



Original Article

Awareness and Perceptions of Malocclusion Among Libyan Adolescents: A Cross-Sectional Study in Zawia City, Libya

Fatimah Rajab Khadhar^{1*}, Rasheed Abdulsalam¹, Fatimah Azhar Nor¹, Shokri Ayad Halila²

¹ Department of Orthodontics, Faculty of Dentistry, Lincoln University College, Selangor, Malaysia.

² Department of Biology, Faculty of Education, University of Zawia, Zawia, Libya.

*Corresponding Author: Fatimah Rajab Khadhar. Email: fa719924@gmail.com

Received: 13-08-2026 - Accepted: 20-10-2026 - Published: 28-10-2026

Abstract

Background: The study aimed to assess the levels of self-reported awareness and perceptions concerning malocclusion aetiology, complications, preventive measures, and its perceived impact on dental aesthetics and oral health among adolescents in Zawia City, Libya. **Method:** A descriptive, school-based cross-sectional study was conducted involving 610 adolescents in 2026. Data were collected using a validated 31-item self-administered questionnaire evaluating self-perceived awareness and perceptions regarding malocclusion (Cronbach's alpha = 0.72). **Results:** Statistical analysis was performed using descriptive statistics in SPSS v.26. Findings indicated generally low-to-moderate awareness across most domains. Participants showed moderate awareness of malocclusion identification (mean = 1.68), causes (mean = 1.74), and complications (mean = 1.70). Awareness of malocclusion-related problems (mean = 1.54) and preventive measures (mean = 1.49) was low, particularly regarding functional and aesthetic consequences. In contrast, awareness of the benefits of orthodontic treatment was high (mean = 2.61), with improving smile appearance receiving the highest score (2.81 ± 0.52). **In conclusion,** adolescents demonstrated limited awareness of malocclusion prevention and its consequences despite recognizing the benefits of orthodontic treatment. Targeted oral health education programs are recommended to improve awareness and promote early prevention of malocclusion.

Keywords: Awareness, Malocclusion, Orthodontics, Adolescents

Introduction

Malocclusion ranks among the three most prevalent oral health conditions globally, following dental caries and periodontal disease [1]. Approximately 56% of children and adolescents worldwide exhibit some degree of dental misalignment [1].

While Class I malocclusion remains the most common presentation, sagittal discrepancies, specifically Class II and Class III malocclusions, contribute substantially to functional impairments, compromised aesthetics, and increased treatment complexity [2].

The aetiology of malocclusion is inherently multifactorial, arising from a complex interplay between genetic predisposition and environmental factors. Genetic determinants influence craniofacial growth patterns, whereas environmental factors such as thumb sucking, prolonged pacifier use, mouth breathing, and dysfunctional swallowing play a pivotal role in the development of increased overjet, anterior open bite, and dental crowding [3]. Early awareness of these modifiable environmental determinants is critical for the implementation and success of preventive and interceptive orthodontic interventions.

Functionally, uncorrected malocclusion can impair mastication and speech articulation, while severe anterior overjet represents a well-documented predisposing factor for traumatic dental injuries [4, 5]. From an aesthetic and psychosocial perspective, visible dental misalignment significantly influences ado-

lescent self-perception, frequently impacting self-esteem, increasing social anxiety, and rendering individuals susceptible to appearance-related bullying [6]. Although the present study did not directly test the Health Belief Model, the questionnaire was adapted from previously published studies informed by HBM concepts. These concepts helped guide the assessment of adolescents' awareness and perceptions regarding malocclusion and its potential consequences. According to the HBM, an individual's motivation to engage in health-promoting behaviours or seek professional care is dictated by their perceived susceptibility to a condition, the perceived severity of its consequences, and the perceived benefits of intervention balanced against perceived barriers [7, 8]. While global literature indicates that awareness and subjective health beliefs directly shape health behaviours, self-reported knowledge regarding malocclusion and its perceived functional and aesthetic impacts among adolescents in Libya remains remarkably under-researched.

Consequently, this study aimed to evaluate awareness levels about malocclusion aetiology, complications, and preventive measures, as well as to assess perceived aesthetic and functional implications among secondary school adolescents in Zawia City, Libya

Materials and Methods

Study Design and Setting

A school-based cross-sectional survey was conducted among adolescents in Zawia City, Libya, between April and May 2026. This study adhered to the Strengthening





the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure methodological rigour. It is important to clarify that this study evaluated adolescents' awareness, subjective knowledge, and self-reported impacts regarding malocclusion through a structured questionnaire.

Sample Size and Sampling

The target sample size was determined using Thompson's equation: $n = [N \times Z^2 \times P(1-P)] / [(N-1) \times d^2 + Z^2 \times P(1-P)]$. Based on a target population of approximately $N \approx 11,246$ individuals, a 95% confidence level ($Z = 1.96$), an expected prevalence ($P = 0.50$), and a margin of error ($d = 0.0386$), a total of 610 participants were recruited [9]. A multistage random sampling technique was utilized to select participants aged 15-17 years from various secondary schools. **Inclusion Criteria:** Adolescents aged 15-17 years who were enrolled in public or private secondary schools in Zawia City and whose parents or legal guardians provided written informed consent, with adolescent assent obtained prior to participation. **Exclusion Criteria:** Adolescents who had previously received orthodontic treatment and those with craniofacial anomalies, congenital disorders, or systemic conditions affecting facial growth were excluded.

Ethical Considerations

Ethical approval was obtained from the Biosafety and Bioethics Committee at the Libyan Medical Research Centre (LMRC) (Approval No. NBC: 018.H.24.95). Data collection was conducted between 25 April 2026 and 21 May 2026, and from the Ethics Committee of Lincoln University College, Malaysia (Reference No.

LUC/DVCECA/23042026/028). Official authorization was also obtained from the Ministry of Health, Libya, and the Zawia Educational Directorate. Written informed consent was secured from all participants and their legal guardians. Participation was entirely voluntary, and all data were anonymized to ensure confidentiality.

Data Collection Instrument

An English version of the questionnaire was prepared solely for publication and reporting purposes, while the Arabic version was used for data collection. Steps for developing the questionnaire:

1. Determine the questionnaire's axes.
2. Formulate the statements for each axis separately.
3. Present the appropriate statements to experts in the field of specialization to determine content validity.
4. Apply the scale to the survey sample to verify scientific conditions (validity, reliability).

Initial exploratory study:

The initial exploratory study was conducted to assess the validity and reliability of the questionnaire. A pilot study was carried out among 30 adolescents (5% of the calculated sample size), who were excluded from the final study sample.

Validity and Reliability

Content validity was evaluated by a panel of ten orthodontic experts, who confirmed the relevance and clarity of all questionnaire items. Internal consistency was assessed using item-total correlation coefficients. The correlation coefficients for the questionnaire domains ranged from 0.608 to 0.813 ($p < 0.01$), indicating acceptable internal consistency. The overall reliability of the questionnaire was confirmed by a Cronbach's alpha coefficient of 0.72.

Table 1. Internal Consistency and Item-Total Correlations of the Questionnaire Domains

Axis No.	Axis Description	Consistency (r)	Consensus Rate
1	Definition of Malocclusion	0.678**	100%
2	Etiological Factors	0.729**	100%
3	Knowledge and Awareness	0.752**	100%
4	Complications of Untreated Cases	0.813**	100%
5	Preventive Measures	0.688**	100%
6	Benefits of Treatment	0.608**	100%

Note: All item-total correlation coefficients were statistically significant at $p < 0.01$.

Statistical Analysis

Data were analysed using SPSS version 26. Descriptive statistics (means, standard deviations [SD], frequencies) summarised the data.

Results

The study included 610 adolescents with a nearly equal gender distribution (50.8% males and 49.2% females).

Participants aged 16 years formed the largest age group (47.7%), followed by those aged 15 years (31.1%) and 17 years (21.1%).

Table 2. Sociodemographic Characteristics among adolescents aged 15-17 years in Zawia City, Libya, (N = 610).

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	310	50.8
	Female	300	49.2



Age (years)	15	190	31.1
	16	291	47.7
	17	129	21.1
Total		610	100.0

The awareness levels were interpreted based on the following weighted mean score classification: Poor (1.00–1.66), Medium (1.67–2.33), and High (2.34–3.00).

General Knowledge of Malocclusion and Awareness of its Etiological Factors

Adolescents' general knowledge regarding malocclusion was found to be overall Medium. The highest level of

recognition was observed for protruding jaws (1.84 ± 0.73), whereas "awareness of treatment options" recorded a significantly lower score (1.34 ± 0.50).

Regarding etiological understanding, premature tooth loss was the most recognised causal factor (1.89 ± 0.81), whereas the impact of "bad oral habits" was poorly understood (1.60 ± 0.75), as detailed in Table 3.

Table 3: General Knowledge of Malocclusion and Awareness of its Etiological Factors among adolescents aged 15-17 years in Zawia City, Libya (N = 610).

Knowledge / Aetiology	Item	Mean	SD	Level
Knowledge	Protruding jaws	1.84	0.73	Medium
	Protruding teeth	1.80	0.76	Medium
	Spaces between teeth	1.76	0.71	Medium
	Identification of misalignment	1.65	0.82	Poor
	Awareness of treatment options	1.34	0.50	Poor
Aetiology	Premature tooth loss	1.89	0.81	Medium
	Diet and nutrition	1.74	0.77	Medium
	Tooth decay	1.74	0.66	Medium
	Genetic factors	1.72	0.74	Medium
	Bad oral habits	1.60	0.75	Poor

Awareness of Complications

Awareness concerning the consequences of untreated malocclusion was generally low. While participants identified "early tooth loss" (1.78 ± 0.86) and "tooth

decay" (1.76 ± 0.78) as complications at a moderate level, they failed to demonstrate adequate awareness regarding functional and aesthetic impacts (Table 4).

Table 4: Awareness of Complications and problems of Malocclusion among adolescents aged 15-17 years in Zawia City, Libya, (N = 610).

Domain	Item	Mean	SD	Level
Complications	Early tooth loss	1.78	0.86	Medium
	Tooth decay	1.76	0.78	Medium
	Gingivitis	1.70	0.86	Medium
	Jaw-related functional problems	1.64	0.81	Poor
	Injury to gums/lips during chewing	1.59	0.79	Poor
Malocclusion problems	Functional problems	1.65	0.80	Poor
	Aesthetic problems	1.43	0.72	Poor

Prevention and Benefits of Orthodontic Treatment

Overall awareness of the benefits of orthodontic treatment was high. Improving smiles recorded the highest mean score (2.81 ± 0.52), followed by

maintaining dental health (2.73 ± 0.64), maintaining oral health (2.67 ± 0.71), and improving facial appearance (2.63 ± 0.69). In contrast, awareness of preventive measures was low to moderate, particularly regarding timely treatment and avoiding harmful oral habits (Table 5).

**Table 5:** Awareness of Prevention and Perceived Benefits of Orthodontic Treatment among adolescents aged 15-17 years in Zawia City, Libya (N = 610).

	Item	Mean	SD	Level
Prevention	Preventing premature tooth loss	1.69	0.86	Medium
	Using space maintainers	1.67	0.87	Medium
	Providing timely treatment	1.31	0.67	Poor
	Avoiding bad oral habits	1.30	0.66	Poor
Benefits	Improving smiles	2.81	0.52	High
	Maintains dental health.	2.73	0.64	High
	Maintains oral health.	2.67	0.71	High
	Improves facial appearance.	2.63	0.69	High
	improves chewing	2.54	0.74	High
	preserves gums.	2.49	0.80	High
	Improves speech.	2.44	0.78	High

Discussion

General Knowledge of malocclusion and Identification of Etiological Factors among adolescents

The present study showed that adolescents in Zawia City had moderate knowledge of malocclusion and its etiological factors. The highest awareness was observed for visible clinical features, particularly protruding jaws and protruding teeth, suggesting that adolescents are more likely to recognize obvious dentofacial irregularities than less apparent aspects of malocclusion. This finding is consistent with previous studies, which reported that awareness and perceptions of malocclusion are largely influenced by visible dentofacial characteristics and their aesthetic implications rather than by a comprehensive understanding of orthodontic conditions and treatment needs [10,12]. The greater recognition of visible features may also reflect the psychosocial and aesthetic concerns associated with malocclusion during adolescence, as reported in earlier research [12]. To the best of our knowledge, this is among the first studies investigating awareness and perceptions of malocclusion among adolescents in western Libya, thereby providing baseline data for future oral health promotion and orthodontic research in the region.

Awareness of Complications and problems of Malocclusion among adolescents

The findings indicate that adolescents had a moderate awareness of some complications associated with malocclusion, particularly early tooth loss, dental caries, and gingivitis. However, awareness of jaw-related functional problems was poor. This suggests that participants were more familiar with common oral health consequences than with functional complications affecting jaw function, chewing, and oral performance. These findings highlight the need for oral health

education programs that emphasize both the dental and functional consequences of malocclusion. Similar gaps in awareness have been reported by Soni et al. (2014)[13], who found that although rural participants were aware of certain aspects of malocclusion, knowledge regarding its causes and consequences remained limited. Furthermore, the importance of improving awareness of functional complications is supported by the findings of Suleman and Hussein (2024)[14], who demonstrated that malocclusion can negatively affect speech, mastication, and oral health-related quality of life among adolescents.

Regarding awareness of malocclusion-related problems, the present study indicated a low level of knowledge among adolescents in Zawia City. The aesthetic problems domain recorded a mean score of 1.43 (SD = 0.72), while the functional problems domain recorded a mean score of 1.65 (SD = 0.80), reflecting low awareness among the study participants. These findings differ from those reported by Soni et al. (2014)[13], who found that 92% of participants were aware of the aesthetic consequences of malocclusion. Similarly, Zakirulla et al. (2019)[15] reported a positive awareness of orthodontic treatment among school children in Saudi Arabia. The observed differences may be related to variations in oral health education, access to dental care services, and cultural attitudes toward dental appearance and orthodontic treatment.

Awareness of Prevention and Perceived Benefits of Orthodontic Treatment

The findings revealed that adolescents demonstrated high awareness of the benefits of orthodontic treatment, particularly improving smiles, maintaining dental and oral health, and enhancing facial appearance. These findings may reflect adolescents' recognition of the



aesthetic and quality-of-life benefits associated with orthodontic care, consistent with the observations of Zhang et al. (2022)[16], who reported that perceptions of improved appearance and oral health were important factors influencing orthodontic care-seeking behavior. Conversely, awareness of preventive measures was low to moderate, particularly regarding timely treatment and avoiding harmful oral habits. Similar observations have been reported in studies evaluating adolescent oral health education, which highlighted the importance of structured educational interventions in improving oral health awareness (Shin et al., 2021)[17]. The relatively greater awareness of aesthetic benefits compared with preventive measures may also be explained by the psychosocial importance of dental appearance during adolescence, as reported by Alsulaiman et al. (2025)[14]. Therefore, oral health promotion programs should place greater emphasis on preventive strategies and early orthodontic assessment while maintaining awareness of the functional and psychosocial benefits of treatment. To the best of our knowledge, this is among the first studies investigating awareness and perceptions of malocclusion among adolescents in western Libya.

Strengths and limitations

This study is strengthened by its large, representative sample size ($N = 610$) drawn from secondary schools in Zawia City and the utilisation of a validated instrument demonstrating acceptable internal consistency (Cronbach's $\alpha = 0.72$).

However, several methodological limitations must be acknowledged:

1. **Lack of Direct Clinical Examination:** Oral health impacts and awareness were evaluated solely through self-reported questionnaire data without incorporating direct epidemiological oral examinations or objective orthodontic diagnostic tools (such as the Index of Orthodontic Treatment Need - IOTN).
2. **Cross-Sectional Design:** The cross-sectional design precludes establishing direct causal relationships between demographic characteristics and awareness-related perceptions.
3. **Response Granularity:** The three-point Likert scale, while age-appropriate for secondary school adolescents, may limit response granularity compared to wider five- or seven-point scales.
4. The study was conducted in a single city, therefore, the findings may not be fully generalizable to all adolescents in Libya.

Conclusion

This study revealed important deficiencies in adolescents' knowledge regarding the causes, complications, and prevention of malocclusion in Zawia City, Libya. Although participants demonstrated positive perceptions regarding the benefits of orthodontic treatment, awareness of preventive measures and potential complications remained limited. These findings highlight the need for school-based oral health education

programs aimed at improving awareness of malocclusion and promoting early orthodontic consultation.

Recommendations

1. **School-Based Educational Interventions:** Develop structured, age-appropriate oral health workshops within secondary school curricula focusing on the early identification of malocclusion and the cessation of deleterious oral habits to preserve the "prevention window."
2. **Interdisciplinary Referral Pathways:** Establish formal collaboration protocols between school health services, general dental practitioners, and orthodontists to facilitate timely clinical screening and interceptive care during optimal growth periods.
3. **Culturally Tailored Public Awareness Campaigns:** Public health initiatives should move beyond cosmetic motivations to emphasize the functional, preventive, and long-term oral health benefits of orthodontic treatment among adolescents and their legal guardians.
4. **Strategic Digital Health Promotion:** Utilize visual-centric digital platforms popular among Libyan youth (e.g., TikTok, Instagram) to challenge normalization bias and promote proactive oral health awareness.
5. **Directions for Future Research:** Future studies should integrate clinical diagnostic evaluations (e.g., IOTN) alongside self-reported questionnaires and incorporate standardized OHRQoL scales to assess the true psychosocial impact of malocclusion in the Libyan context.

Declarations and ethical statements

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki and approved by the Biosafety and Bioethics Committee at the Libyan Medical Research Centre (Protocol Code: NBC: 018.H.24.95), and from the Ethics Committee of Lincoln University College, Malaysia (Reference No. LUC/DVCECA/23042026/028). Written informed consent was obtained from all participants and their legal guardians prior to data collection. Participation was entirely voluntary, and all collected data were anonymized to protect confidentiality.

Consent for Publication

Not applicable (no identifying individual participant data or images are included).

Availability of Data and Materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request. The data are not publicly available due to institutional review board ethical restrictions protecting participant confidentiality.

All authors contributed substantially to this work.

Conceptualisation and Methodology: F.R.K. and F.A.N.; **Validation and Formal Analysis:** R.A., F.A.N., and F.R.K.; **Writing – Original Draft Preparation:**



F.R.K.; Writing – Review & Editing: R.A. and S.A.H.
All authors read and approved the final manuscript.

acknowledgments

The authors extend their gratitude to the administration of secondary schools in Zawia City and all participating adolescents and their guardians for their cooperation.

References

- De Ridder L, Willems G, Carels C. Prevalence of orthodontic malocclusions in healthy children and adolescents: a systematic review. *Int J Environ Res Public Health*. 2022; 19(12):7446. Doi: 10.3390/ijerph19127446.
- Hou LY, Zheng YY, Lin Q, Yao Y, et al. Assessment of masticatory muscle activity and mandibular border movement in skeletal Class II malocclusion adolescents with mandibular retrognathia. *Res Sq [Preprint]*. 2025. doi:10.21203/rs.3.rs-7489326/v1.
- Severino M, Mattei A, Vena F, et al. Associations between oral habits and specific malocclusion traits in children: a retrospective cross-sectional study in Italy. *BMC Oral Health*. 2025; 25:1534. Doi: 10.1186/s12903-025-06892-5.
- Di Venere D, Rapone B, Corsalini M. Dental trauma in the anterior sector: analysis of predisposing factors in a group of orthodontic patients. *Clin Ter*. 2020; 171(6):e494-e500.
- Shree R, Vaishnav K, Kashyap P, Kumar R, et al. Malocclusion Type and TDI Susceptibility in Adolescent. *Adv Hum Biol*. 2025. doi:10.4103/aihb.aihb.142_24.
- Custódio Abílio MA, Nascimento GFF, de Souza R, Gueiros R, Ribeiro AC. Psychosocial impact of malocclusion in adolescents. *Braz J Health Rev*. 2025; 8(3):e80534. Doi: 10.34119/bjhrv8n3-287.
- Liu D, et al. Knowledge, attitude, and practice of adolescents regarding malocclusion and orthodontic treatment. *Sci Rep*. 2024; 14:28150. Doi: 10.1038/s41598-024-77474-8.
- Alshammari AK, Algharbi MA, Alshammari FL, Madfa AA. Association between dental anomalies and skeletal malocclusions in different facial patterns in a Saudi subpopulation. *BMC Oral Health*. 2025; 25(1):1616. Doi: 10.1186/s12903-025-06979-z.
- Thompson, S. K. (1992). Sampling. New York: John Wiley & Sons.
- Machibya FM, Mseke M, Mlangwa M. Prevalence of Malocclusion and Dental Anomalies in Tanzanian Orthodontic Patients. *Med J Zambia*. 2025; 52(3):358-368. doi:10.55320/mjz.52.3.638.
- Ibrahim T, Taha ZC, Bilal FM, Tahir DH. Awareness of Malocclusion among Dental Students of Hawler Medical University. *J Med Health Stud*. 2025; 6(3):191-200. doi:10.32996/jmhs.2025.6.3.28.
- Gardezi AA, Khadim S, Nadeem N, et al. Assessment of malocclusion severity and its psychosocial impact in adolescents wearing clear aligners. *Insights-J Life Soc Sci*. 2025; 3(5):34-42. Doi: 10.71000/tjtt9235.
- Soni, U.N., Baheti, M.J., Dash, S., Toshniwal, N.G. and Baldawa, R.S. (2014) 'Knowledge and awareness of malocclusion among rural population in India', *Asian Pacific Journal of Health Sciences*, 1(4), pp. 329-334. Available at: <https://doi.org/10.21276/apjhs.2014.1.4.6>
- Sulaiman, H.J. and Hussein, V.M. (2024) 'Impact of malocclusion on oral health-related quality of life of early adolescents in Erbil city', *South Eastern European Journal of Public Health*, pp. 370-377. doi:10.70135/seejph.vi.1141
- Zakirulla, M., Almubarak, H., Fageeh, S.N., Alghothimi, A.A., Alqahtani, S.K., Alqahtani, F.M. and Alshahrani, F.T. (2019) 'Awareness and behaviour related to orthodontic treatment among school children in Aseer Region, Kingdom of Saudi Arabia', *Open Journal of Stomatology*, 9(4), pp. 87-94. doi: 10.4236/ojst.2019.94009.
- Zhang M, McGrath C, Hägg U. Application of the Health Belief Model to explore orthodontic care-seeking behaviours and Oral Health-Related Quality of Life among adolescents. *Am J Orthod Dentofacial Orthop*. 2022; 161(3):380-388. doi:10.1016/j.ajodo.2021.01.025.
- Shin SJ, Kim YJ, Park JH. Effectiveness of school-based oral health educational programs on adolescent oral health awareness in East Asia: A systematic review. *Community Dent Oral Epidemiol*. 2021; 49(5):412-421. doi:10.1111/cdoe.12615.