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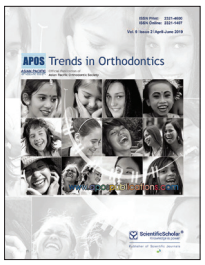

Original Article

Public perception of Invisalign® clear aligner treatment: A cross-sectional survey-based study

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ABSTRACT

Objectives: The demand for clear aligner treatment has increased in recent years. Thus, this study investigated public knowledge regarding Invisalign clear aligner treatment.

Material and Methods: A web-based survey was administered through different social media platforms covering different aspects of Invisalign treatment, namely: Treatment efficiency, patient discomfort, appliance esthetic attractiveness, oral hygiene maintenance, and treatment aesthetic results. Participants were also asked to outline their perception of Invisalign treatment cost. A Likert-type scale was used to rank the participant responses. Data were analyzed with the Chi-square test and Bonferroni correction for multiple comparisons.

Results: Out of 934 eligible adult participants, 19.6% were aware of Invisalign. Most of the Invisalign-familiar respondents were unaware of its cost (27.9%) but agree it is generally better (49.7%), requires fewer visits (38.2%), results in shorter treatment duration (39.4%) and reduced teeth discomfort (35%), more esthetically attractive (64%), yields easier oral hygiene maintenance (55.2%), and produces superior esthetic results (43.7%) than traditional braces. In addition, males and average-income participants were more likely to believe that Invisalign treatment produces superior esthetic results than traditional braces ($P = 0.0002$ and $P = 0.002$, respectively). Average-income participants also believed that Invisalign treatment was generally better ($P < 0.0001$). While participants in the age-range 55–64 years strongly believe, it is cheaper ($P < 0.0001$) than traditional braces.

Conclusion: This study highlighted the lack of public knowledge about Invisalign treatment. The results also indicated the importance of ensuring public access to reliable information backed up by high-quality evidence.

Keywords: Clear aligner, Invisalign, Patient perception, Patient knowledge

INTRODUCTION

In recent years, developments in the field of orthodontics have led to a major increase in patients' esthetic demands. Patients frequently express their desire to determine the aspects and objectives of treatments along with the orthodontist. This is largely driven by the influence that orthodontic appliances have on a person's appearance. Traditional orthodontic treatments have been associated with a compromise in facial appearance, and this has raised concerns among patients seeking orthodontic treatment.[1] Therefore, different esthetic materials and modalities have been developed to address these concerns and overcome existing limitations.[2]

Clear aligner treatment has long been used in orthodontic practice.[3] In fact, in 1946, Kesling introduced the concept of sequentially applying a series of thermoplastic tooth positioners to progressively reposition maligned teeth.[4,5] Nonetheless, Align Technology Inc. (San Jose, CA,

USA) was a pioneer in this field, introducing orthodontic treatments involving the sequential application of clear aligners made of thermoplastic material in the late 1990s.[4-8] This system is known as Invisalign®.

Due to recent advancements in applied biomechanics and the design and engineering of biomaterials, clear aligners have evolved drastically in recent years. Thus, they can now be applied for complete orthodontic therapy to treat various forms of malocclusions.[9] However, even though these devices have benefits in terms of patient comfort and acceptability, oral hygiene maintenance, and esthetics, there is still significant debate regarding the efficiency of clear aligners, and a wide consensus on their clinical performance has not been reached in the literature.[10-13]

As Invisalign is the leading and most popular brand of clear aligners, the present study investigates public knowledge regarding Invisalign clear aligner treatment and compares this treatment to traditional braces. Recently, there has been an increase in demand for clear aligner treatment driven by its increased marketing across various media platforms. The previous studies reported that approximately 33% of Invisalign tweets were categorized as adverts concerning the total proportion of Invisalign tweets and that 73% of patients had learned about clear aligners through external media advertisements.[14,15] Although a few studies have already examined the clinical performance of clear aligners, public knowledge regarding clear aligner treatment is yet to be studied, as far as the author is aware.[10-12]

MATERIAL AND METHODS

The Committee of Research Ethics at Qassim University approved this study (#ST/6039/2021). The key features of Invisalign treatment (in comparison to traditional braces) were gathered from literature and were classified into five general categories, namely:

1. Treatment efficiency
2. Appliance aesthetic attractiveness
3. Patient discomfort
4. Oral hygiene maintenance
5. Treatment esthetic results.

Based on the feature categorization, a web-based open survey in the Arabic language was built using the SurveyMonkey website (Momentive Inc., California, United States) following the Checklist for Reporting Results of Internet E-Surveys.[16] Two experienced orthodontists tested the validity of the survey. Then, the survey was piloted with five patients visiting the orthodontic clinic to test the clarity of the survey questions for non-specialists.

The research purpose, survey-filling duration, data management, and the researcher's contact details were outlined on the first page of the survey. Before progressing to the next section, respondents were required to agree to participate in the study. Furthermore, this section asked sociodemographic questions (nationality, age, gender, educational level, job title, and monthly income in Saudi Riyal). In addition, information regarding the respondents' orthodontic treatment history was collected, and these details included the type of orthodontic appliance (traditional braces, self-ligating braces, lingual braces, removable functional appliances, or clear aligners) and treatment duration. The survey also collected information regarding the participants' sources of orthodontic information (i.e., books and magazines, orthodontists, word-of-mouth, or social media platforms). Participants were also asked a yes/no question to determine whether or not they were familiar with Invisalign clear aligners. If the participant answers "no," then no further questions will be asked. Instead, they will be asked to click the "submit" button to terminate the survey. However, if they respond "yes," then the participant will be presented with further questions to gain insight into their understanding of Invisalign treatment and to determine whether participants believe that they are generally better to traditional braces (answered with "Yes," "No," or "Do not know"). After this, seven questions about the key features of Invisalign treatment were presented. The final question was designed to uncover participants' opinions regarding the costs of Invisalign treatment. All items were measured using a 6-point Likert-type scale (0 – Don't know, 1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, or 5 – Strongly agree).

Convenience sampling was employed to recruit adult participants through social media platforms, such as Facebook, Twitter, Telegram, Instagram, and WhatsApp. The survey link was available from January 3 to February 4, 2021, and was reposted at 1-week and 3-week intervals. An IP-blocking feature was enabled to ensure that each participant only completed the survey once.

Statistics

Participants' survey responses were exported to Microsoft Excel, after which they were translated into English. Moreover, participants who worked in dentistry-related fields or had previously received clear aligner treatment were excluded from the study. The participants' educational levels and monthly income were categorized as low, average, or high based on the data published by the General Authority of Statistics in Saudi Arabia. Statistical analysis and data representation were carried out using SPSS program (version 23; SPSS Inc., Chicago, IL). The absolute values and response percentages were calculated for each question. A Chi-square test was also used to examine the relationship between Invisalign treatment knowledge and participant age, gender, educational level, monthly income, previous history of orthodontic treatment, and source of orthodontic

information. $P < 0.05$ was considered statistically significant. Moreover, adjusted standardized residuals (Z-scores) were used for *post hoc* comparison with Bonferroni correction for multiple comparisons.

RESULTS

Study sample characteristics

Altogether, 964 completed surveys were returned, with 30 responses being excluded, seven of which were completed by dentists and 23 by individuals who reported already having received Invisalign/clear aligner therapy. A total of 183 individuals (19.6% of the 934 participants) were aware of Invisalign treatment [Table 1].

Of the participants who were familiar with Invisalign, 60.1% were females and were mostly between 18 and 24 years (42.6%). Moreover, respondents' education was mostly average (66.7%) with age ($P < 0.0001$) but no sex ($P = 0.275$) differences [Tables 2 and 3]. Participants aged between 18 and 24 were more likely to have a low educational level ($P < 0.001$), while the older age group (55–64 years) was found to have high education ($P < 0.0001$). In addition, participants' monthly income was generally low (43.2%) with age ($P < 0.0001$) and sex ($P = 0.011$) differences. Participants between 18 and 24 and females were more likely to have low monthly income ($P < 0.001$ and $P = 0.004$, respectively) while those aged between 35 and 44 had higher income ($P = 0.002$). Participants' educational level also seemed to impact their monthly income ($P < 0.001$) and those with low education were more likely to have low monthly income ($P < 0.001$). On the other hand, those with average and high educational levels were more likely to have an average ($P = 0.005$) and high ($P < 0.0001$) monthly incomes, respectively.

Approximately 44.8% of the participants had a history of orthodontic treatment. Although there appeared to be differences between the sexes (Fisher's Exact test; $P = 0.001$), age differences were not apparent ($P = 0.610$). The findings indicated that females were more likely than males to have a history of orthodontic treatment ($P = 0.001$). Meanwhile, no relationship could be found between participants' educational level or monthly income and their orthodontic treatment history ($P = 0.966$ and $P = 0.237$, respectively).

For most of the participants, their orthodontic knowledge was from social media (47%). Moreover, no differences could be identified between participant sex, educational level, or orthodontic treatment history ($P = 0.970$, $P = 0.194$, and $P = 0.896$, respectively; [Table 2]). However, there appeared to be a significant relationship between the participant's age and the source of orthodontic knowledge ($P = 0.003$). The findings showed that respondents aged between 45 and 54 were more likely to obtain information from an orthodontist ($P < 0.001$).

Table 1: Characteristics of the research participants.

Variable	*n*	%
Age (year)		
18–24	78	42.62
25–34	58	31.69
35–44	32	17.49
45–54	8	4.37
55–64	7	3.83
Sex		
Male	73	39.9
Female	110	60.11
Educational level		
Low		
Primary school	1	0.55
Elementary school	0	0
High school	41	22.4
Average		
Diploma degree	21	11.48
Bachelor degree	101	55.19
High		
Master's degree	17	9.29
PhD	2	1.09
Monthly Income Saudi Riyal		
Low		
<3000	79	43.17
Average		
3000–5000	26	14.21
5000–10,000	45	24.59
High		
10,000–15,000		
>15,000		
Orthodontic treatment history		
No	101	55.19
Yes	82	44.81
Orthodontic treatment type		
Traditional fixed braces	60	73.17
Removable functional appliance	14	17.07
Lingual braces	1	1.22
Self-ligating brackets	7	8.54
Orthodontic treatment duration (years)		
≤1	31	29.52
≤1.5	30	28.57
≤2	21	20
≤2.5	10	9.52
≤3	9	8.57
>3	4	3.81
Orthodontic information source		
Books and magazines	23	12.57
Social media platforms	86	46.99
Orthodontist	29	15.85
Word of mouth	45	24.59

Public knowledge of Invisalign treatment

Most participants who were familiar with Invisalign (64.4%) believe that it is generally better than traditional braces [Table 4]. Regarding the features of Invisalign aligners,

Table 2: Statistical result summary of the relationship between participants' sociodemographic data and the investigated Invisalign treatment features.

Variable	Age	Sex	Educational level	Monthly income	Orthodontic treatment history	Orthodontic information source
Age	—	NS	<0.0001	<0.0001	NS	0.0026
Sex	NS	—	NS	0.011	0.0014	NS
Educational level	<.0001	NS	—	<.0001	NS	NS
Monthly income	<.0001	0.011	<0.0001	—	NS	0.0028
Orthodontic treatment history	NS	0.0014	NS	NS	—	NS
Orthodontic information source	0.0026	NS	NS	0.0028	NS	—
Overall better	0.0022	NS	0.0013	<0.0001	NS	NS
Suitable for all cases	NS	0.0253*	NS	0.0269	NS	NS
Fewer visits	0.0153*	NS	NS	0.0204	NS	NS
Shorter treatment duration	0.0196*	NS	0.0121	0.0054	NS	0.043*
Reduced patient discomfort	NS	NS	NS	0.0143	NS	0.0131*
More esthetically attractive	0.0197*	0.0297*	NS	0.0173	NS	0.0429*
Easier to maintain oral hygiene	NS	NS	NS	NS	NS	0.0346*
Superior esthetic result	0.0038	<0.0001	0.0127	0.0013	NS	NS
Reduced treatment cost	<0.0001	NS	NS	<0.0001	NS	0.0199

NS, Not a significant result at P=0.05, *No statistically significant *post hoc* differences after Bonferroni correction

most participants were neutral on whether Invisalign is suitable for treating all types of malocclusions (38.3%). In addition, 32.2% of participants agreed and 6.1% strongly agreed that Invisalign treatment required fewer visits than traditional braces. Likewise, 32.8% and 6.6% of participants agree or strongly agree that Invisalign produces a shorter treatment duration than traditional braces. Regarding patient discomfort during treatment, 27.9% of participants agreed and 7.1% strongly agreed that Invisalign treatment causes less discomfort compared to traditional braces. A larger percentage of respondents also agree or strongly agree that Invisalign is more esthetically attractive (33.9% and 30.1%, respectively) or easier to maintain oral hygiene (37.7% and 17.5%, respectively) in comparison to traditional braces. On the other hand, 30.6% of participants agreed and 13.1% strongly agreed that Invisalign treatment yields superior esthetic results than traditional braces. However, regarding perceptions of cost, most respondents had no awareness of the cost of Invisalign treatment compared to traditional braces (27.9%; 'Do Not Know" option).

Relationship between Invisalign knowledge and sociodemographic factors

The results showed a statistical relationship between participants' age and the belief that Invisalign treatment was generally better (P = 0.002; Supplementary [Table 1]), yields superior aesthetic results (P = 0.004) or cheaper (P < 0.0001) than traditional braces. Moreover, when asked to state whether they believed that Invisalign treatment was generally better (P < 0.0001), yields superior esthetic results (P = 0.001) or cheaper (P < 0.0001) than traditional braces, participants aged 18–24 were found to be more likely to opt for the "Do Not Know" option. Meanwhile, participants aged between 55 and 64 years were more likely to disagree that Invisalign yields superior esthetic results (P = 0.002) and to strongly agree that Invisalign is cheaper than traditional braces (P < 0.001). Moreover, the findings revealed that there was a statistically significant difference between the participants' sex and the perception that Invisalign treatment produces superior aesthetic results than traditional braces (P < 0.0001), with males being more likely to agree than females (P < 0.001).

A statistically significant relationship was identified between the participants' educational levels and the belief that Invisalign treatment was generally better than traditional braces (P = 0.001). The findings revealed that, when asked whether Invisalign treatment was generally better than traditional braces, participants with high educational levels were more likely to select the "No" option (P < 0.001). There was also a statistically significant difference between the respondents' educational levels and the belief that treatment duration with Invisalign treatment was shorter than with traditional braces (P = 0.012); those with low educational level were more likely to "strongly disagree" with this statement (P < 0.001). A statistically significant relationship was also identified between participants' educational levels and the belief that Invisalign treatments produce superior esthetic results than traditional braces (P = 0.013). Participants with high educational levels were more likely to disagree that Invisalign treatment produces better esthetic results than traditional braces (P < 0.001).

Furthermore, a statistically significant relationship was identified between respondents' monthly income and the

Table 3: *Post hoc* comparison (Bonferroni corrected) of the relationship between participants' sociodemographic data.

Variable	Age (year), *n* (%)					Sex, *n* (%)		Educational level, *n* (%)			Monthly income, *n* (%)			Orthodontic treatment history, *n* (%)		Orthodontic information source, *n* (%)			
	18–24	25–34	35–44	45–54	55–64	Female	Male	Low	Average	High	Low	Average	High	No	Yes	Books and magazines	Social media platforms	Orthodontist	Word of mouth
Age (year), *n* (%)																			
18–24	—	—	—	—	—	49 (44.55)	29 (39.73)	28 (66.67) ¶	49 (40.16)	1 (5.26)	58 (73.42)§	16 (22.54)	4 (12.12)	44 (43.56)	34 (41.46)	5 (21.74)	39 (45.35)	8 (27.59)	26 (57.78)
25–34	—	—	—	—	—	34 (30.91)	24 (32.88)	8 (19.05)	42 (34.43)	8 (42.11)	16 (20.25)	30 (42.25)	12 (36.36)	28 (27.72)	30 (36.59)	7 (30.43)	32 (37.21)	8 (27.59)	11 (24.44)
35–44	—	—	—	—	—	18 (16.36)	14 (19.18)	3 (7.14)	23 (18.85)	6 (31.58)	5 (6.33)	15 (21.13)	12 (36.36)*	20 (19.8)	12 (14.63)	7 (30.43)	12 (13.95)	6 (20.69)	7 (15.56)
45–54	—	—	—	—	—	5 (4.55)	3 (4.11)	1 (2.38)	7 (5.74)	0 (0)	0 (0)	7 (9.86)	1 (3.03)	4 (3.96)	4 (4.88)	2 (8.7)	1 (1.16)	5 (17.24)	0 (0)
55–64	—	—	—	—	—	4 (3.64)	3 (4.11)	2 (4.76)	1 (0.82)	4 (21.05)§	0 (0)	3 (4.23)	4 (12.12)	5 (4.95)	2 (2.44)	2 (8.7)	2 (2.33)	2 (6.9)	1 (2.22)
Sex, *n* (%)																			
Female	49 (44.55)	34 (30.91)	18 (16.36)	5 (4.55)	4 (3.64)	—	—	21 (50)	76 (62.3)	13 (68.42)	57 (72.15)*	38 (53.52)	15 (45.45)	50 (49.5)	60 (73.17)*	13 (56.52)	52 (60.47)	19 (65.52)	26 (57.78)
Male	29 (39.73)	24 (32.88)	14 (19.18)	3 (4.11)	3 (4.11)	—	—	21 (50)	46 (37.7)	6 (31.58)	22 (27.85)	33 (46.48)	18 (54.55)	51 (50.5)*	22 (26.83)	10 (43.48)	34 (39.53)	10 (34.48)	19 (42.22)
Educational level, *n* (%)																			
Low	28 (66.67)¶	8 (19.05)	3 (7.14)	1 (2.38)	2 (4.76)	21 (50)	21 (50)	—	—	—	28 (35.44) ¶	9 (12.68)	5 (15.15)	23 (22.77)	19 (23.17)	5 (21.74)	19 (22.09)	5 (17.24) ¶	13 (28.89)
Average	49 (40.16)	42 (34.43)	23 (18.85)	7 (5.74)	1 (0.82)	76 (62.3)	46 (37.7)	—	—	—	48 (60.76)	56 (78.87)*	18 (54.55)	68 (67.33)	54 (65.85)	12 (52.17)	60 (69.77)	21 (72.41)	29 (64.44)
High	1 (5.26)	8 (42.11)	6 (31.58)	0 (0)	4 (21.05)§	13 (68.42)	6 (31.58)	—	—	—	3 (3.8)	6 (8.45)	10 (30.3)§	10 (9.9)	9 (10.98)	6 (26.09)	7 (8.14)	3 (10.34)	3 (6.67)
Monthly income, *n* (%)																			
Low	58 (73.42)§	16 (20.25)	5 (6.33)	0 (0)	0 (0)	57 (72.15)*	22 (27.85)	28 (35.44) ¶	48 (60.76)	3 (3.8)	—	—	—	39 (38.61)	40 (48.78)	4 (17.39)	44 (51.16)	6 (20.69)	25 (55.56)
Average	16 (22.54)	30 (42.25)	15 (21.13)	7 (9.86)	3 (4.23)	38 (53.52)	33 (46.48)	9 (12.68)	56 (78.87)*	6 (8.45)	—	—	—	40 (39.6)	31 (37.8)	15 (65.22)	29 (33.72)	16 (55.17)	11 (24.44)
High	4 (12.12)	12 (36.36)	12 (36.36)*	1 (3.03)	4 (12.12)	15 (45.45)	18 (54.55)	5 (15.15)	18 (54.55)	10 (30.3)§	—	—	—	22 (21.78)	11 (13.41)	4 (17.39)	13 (15.12)	7 (24.14)	9 (20)
Orthodontic treatment history, *n* (%)																			
No	44 (43.56)	28 (27.72)	20 (19.8)	4 (3.96)	5 (4.95)	50 (49.5)	51 (50.5)*	23 (22.77)	68 (67.33)	10 (9.9)	39 (38.61)	40 (39.6)	22 (21.78)	—	—	14 (60.87)	46 (53.49)	17 (58.62)	24 (53.33)
Yes	34 (41.46)	30 (36.59)	12 (14.63)	4 (4.88)	2 (2.44)	60 (73.17)*	22 (26.83)	19 (23.17)	54 (65.85)	9 (10.98)	40 (48.78)	31 (37.8)	11 (13.41)	—	—	9 (39.13)	40 (46.51)	12 (41.38)	21 (46.67)
Orthodontic information source, *n* (%)																			
Books amnd magazines	5 (21.74)	7 (30.43)	7 (30.43)	2 (8.7)	2 (8.7)	13 (56.52)	10 (43.48)	5 (21.74)	12 (52.17)	6 (26.09)	4 (17.39)	15 (65.22)	4 (17.39)	14 (60.87)	9 (39.13)	—	—	—	—
Social media platforms	39 (45.35)	32 (37.21)	12 (13.95)	1 (1.16)	2 (2.33)	52 (60.47)	34 (39.53)	19 (22.09)	60 (69.77)	7 (8.14)	44 (51.16)	29 (33.72)	13 (15.12)	46 (53.49)	40 (46.51)	—	—	—	—
Orthodontist	8 (27.59)	8 (27.59)	6 (20.69)	5 (17.24) ¶	2 (6.9)	19 (65.52)	10 (34.48)	5 (17.24)	21 (72.41)	3 (10.34)	6 (20.69)	16 (55.17)	7 (24.14)	17 (58.62)	12 (41.38)	—	—	—	—
Word of mouth	26 (57.78)	11 (24.44)	7 (15.56)	0 (0)	1 (2.22)	26 (57.78)	19 (42.22)	13 (28.89)	29 (64.44)	3 (6.67)	25 (55.56)	11 (24.44)	9 (20)	24 (53.33)	21 (46.67)	—	—	—	—

Symbols represent significant *P* values after Bonferroni correction: * < 0.01, ¶ < 0.001, §< 0.0001

Table 4: Participants' knowledge of the investigated invisalign treatment features.

Invisalign features	Response, *n* (%)					
Overall better	**Don't know**		**No**		**Yes**	
	71 (38.8)		**21 (11.48)**		**91 (49.73)**	
	Don't know	**Disagree**	**Strongly Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Suitable for all cases	36 (19.67)	29 (15.85)	12 (6.56)	70 (38.25)	32 (17.49)	4 (2.19)
Fewer visits	50 (27.32)	17 (9.29)	3 (1.64)	43 (23.5)	59 (32.24)	11 (6.01)
Shorter treatment duration	41 (22.4)	21 (11.48)	6 (3.28)	43 (23.5)	60 (32.79)	12 (6.56)
Reduced patient discomfort	45 (24.59)	19 (10.38)	2 (1.09)	53 (28.96)	51 (27.87)	13 (7.1)
More esthetically attractive	29 (15.85)	15 (8.2)	4 (2.19)	18 (9.84)	62 (33.88)	55 (30.05)
Easier to maintain oral hygiene	34 (18.58)	13 (7.1)	3 (1.64)	32 (17.49)	69 (37.7)	32 (17.49)
Superior esthetic result	43 (23.5)	17 (9.29)	4 (2.19)	39 (21.31)	56 (30.6)	24 (13.11)
Reduced treatment cost	51 (27.87)	18 (9.84)	17 (9.29)	48 (26.23)	38 (20.77)	11 (6.01)

belief that Invisalign was generally better ($P < 0.0001$), can treats all types of malocclusions ($P = 0.027$), requires fewer clinical visits ($P = 0.020$), results in a shorter treatment duration ($P = 0.005$), causes less patient discomfort ($P = .014$), is more esthetically attractive ($P = 0.017$), yields superior esthetic results ($P = 0.001$), and cheaper ($P < 0.0001$) than traditional braces. Participants with low monthly income selected the "Do Not Know" option when asked whether they believe that Invisalign treatment is generally better than traditional braces ($P < 0.0001$), requires fewer clinical visits ($P < 0.001$), results in shorter treatment duration ($P < 0.001$), causes less patient discomfort ($P < 0.001$), more esthetically attractive ($P < 0.001$), produces superior esthetic results ($P < 0.001$), or cheaper ($P < 0.0001$) than traditional braces. Moreover, participants with average income are more likely to perceive Invisalign treatment to be generally better than traditional braces ($P < 0.0001$) or yields better aesthetic results ($P = 0.002$). Finally, more high-income level participants strongly agreed that Invisalign could be used to treat all types of malocclusions ($P = 0.0027$).

The findings of this study did not show any relationship between orthodontic treatment history and any of the Invisalign treatment features [Tables 2 and 3]. However, there was a statistically significant difference between participants' orthodontic information sources and perceptions that Invisalign treatment is less expensive than traditional braces ($P = 0.020$). Participants who obtained orthodontic information from orthodontists agreed that Invisalign treatment was less expensive than traditional braces ($P < 0.001$).

DISCUSSION

In recent years, the use of clear dental aligners has significantly grown in popularity, with more and more advertisements promoting it and garnering public exposure.[14,15] This study examined the general public's knowledge regarding Invisalign treatment and found that around one-fifth of the respondents were familiar with Invisalign aligners. This figure was lower than that was previously found in a report on direct-to-consumer aligners (45%).[17]

Furthermore, previous studies have found that online information regarding clear aligners is generally inadequate.[18-21] Given the growing patient interest in clear aligner treatment, health providers must strive to deliver credible and evidence-based information to patients. The present study found that participants had misconceptions about the Invisalign clear aligner treatment, with most respondents believing that such devices were generally better than traditional braces, particularly among individuals with average monthly income. Clear aligners are often promoted as an equally effective orthodontic treatment modality to traditional fixed appliances. Nonetheless, the current evidence-based research suggests that clear-aligner treatment is more suitable for mild-to-moderate malocclusions, whereas traditional braces remain the gold standard treatment choice in orthodontics.[10-13]

In addition, most participants stated that Invisalign aligners are more aesthetically attractive than traditional braces, which is in line with the findings of other studies.[1,22,23] Nonetheless, the increase in clear aligner attachments could compromise its esthetic attractiveness.[22] Meanwhile, most participants stated that treatment using Invisalign aligners is easier to keep clean than traditional braces. One of the promoted advantages of clear aligners is easier oral hygiene maintenance because it is a removable appliance with fewer retentive parts than fixed appliances. Although the previous literature supports this claim, it is with low to very-low evidence certainty.[12,24]

Moreover, this study revealed that almost one-third of participants believed Invisalign treatment to be faster and require fewer visits than traditional braces. However, prior meta-analyses have failed to identify significant differences in treatment duration between clear aligners and traditional braces.[12,25,26] Nonetheless, a recent randomized clinical trial

found that, when using Invisalign clear aligners to treat minor malocclusions, treatment duration was longer than traditional braces by 4.8 months.[27]

Most respondents in the present study (especially males) believed that Invisalign treatment produces superior results to traditional braces. Very few studies have employed occlusal indices to measure the quality of treatment outcomes with clear aligners. Nonetheless, studies had shown that the treatment outcomes of clear aligners (rated using the American Board of Orthodontics Objective Grading System) were worse than traditional braces.[12,26] However, no differences were found when the Peer Assessment Rating Index was employed.[12] Most participants also stated that they believed Invisalign treatment causes less discomfort than traditional braces. This is in line with the findings of a previous work, which found that patient discomfort was reduced in the first few days of treatment, although the differences disappeared after that.[28]

Invisalign treatment costs have been discussed in many YouTube testimonials and Twitter posts.[21,29,30] However, most participants in this study did not know the cost of Invisalign treatment, except for those aged 55–64 years, who strongly believed it is less expensive. Over the past decade, more and more people have been using social media. It is also a vital source of information in many fields, including orthodontics.[31] Previous studies showed that over 80% of orthodontic patients use social media, with the most popular platforms being Facebook and Instagram.[32-35] In addition, Hanzell *et al.* found that only 6.7% of participants use social media to seek orthodontic information, whereas Siddiqui *et al.* found this figure to be 30%.[33,35] The present study found that around half of the participants use social media to seek orthodontic information. The differences between these findings and those of the previous studies may be due to the research time frame, as well as participants' ages and ethnicity. Moreover, research participants in this study were selected through social media sites, and thus their social media use may be over-represented.

It is not uncommon that public surveys are designed without patient input.[33] The present study used a validated survey involving inputs from orthodontic patients. However, selection bias may be present in this work. Moreover, the survey link was shared through social media and thus not all Saudi citizens had an equal opportunity to be selected for participation. Furthermore, the findings cannot be generalized to any other countries except Saudi Arabia, as factors including ethnicity, educational level, population age and internet access may produce a different outcome. Thus, it cannot be assumed that the sample is fully representative of Saudi Arabia or any other country. In the future, researchers should examine public perceptions of Invisalign treatment in other countries.

CONCLUSION

In this study, only 19.6% of the 934 participants knew Invisalign, highlighting the lack of public knowledge regarding the treatment. Most participants perceived Invisalign treatment to be generally better, quicker and requires fewer visits, causes less discomfort, is easier to hygienically maintain, yields superior esthetics results, and is more aesthetically attractive than traditional braces. However, not many participants were aware of Invisalign treatment costs. Respondents aged 55–64 strongly agreed that Invisalign is cheaper than traditional braces. On the other hand, males and average-income participants were more likely to believe that Invisalign devices produce better results than traditional braces. The current results indicated the importance of ensuring public access to high-quality information.

Data availability

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

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Conflicts of interest

There are no conflicts of interest.

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