



Evaluation of General Knowledge and Understanding of Clear Aligner Therapy Among Dental Students

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ABSTRACT

Background: The growing importance of dental aesthetics has driven increasing demand for adult orthodontic treatment. Clear Aligner Therapy (CAT) has emerged as a prominent aesthetic alternative to conventional fixed appliances.

Aim: To evaluate the general knowledge, understanding, and perceptions of CAT among undergraduate dental students in Iraq, and to assess how this knowledge influences their clinical preferences.

Materials and Methods: A cross-sectional digital survey was conducted using Google Forms and distributed via WhatsApp and Telegram to dental students across several dental colleges in Iraq during January–March 2026. A total of 164 respondents were included, data were analyzed using Microsoft Excel 2021.

Results: The sample comprised 164 students (mean age was 21.5 years). Overall, CAT awareness was 61%. The majority correctly identified that clear aligners are not universally indicated (81.7%) and are more expensive than fixed braces (70.1%). Despite higher cost, 65.2% preferred clear aligners. Most students considered CAT less painful (62.8%), requiring fewer clinic visits (71.3%), and posing a lower risk of tooth decay (81.7%). Furthermore, 56.7% believed CAT achieves equivalent clinical efficacy to fixed appliances.

Conclusion: Dental students demonstrate a moderate-to-high level of knowledge about CAT with a strong aesthetic preference for clear aligners. Dedicated curricular workshops and clinical case exposure are recommended to bridge the remaining knowledge gaps.

1. Introduction

The demand for orthodontic treatment among adults has significantly increased in recent years, driven by a greater awareness of dental and facial aesthetics in personal and professional environments[1]. Despite the orthodontic effectiveness of traditional fixed orthodontic equipment, the look of the face is compromised throughout treatment given to the

visible metallic brackets and arch wires[2]. Adults usually prefer more esthetic options and are more prepared to spend more prices for discrete alternatives[3].

Clear Aligner Therapy (CAT), commercially initiated by Invisalign in 1999, employs a set of consecutive clear polyurethane trays to provide controlled, increasing forces for the gradual correction of

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malocclusions [4]. In addition to being more aesthetically pleasing than fixed systems, transparent aligners provide better comfort, easier maintenance of dental hygiene, less food restrictions, and fewer emergency appointments [5].

Despite these benefits, the effectiveness of removable appliances in general is directly reliant on patient compliance which should be between 20-22 hours of daily wear [6]. Besides, the biomechanical control of teeth movement is limited in difficult extraction cases, with marked skeletal discrepancies, and specific root-torquing movements [7].

Students in the dental field are recommended to learn about new techniques like CAT, which will help them make better clinical decisions and provide better patient counseling, as they are both patients and future dentists [8]. Although a number of research have investigated the level of CAT awareness among patients and the general public [9,10], a smaller number of studies have performed thorough evaluations of dentistry students' knowledge relevant to the Middle Eastern environment. The objective of this study was to: (1) evaluate the general knowledge and understanding of CAT among undergraduate dental students in Iraq; and (2) assess how this knowledge influences their orthodontic treatment preferences.

2. Materials and Methods

2.1. Study Design and Sampling

A cross-sectional descriptive survey was conducted between January and March 2026 among undergraduate dental students enrolled from four recognised dental institutions in Iraq: Al-Rafidain University College, the University of Baghdad, Al-Mustansiriyah University, and Dijlah University College. A convenient sampling method was executed in compliance with the principles of the Declaration of Helsinki relevant to survey-based research. Dental students from all academic years (first to fifth year) at participating institutions with access to

social media platforms were eligible to participate. There were no specific exclusion criteria, and only fully completed submissions were accepted.

2.2.Data Collection

A standardized digital questionnaire was developed using Google Forms and sent to students through WhatsApp and Telegram during the data collecting period. The questionnaire was piloted on 10 students to ensure clarity and validity and no substantial revisions were necessary. The introductory page of the Google Form explained the study purpose and assured participants of full confidentiality. The final questionnaire was composed of three sections:

- Demographics: age, sex and year of study.
- Orthodontic history and satisfaction with smile: kind of prior treatment (fixed, removable or clear aligner).
- CAT knowledge and perceptions: awareness, case appropriateness, cost comparison, treatment preference, levels of discomfort, frequency of clinical visits, comparative efficacy and likelihood of tooth decay.

2.3.STATISTICAL ANALYSIS

For descriptive analysis, Google Forms' raw data was exported to Microsoft Excel (version 2021). All categorical variables' frequencies and percentages were computed, and the findings were displayed as summary tables and bar charts.

3. RESULTS

3.1.Demographic data

A total of 164 dental students responded to the survey. The age was ranging from 19 to 25 years (mean 21.5 years), with the maximum frequency at 22 years (n=38; 27.0%). The sample was mostly female (n=112, 68.3%), with 31.7% being male (n=52). The gender distribution is seen in Figure 1. The academic year distribution of respondents was as follows: first year 14.0% (n=23), second year 18.3% (n=30), third year 22.6% (n=37), fourth year 27.4% (n=45), and

fifth year 17.7% (n=29). The majority (70.1%, n=115) expressed satisfaction with their grin. In terms of orthodontic history, 42.7% (n=70) had received prior treatment. Figure 2 shows that conventional fixed orthodontic appliances were the most often utilized treatment option (56.5%, n=48), followed by detachable appliances (25.9%, n=22) and transparent aligners (17.6%, n=15).

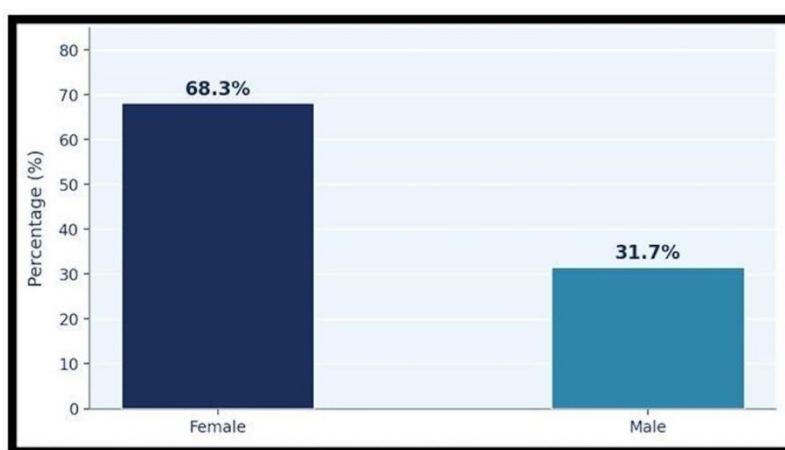


Figure 1. Gender distribution of study participants.

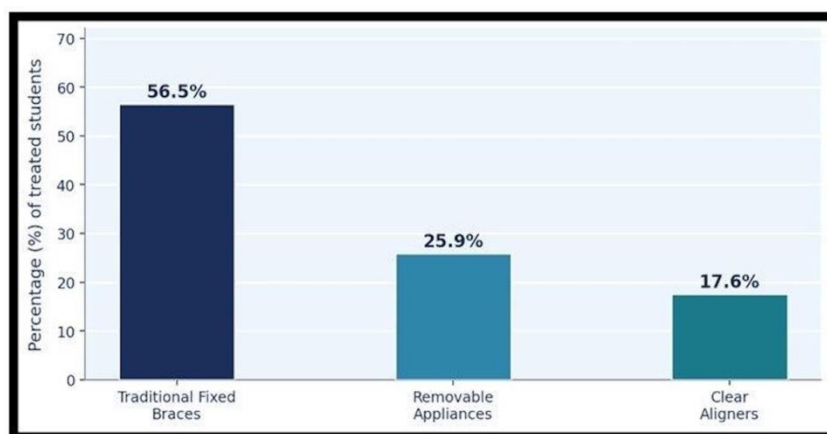


Figure 2. Type of previous orthodontic treatment among students with a history of orthodontic care.

3.2. Clear aligners awareness and treatment preferences

A total of 61.0% (n = 100) of subjects indicated awareness of clear aligners. A majority of participants (81.7%, n = 134) acknowledged that CAT is inappropriate for all types of orthodontic malocclusions. Regarding cost perception, 70.1% (n = 114)

thought aligners were often more expensive than traditional fixed braces. Figure 3 presents a comparison of these findings.

Nonetheless, despite the higher level of perceived expense, 65.2% (n = 107) favored clear aligners over fixed braces for their treatment (Figure 4). Moreover, in a scenario involving a reduced-cost metal braces, 54.3% (n = 89) continued to reject metal braces,

indicating that aesthetic preference prevails factors for most respondents.
over
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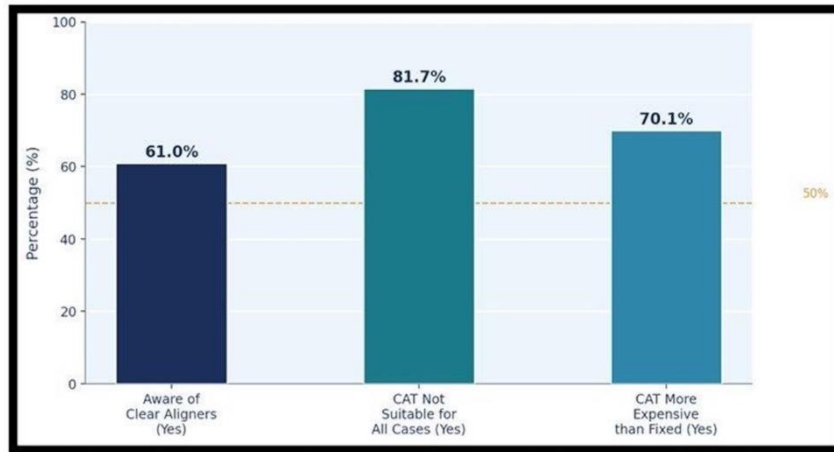


Figure 3. Awareness of CAT, knowledge of case-suitability limitations, and cost perception among dental students.

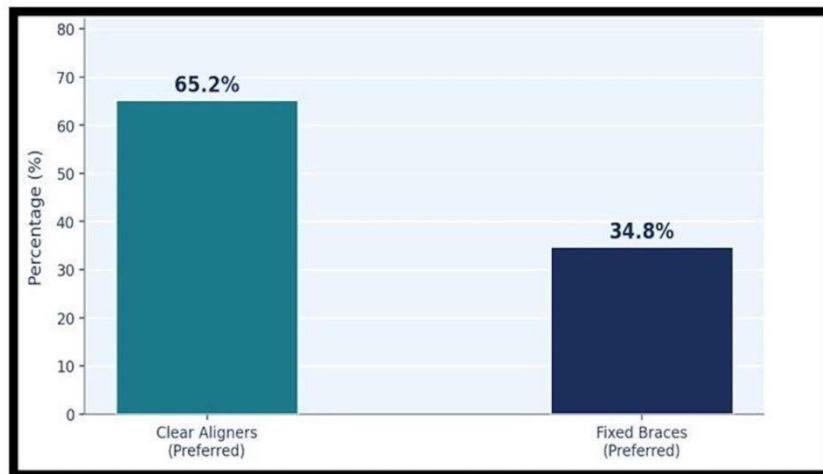


Figure 4.

treatment preference among dental students.

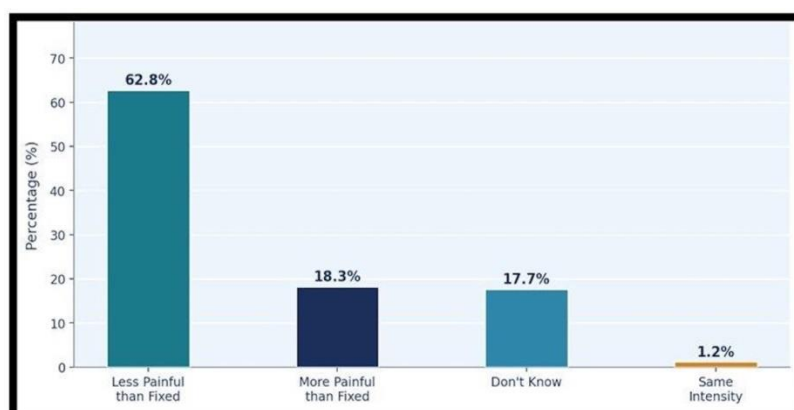
Personal orthodontic

depicted in Figure 5.

3.3. Pain, Clinical Visits, Effectiveness, and Oral Hygiene

Table 1 presents participants' perceptions regarding pain intensity when comparing CAT to traditional fixed appliances; The distribution of the four categories is

Concerning clinical visit frequency, traditional fixed appliances necessitated more frequent orthodontic visits, according to 71.3% (n=117) of respondents. With regard to the relative clinical efficacy, 56.7%



(n=93) of respondents thought that clear aligners are just as effective as fixed appliances, whereas 43.3% (n=71) had the opposite opinion. Ultimately, 81.7% (n = 134) predicted a higher risk of enamel demineralization and dental caries associated

with traditional fixed appliances compared to clear aligners. Figure 6 presents a comparison of these three clinical perception categories. A comprehensive summary of all key knowledge and perception domains is presented in Table 2.

Figure 5. Four-category distribution of students' pain perceptions comparing clear aligners with traditional fixed braces.

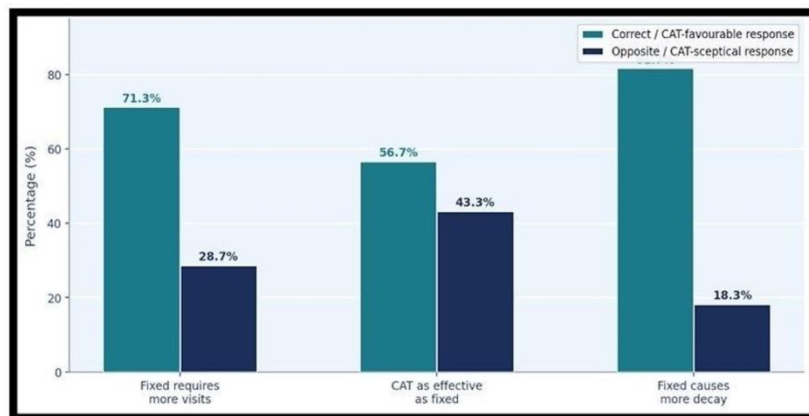


Figure 6. Grouped comparison of students' perceptions across three clinical domains: visit frequency, comparative efficacy, and oral hygiene risk.

Table 1. Participants' perceptions of pain: clear aligners versus traditional fixed braces.

Perception of Pain	Number of Students (n)	Percentage (%)
Less painful	103	62.8%
More painful	30	18.3%
I don't know	29	17.7%
Same intensity	2	1.2%

Table 2. Summary of key knowledge and perception findings.

Question / Domain	Correct / Preferred Response	n	%
Awareness of clear aligners	Yes — aware	100	61.0%
CAT not for all cases	Correctly identified limitation	134	81.7%
Cost of CAT vs. fixed	More expensive	114	70.1%
Personal treatment preference	Clear aligners	107	65.2%
Preference regardless of price	Clear aligners still preferred	89	54.3%
Pain perception	Less painful with CAT	103	62.8%
Visit frequency	Fixed requires more visits	117	71.3%
Comparative effectiveness	CAT as effective as fixed	93	56.7%
Tooth decay risk	Higher with fixed appliances	134	81.7%

4. Discussion

This study evaluated the knowledge, clinical perceptions, and aesthetic preferences of undergraduate dental students in Iraq regarding Clear Aligner Therapy. The predominance of female participants (68.3%) reflects contemporary dental student demographics and is consistent with findings from previous studies documenting that females exhibit greater interest in orthodontic aesthetic interventions [11].

The finding that 42.7% of students had prior orthodontic treatment, predominantly with fixed braces (56.5%), reflects the established clinical dominance of traditional fixed labial techniques in Iraqi orthodontic practice. The relatively low rate of prior clear aligner use (17.6%) confirms that CAT remains an emerging modality in the region, consistent with the observation by Bilal *et al.* that most Iraqi orthodontists continue to prefer fixed appliances [12].

General awareness of CAT was reported by 61.0% of participants, a level comparable to dental student surveys conducted in Saudi Arabia and India [9,13]. Importantly, 81.7% correctly identified that clear aligners are not universally applicable a detailed understanding of biomechanical constraints, including the difficulty in controlling root torque, severe skeletal discrepancies, and complex bodily tooth movements [7,14].

The strong preference for clear aligners over fixed braces (65.2%), even when price parity was hypothetically introduced, highlights an aesthetics-driven decision-making paradigm among this young adult cohort. This finding concurs with those of Alansari and Jedliński *et al.* [15,11] who reported a dominant youth preference for less visible orthodontic appliances across different geographic populations.

Students' perceptions of reduced pain with CAT (62.8%) are supported by clinical evidence demonstrating lower pain indices during initial aligner changes compared to arch wire activation in fixed systems [16]. The correct identification by 71.3% that fixed appliances require more frequent chair visits aligns with data from Buschang *et al.*, who documented less chair time and fewer emergency appointments associated with aligner therapy [17].

The high proportion (81.7%) correctly attributing greater decay risk to fixed appliances is supported by evidence demonstrating that clear aligner removability permits superior oral hygiene, reducing plaque stagnation and the incidence of white spot lesions [18,19].

The finding that 43.3% of respondents did not believe CAT is as effective as fixed appliances warrants careful interpretation rather than simple classification as a

knowledge deficit. This scepticism may in part reflect a clinically valid concern: current evidence confirms that CAT does exhibit genuine biomechanical limitations in complex tooth movements, particularly deep-bite correction, molar up righting, and extraction-space closure [7,14]. Students who are aware of these constraints may thus be expressing calibrated scientific caution rather than misinformation. Nevertheless, the same evidence base also shows that CAT achieves equivalent or superior outcomes to fixed appliances for mild-to-moderate malocclusions when patients are compliant [4,5]. The mixed responses therefore most likely reflect an incomplete mapping of CAT's evidence profile: students understand its limitations but underestimate its proven scope pointing to a specific curricular gap around evidence-based case-selection teaching.

A notable methodological observation concerns the 17.7% of participants who selected 'I don't know' when asked about pain levels. This category of response is distinct from incorrect answers and carries independent informational value: it indicates a genuine absence of prior exposure to CAT rather than a misconception. Because the questionnaire did not capture the source of students' knowledge, it is not possible to determine whether this uncertainty reflects limited curriculum coverage, absence of personal or family orthodontic experience, or restricted access to clinical demonstrations.

Several limitations must be acknowledged. First, convenience sampling via social media platforms introduces a self-selection bias: students who are more engaged with digital communication or more interested in orthodontics may be over-represented, potentially inflating awareness and preference scores [12]. Second, the sample was drawn from four colleges in Baghdad and is therefore not nationally representative of all Iraqi dental students. Third, the academic year distribution of respondents was not collected as a primary variable and the figures reported in Section 2.2 are estimates based on the age distribution; direct year-of-study data should be recorded in

future. Forth, all data were self-reported and susceptible to recall bias and social desirability effects. Future research should employ stratified random sampling across academic years, multiple governorates, and ideally multiple countries to improve external validity.

5. Conclusions

Undergraduate dental students in Iraq demonstrate a moderate-to-high level of knowledge about Clear Aligner Therapy, with correct identification of its clinical advantages, cost profile, and major limitations. Their strong aesthetic preference for CAT even irrespective of cost signals a generational shift in orthodontic treatment attitudes likely to shape future clinical practice. Residual knowledge gaps, particularly regarding the evidence base for CAT efficacy across case complexities, and the presence of domain-specific uncertainty among students lacking direct clinical exposure, indicate that targeted educational interventions remain warranted. To translate students' positive CAT perceptions into sound clinical competency, the following curricular interventions are recommended: Curriculum integration: Incorporate dedicated didactic lectures on CAT biomechanics, attachment design, evidence-based case-selection criteria, and comparative efficacy data into undergraduate orthodontic curricula, Clinical exposure: Increase supervised observation and participation in CAT cases, including digital treatment planning exercises, to reduce domain-specific uncertainty, Specialized workshops: Organize workshops led by experienced orthodontists to address existing misconceptions and build clinical confidence, particularly regarding CAT's scope of effectiveness, and Evidence-based teaching: Emphasize comparative clinical outcome data across malocclusion severities to help students distinguish genuine biomechanical limits from addressable knowledge gaps.

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