.org/10.1055/s-0042-1753452>
 20. Khandakji MN, Ghafari JG. Evaluation of commonly used occlusal indices in determining orthodontic treatment need. *Eur J Orthod.* 2020;42(1):107-114. <https://doi.org/10.1093/ejo/cjz042>

CONFLICT OF INTEREST
Authors declare no conflict of interest.
GRANT SUPPORT AND FINANCIAL DISCLOSURE
None declared.

AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design: ST, AMA, MH, WUK, ANK, RS

Acquisition, Analysis or Interpretation of Data: ST, AMA, MH, WUK, ANK, RS

Manuscript Writing & Approval: ST, AMA, MH, WUK, ANK, RS

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



Shahzonnia Tariq et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License, which permits unrestricted use, distribution & reproduction in any medium provided that original work is cited properly.