

# Evaluation of Orthodontic Treatment Need of Orthodontic Patients in a Tertiary Health Facility in South-South Nigeria using the Index of Orthodontic Treatment Need

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## ABSTRACT

**Background:** Malocclusion is a common oral health condition and a major reason for orthodontic consultation. Objective assessment of orthodontic treatment need is important for prioritizing care, especially in resource-limited settings. This study assessed orthodontic treatment need among orthodontic patients in a tertiary health facility in South-South Nigeria using the Index of Orthodontic Treatment Need (IOTN).

**Methods:** This descriptive cross-sectional study included 120 orthodontic patients attending the University of Benin Teaching Hospital. Treatment need was assessed using the Dental Health Component (DHC) and Aesthetic Component (AC) of the IOTN. Data were analyzed using SPSS version 26, with chi-square tests applied ( $p < 0.05$ ).

**Results:** Participants comprised 76 females (63.3%) and 44 males (36.7%), with a mean age of  $22.4 \pm 8.9$  years. Based on the DHC, 66 patients (55.0%) had a definite treatment need, 34 (28.3%) had a moderate need, and 20 (16.7%) had no need. Using the AC, 86 patients (71.7%) had no aesthetic treatment need, 19 (15.8%) had a moderate need, and 15 (12.5%) had a definite need. Orthodontic treatment need was not significantly associated with age, gender, or ethnicity ( $p > 0.05$ ). A significant association was observed between the DHC and AC ( $\chi^2 = 17.57$ ,  $p = 0.002$ ).

**Conclusion:** More than half of the patients had a definite orthodontic treatment need based on dental health criteria, despite most having no perceived aesthetic need. Using both components of the IOTN provides a more comprehensive assessment of orthodontic treatment priority.

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**Keywords:** Malocclusion; Orthodontic treatment need; Index of Orthodontic Treatment Need.

## INTRODUCTION

Malocclusion is a common oral health condition and a major reason for orthodontic consultation worldwide (Zou *et al.*, 2018). It involves

abnormalities in tooth position and occlusal relationships that may interfere with oral function, facial aesthetics, and psychosocial well-being (Enzo, 2020; Jafari *et al.*, 2024). The World Health

Organization ranks malocclusion as the third most prevalent oral health problem globally, after dental caries and periodontal disease, showing its relevance in dental public health (Petersen, 2003; World Health Organization, 2025).

Although malocclusion is not typically life-threatening, its consequences can be significant. Individuals with moderate to severe malocclusion may experience difficulty with mastication and speech, increased susceptibility to dental caries and periodontal disease, and a higher risk of traumatic dental injuries (Anthony et al., 2018; Szyska-Sommerfeld *et al.*, 2026). Aesthetic concerns also play a major role, as dental appearance has been shown to influence self-esteem and social interactions, particularly among adolescents and young adults (Kanmodi *et al.*, 2020).

The need for orthodontic treatment is considerable, with local studies indicating that approximately 30–50% of children and adolescents require some form of orthodontic care, while about 10–20% present with severe malocclusion requiring definite treatment (Ajayi, 2008; Adeyemi et al., 2022). However, orthodontic resources are often limited, especially in developing countries, making it necessary to objectively assess and prioritize treatment need (Etim & Umeh, 2025).

The Index of Orthodontic Treatment Need (IOTN) is a widely accepted tool developed to standardize the assessment of orthodontic treatment requirement (Jenny & Cons, 1996). It evaluates malocclusion using two components: the Dental Health Component, which assesses occlusal traits based on their potential impact on oral health, and the Aesthetic Component, which measures dental attractiveness using a standardized scale (Padisar *et al.*, 2016). The IOTN provides an objective and reproducible method for classifying patients according to treatment priority.

Evaluating the need for orthodontic treatment among orthodontic patients using the IOTN is essential for informed clinical decision-making, equitable allocation of limited orthodontic services, and effective planning of orthodontic care. Given that the pattern and severity of malocclusion vary across populations, conducting

population-specific assessments remains important. This study therefore seeks to evaluate the orthodontic treatment need of orthodontic patients using the Index of Orthodontic Treatment Need, providing data that may support improved orthodontic service delivery and planning within the study setting.

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## MATERIALS AND METHODS

### Study Design and Location

This descriptive cross-sectional study was conducted at the Orthodontic Clinic of the University of Benin Teaching Hospital, Benin City, Edo State, Nigeria. The study evaluated orthodontic treatment need among orthodontic patients using the Index of Orthodontic Treatment Need (IOTN).

### Study Population

The study population comprised orthodontic patients attending the clinic during the study period. A total of 120 patients were recruited using a consecutive sampling technique. Patients indicated for orthodontic assessment who consented to participate were included. Individuals with previous orthodontic treatment, craniofacial anomalies, or incomplete records were excluded.

### Data Collection

Orthodontic treatment needs were assessed using the IOTN, which consists of the Dental Health Component (DHC) and the Aesthetic Component (AC). The DHC was evaluated on dental study models and classified into five grades based on the most severe occlusal trait present. The AC was assessed using standardized intraoral frontal photographs and scored on a 10-point scale according to the IOTN aesthetic reference photographs. For analysis, AC scores were grouped into no or little need, borderline need, and definite treatment need categories.

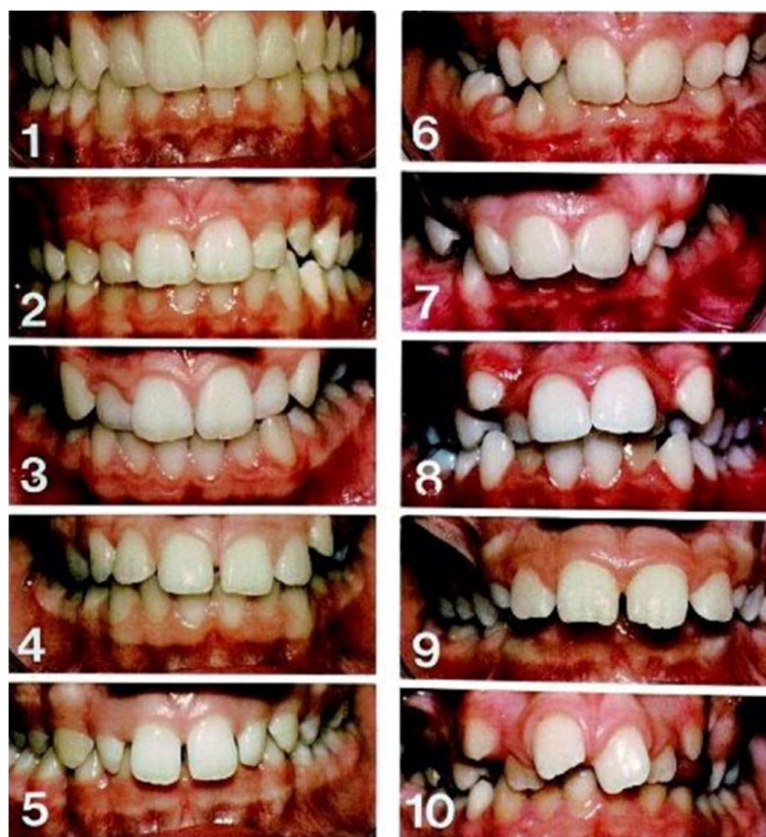


Figure 1: Aesthetic Component of the IOTN

| Grade                 | Characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>5 (Very great)</b> | <p>5.i Impeded eruption of teeth (with the exception of third molars) owing to crowding, displacement, the presence of supernumerary teeth, retained primary teeth and any pathological cause</p> <p>5.h Extensive hypodontia with restorative implications (more than one tooth missing in any quadrant) requiring preresorative orthodontics</p> <p>5.a Increased overjet &gt;9 mm</p> <p>5.m Reverse overjet &gt;3.5 mm with reported masticatory and speech difficulties</p> <p>5.p Defects of cleft lip and palate</p> <p>5.s Submerged primary teeth</p>                                                                                                                                                                                                                                                                                                                                                                      |
| <b>4 (Great)</b>      | <p>4.h Less extensive hypodontia, requiring preresorative orthodontics or orthodontic space closure to obviate the need for a prosthesis</p> <p>4.a Increased overjet &gt;6 mm but ≤9 mm</p> <p>4.b Reverse overjet &gt;3.5 mm with no masticatory or speech difficulties</p> <p>4.m Reverse overjet &gt;1 mm but &lt;3.5 mm, with recorded masticatory and speech difficulties</p> <p>4.c Anterior or posterior crossbites with &gt;2 mm discrepancy between retruded contact position and intercuspal position</p> <p>4.l Posterior lingual crossbite with no functional occlusal contact in one or both buccal segments</p> <p>4.d Severe displacements of teeth &gt;4 mm</p> <p>4.e Extreme lateral or anterior open bites &gt;4 mm</p> <p>4.f Increased and complete overbite with gingival or palatal trauma</p> <p>4.t Partially erupted teeth, tipped and impacted against adjacent teeth</p> <p>4.x Supplemental teeth</p> |
| <b>3 (Moderate)</b>   | <p>3.a Increased overjet &gt;3.5 mm but ≤6 mm with incompetent lips</p> <p>3.b Reverse overjet &gt;1 mm but ≤3.5 mm</p> <p>3.c Anterior or posterior crossbites with &gt;1 mm but ≤2 mm discrepancy between retruded contact position and intercuspal position</p> <p>3.d Displacement of teeth &gt;2 mm but ≤4 mm</p> <p>3.e Lateral or anterior open bite &gt;2 mm but ≤4 mm</p> <p>3.f Increased and complete overbite without gingival or palatal trauma</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>2 (Little)</b>     | <p>2.a Increased overjet &gt;3.5 mm but ≤6 mm with competent lips</p> <p>2.b Reverse overjet &gt;0 mm but ≤1 mm</p> <p>2.c Anterior or posterior crossbite with ≤1 mm discrepancy between retruded contact position and intercuspal position</p> <p>2.d Displacement of teeth &gt;1 mm but ≤2 mm</p> <p>2.e Anterior or posterior open bite &gt;1 mm but ≤2 mm</p> <p>2.f Increased overbite ≥3.5 mm without gingival contact</p> <p>2.g Prenormal or postnormal occlusions with no other anomalies; includes up to half a unit discrepancy</p>                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>1 (None)</b>       | Extremely minor malocclusions including displacements <1 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

Figure 2: Dental Health Component of the IOTN

### Examiner Calibration

All assessments were carried out by a single trained examiner. Examiner calibration was performed prior to data collection, and intra-examiner reliability was assessed by re-evaluating 20% of the samples after a two-week interval.

### Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were used to summarize orthodontic treatment need, while the chi-square ( $\chi^2$ ) test was employed to assess associations between variables. Statistical significance was set at  $p < 0.05$ .

### Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of the University of Benin Teaching Hospital. Informed consent was obtained from all participants or their guardians,

and confidentiality was maintained throughout the study.

## RESULTS

### Sociodemographic Characteristics of the Participants (Table 1)

A total of 120 orthodontic patients participated in the study. Of these, 44 (36.7%) were male and 76 (63.3%) were female, indicating a higher proportion of female participants. The mean age of the participants was  $22.4 \pm 8.9$  years, reflecting a predominantly young population.

Regarding ethnicity, participants were mainly of Benin origin, accounting for 41 (34.2%) of the study population. This was followed by individuals of Igbo ethnicity with 30 (25.0%), and Esan ethnicity with 20 (16.7%). Participants of Urhobo and Etsako ethnic groups constituted 14 (11.7%) and 9 (7.5%), respectively. A smaller proportion of the participants were Yoruba, accounting for 5 (4.2%), while Akwa Ibom ethnicity was least represented with 1 (0.8%).

Table 1: Sociodemographic characteristics of respondents

| Variable                                        | Frequency n = 120 | Percentage (%)                   |
|-------------------------------------------------|-------------------|----------------------------------|
| <b>Gender</b>                                   |                   |                                  |
| Male                                            | 44                | 36.7                             |
| Female                                          | 76                | 63.3                             |
| <b>Mean age in years (<math>\pm</math> S.D)</b> |                   | <b>22.4 <math>\pm</math> 8.9</b> |
| <b>Ethnicity</b>                                |                   |                                  |
| Benin                                           | 41                | 34.2                             |
| Igbo                                            | 30                | 25.0                             |
| Esan                                            | 20                | 16.7                             |
| Urhobo                                          | 14                | 11.7                             |
| Etsako                                          | 9                 | 7.5                              |
| Yoruba                                          | 5                 | 4.2                              |
| Akwa Ibom                                       | 1                 | 0.8                              |

### Orthodontic Treatment Need According to the IOTN (Figure 3 & Figure 4)

Assessment of orthodontic treatment need using the Index of Orthodontic Treatment Need revealed differing patterns between the Dental Health Component and the Aesthetic Component. Based on the Dental Health Component, 66 participants (55.0%) had a definite need for orthodontic treatment, while 34 (28.3%) showed a moderate need and 20 (16.7%) had no treatment need. In contrast, evaluation using the Aesthetic Component showed that the majority of participants, 86 (71.7%), had no aesthetic treatment need, whereas 19 (15.8%) were classified as having a moderate need and 15 (12.5%) had a definite aesthetic need.

### Association Between Sociodemographic Variables and Orthodontic Treatment Need (Table 2)

Using the Aesthetic Component, participants aged  $<18$  years mostly had no treatment need 27 (77.1%), followed by moderate need 6 (17.1%) and definite need 2 (5.7%), while among those aged  $\geq 18$  years, no need 59 (69.4%), moderate need 15 (15.3%), and definite need 13 (15.3%) were observed. The association between age and aesthetic treatment need was not statistically significant ( $\chi^2 = 2.08$ ,  $p = 0.35$ ). Similarly, based on the Dental Health Component, definite treatment need predominated in both age groups, with no significant association ( $\chi^2 = 0.58$ ,  $p = 0.75$ ).

With respect to gender, the Aesthetic Component showed that no treatment need was observed in 31 (70.5%) males and 55 (72.4%) females, while definite need occurred in 5 (11.4%) males and 10 (13.2%) females. This association was not statistically significant ( $\chi^2 = 0.33$ ,  $p = 0.85$ ). Based on the Dental Health Component, definite

treatment need was recorded in 25 (56.8%) males and 41 (54.7%) females, with no significant association ( $\chi^2 = 1.21$ ,  $p = 0.57$ ). Across ethnic groups, the Aesthetic Component showed that no treatment need was most frequent among Etsako and Akwa Ibom participants 9 (100.0%) and 1 (100.0%), respectively, while definite need was highest among Urhobo participants 3 (21.4%). However, no statistically significant association was found ( $\chi^2 = 11.40$ ,  $p = 0.51$ ). Similarly, assessment using the Dental Health Component showed that definite treatment need was the most frequent category across ethnic groups, with no statistically significant association observed ( $\chi^2 = 9.64$ ,  $p = 0.67$ ).

**Relationship Between the Aesthetic Component and Dental Health Component (Table 3)**

A statistically significant association was observed between the Aesthetic Component and the Dental Health Component of the Index of Orthodontic Treatment Need ( $\chi^2 = 17.57$ ,  $p = 0.002$ ). Among participants with no dental health treatment need, the majority had no aesthetic treatment need 18 (94.7%), while 1 (5.3%) had a moderate aesthetic need and none had a definite aesthetic need (0.0%). In the moderate dental health treatment need category, most participants also had no aesthetic treatment need 30 (88.2%), while 2 (5.9%) had a moderate aesthetic need and 2 (5.9%) had a definite aesthetic need. However, among participants with a definite dental health treatment need, the proportion with no aesthetic treatment need reduced to 37 (56.1%), while 16 (24.2%) had a moderate aesthetic need and 13 (19.7%) had a definite aesthetic need.

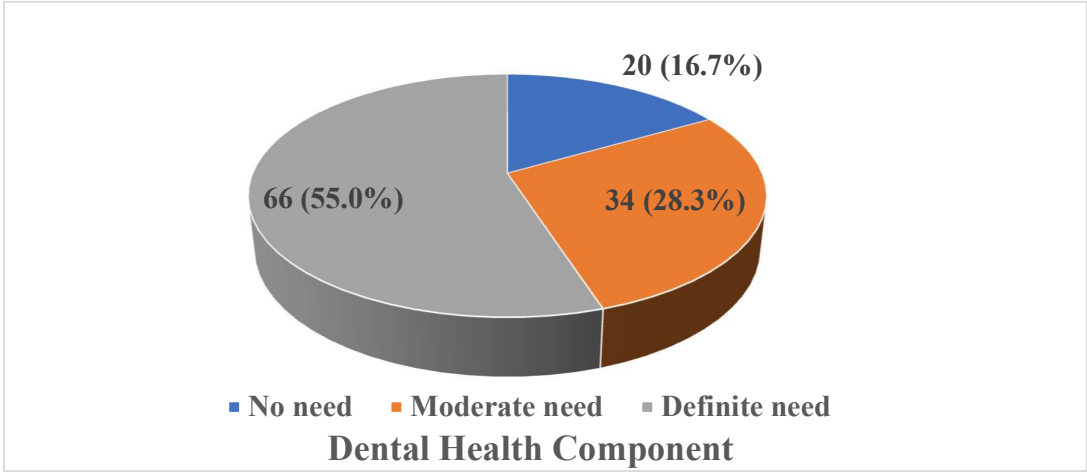


Figure 3: Requirement for treatment according to the dental health component of the IOTN

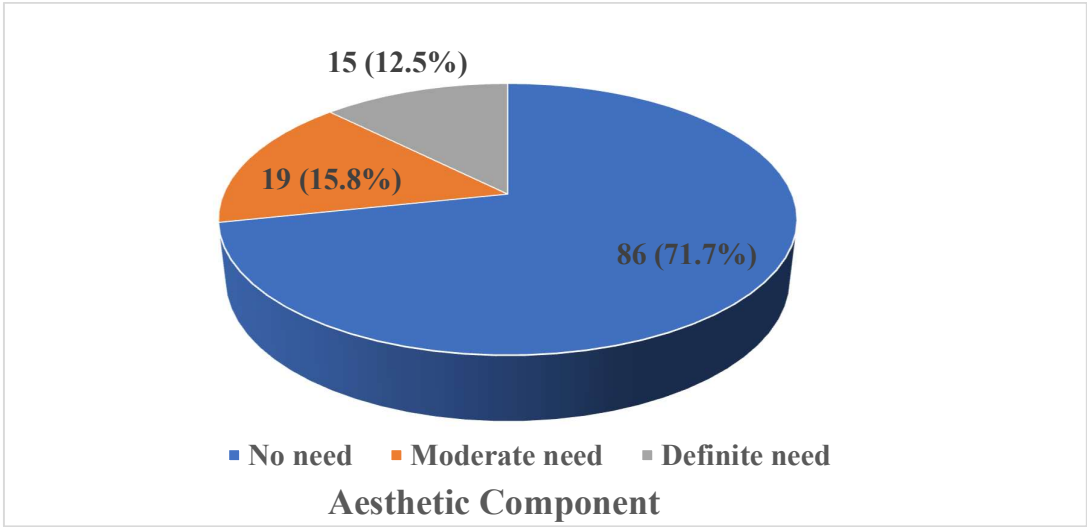


Figure 4: Requirement for treatment according to the aesthetic component of the IOTN



Table 2: Association between sociodemographic variables and orthodontic treatment need

| 9.5<br>Variable  | Aesthetic           |                         |                           | $\chi^2$ | p-value | Dental              |                         |                           | $\chi^2$ | P-value |
|------------------|---------------------|-------------------------|---------------------------|----------|---------|---------------------|-------------------------|---------------------------|----------|---------|
|                  | No<br>Need<br>n (%) | Moderate<br>Need<br>(%) | Definite<br>Need<br>n (%) |          |         | No<br>Need<br>n (%) | Moderate<br>Need<br>(%) | Definite<br>Need<br>n (%) |          |         |
| <b>Age</b>       |                     |                         |                           | 2.08     | 0.35    |                     |                         |                           | 0.58     | 0.75    |
| <18              | 27(77.1)            | 6 (17.1)                | 2 (5.7)                   |          |         | 7 (17.6)            | 11 (32.4)               | 17 (50.0)                 |          |         |
| ≥18              | 59(69.4)            | 15 (15.3)               | 13 (15.3)                 |          |         | 13 (15.3)           | 23 (27.1)               | 49 (57.6)                 |          |         |
| <b>Gender</b>    |                     |                         |                           | 0.33     | 0.85    |                     |                         |                           | 1.21     | 0.57    |
| Male             | 31 (70.5)           | 8 (18.2)                | 5 (11.4)                  |          |         | 5 (11.4)            | 14 (31.8)               | 25 (56.8)                 |          |         |
| Female           | 55 (72.4)           | 11 (14.5)               | 10 (13.2)                 |          |         | 14 (18.7)           | 20 (26.7)               | 41 (54.7)                 |          |         |
| <b>Ethnicity</b> |                     |                         |                           | 11.40    | 0.51    |                     |                         |                           | 9.64     | 0.67    |
| Benin            | 29 (70.7)           | 5 (12.2)                | 7 (17.1)                  |          |         | 6 (14.6)            | 11 (26.8)               | 24 (58.5)                 |          |         |
| Igbo             | 19 (63.3)           | 8 (26.7)                | 3 (10.0)                  |          |         | 6 (20.2)            | 8 (26.7)                | 16 (53.3)                 |          |         |
| Esan             | 16 (80.0)           | 3 (15.0)                | 1 (5.0)                   |          |         | 2 (10.5)            | 5 (26.3)                | 12 (63.2)                 |          |         |
| Etsako           | 9 (100.0)           | 0 (0.0)                 | 0 (0.0)                   |          |         | 2 (22.2)            | 3 (33.3)                | 4 (44.4)                  |          |         |
| Urhobo           | 8 (57.1)            | 3 (21.4)                | 3 (21.4)                  |          |         | 2 (14.3)            | 4 (28.6)                | 8 (57.1)                  |          |         |
| Yoruba           | 4 (80.0)            | 0 (0.0)                 | 1 (20.0)                  |          |         | 0 (0.0)             | 3 (60.0)                | 2 (40.0)                  |          |         |
| Akwa<br>Ibom     | 1 (100.0)           | 0 (0.0)                 | 0 (0.0)                   |          |         | 1 (100.0)           | 0 (0.0)                 | 0 (0.0)                   |          |         |

Table 3: Relationship Between Aesthetic Component and Dental Health Component

| Aesthetic Component | Dental Health       |                           |                         | $\chi^2$ | p-value       |
|---------------------|---------------------|---------------------------|-------------------------|----------|---------------|
|                     | No Need<br>n=19 (%) | Moderate Need<br>n=34 (%) | Severe Need<br>n=66 (%) |          |               |
| No need             | 18 (94.7)           | 30 (88.2)                 | 37 (56.1)               | 17.57    | <b>0.002*</b> |
| Moderate need       | 1 (5.3)             | 2 (5.9)                   | 16 (24.2)               |          |               |
| Definite need       | 0 (0.0)             | 2 (5.9)                   | 13 (19.7)               |          |               |

## DISCUSSION

This study evaluated orthodontic treatment need among orthodontic patients using the Index of Orthodontic Treatment Need and explored its association with selected sociodemographic variables. The findings provide insight into both the objective and aesthetic dimensions of malocclusion within the study population.

The higher proportion of female participants observed in this study is consistent with reports from previous orthodontic clinic-based studies. Ndukwe et al. (2020) and Babalola et al. (2024), in studies conducted among Nigerian orthodontic patients in Lagos and Edo state, respectively, also reported a female predominance, attributing this trend to greater aesthetic awareness and higher health-seeking behaviour among females. Perillo et al. (2010) also reported higher orthodontic attendance among females in an Italian population. The mean age of  $22.4 \pm 8.9$  years observed in this study reflects a predominantly young population, which aligns with findings in similar studies, which noted that orthodontic treatment is most commonly sought during adolescence and early adulthood when malocclusion becomes more evident and concerns

about appearance intensify (Motloba et al., 2016; Adeyemi et al., 2022).

With respect to orthodontic treatment need, more than half of the participants were classified as having a definite treatment need based on the Dental Health Component of the IOTN. This finding is comparable to reports by Osadolor et al. (2019) among Nigerian adolescents and young adults, where a high proportion of participants demonstrated definite dental health treatment need. Similar observations were made by Brook and Shaw, (1989), the developers of the IOTN, who emphasized that a substantial proportion of orthodontic patients present with clinically significant malocclusion requiring treatment. In contrast, the Aesthetic Component revealed that most participants had no aesthetic treatment need. This discrepancy between clinical severity and aesthetic perception may be because many individuals with objectively severe malocclusion may not perceive their dental appearance as unattractive, particularly in populations where aesthetic norms differ.

The lack of a statistically significant association between age and orthodontic treatment need in this study is at variance with findings by Nichols et al. (2024), who reported that malocclusion severity

among orthodontic patients increased with age. Similarly, the absence of a significant association between gender and orthodontic treatment need aligns with reports by dos Santos Junior et al. (2016) , Ajayi and Ize-Iyamu, (2010) in Edo state, and Anibor, (2021) in Delta state, all of whom found that while females were more likely to seek orthodontic care, the severity of malocclusion did not differ significantly between males and females. Ethnicity was also not significantly associated with orthodontic treatment need in this study. The lack of statistical significance observed in the present study may also be partly due to smaller sample sizes within some ethnic subgroups.

A major finding of this study was the statistically significant relationship between the Aesthetic Component and the Dental Health Component of the IOTN. As dental health treatment needs increased, the proportion of participants with moderate and definite aesthetic treatment needs also increased. However, a notable proportion of participants with definite dental health treatment needs still had no aesthetic treatment needs. This pattern has been documented by Sato et al. (2025) and Ajayi (2015), who emphasized that reliance on aesthetic perception alone may underestimate true orthodontic treatment need. This finding reinforces the importance of using both components of the IOTN when assessing orthodontic treatment priority.

## CONCLUSION

This study found that more than half of the orthodontic patients had a definite need for treatment based on the Dental Health Component of the Index of Orthodontic Treatment Need, while the majority had no treatment need according to the Aesthetic Component, demonstrating a disparity between clinical severity and aesthetic perception. Sociodemographic variables such as age, gender, and ethnicity were not significantly associated with orthodontic treatment need. However, a significant relationship existed between the Dental Health and Aesthetic Components, supporting the value of using both components for comprehensive orthodontic assessment.

## LIMITATIONS

This study was conducted in a single tertiary healthcare facility with a relatively small sample size, which may limit the generalizability of the findings to the wider population. This limitation was mitigated by recruiting consecutive orthodontic patients over the study period to ensure adequate representation of the clinic

population. Additionally, the cross-sectional design limited the ability to assess changes in treatment need over time; however, the use of a standardized and widely validated index, the IOTN, enhanced the reliability and comparability of the findings. To minimize measurement bias, assessments were carried out by a calibrated examiner using standardized study models and photographs.

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