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Patient Preferences, Knowledge and Acceptance of Surgical Versus Nonsurgical Approaches in Accelerated Orthodontic Treatment: A Cross-Sectional Survey Study

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Abstract **Objectives:** Both orthodontists and patients are significantly concerned about the length of orthodontic treatment, which typically lasts between 24 and 36 months on average but can be substantially longer. Orthodontic care is essential not only for aesthetics and function but also for enhancing the overall quality of life. With the increasing demand for shorter treatment durations, patient-centered care becomes more relevant. Previous studies in Saudi Arabia and internationally have evaluated patient awareness, acceptance and preferences for different acceleration methods. Factors such as comfort, cost, effectiveness and anxiety significantly influence patient decision-making between surgical and non-surgical options. This study aims to evaluate patient awareness of both surgical and non-surgical accelerated orthodontic treatment modalities, assess their preferences between these approaches and to identify the key factors influencing acceptance such as perceived pain, treatment cost and expected duration. **Methodology:** This cross-sectional study conducted from September 2025 to December 2025 in Saudi Arabia. The study plans to recruit participants through social media platforms like X, Snapchat, Instagram, WhatsApp and Facebook. The inclusion criteria are Saudi citizens, both males and females, from all provinces of Saudi Arabia, with or without knowledge of different treatment options, who agree to participate and complete questionnaires. Excluded are dental practitioners and individuals under 18 years old. The minimum target sample size is 384 was calculated using a formula based on prevalence estimation, 95% confidence level and 5% acceptable error. **Results:** A total of 652 participants responded (mean age 33.4±12.7 years; 61.7% female). Only 35.4% were currently undergoing or planning orthodontic treatment. Preference favored non-surgical acceleration (55.1%) over surgical (13.2%), traditional (10.7%), or no difference (21.0%). Effectiveness was the most important factor for 35.3% of participants, whereas cost (28.4%) and recovery time (27.6%) were most commonly selected as least important. Pain was the main barrier to surgical approaches (37.3%), followed by fear (29.8%) and cost (12.7%) and 71.3% reported concerns about post-surgical pain. Most participants preferred slower but less painful non-surgical options (72.9%) and 64.3% would not accept a faster but more painful surgical method. Willingness to pay for acceleration varied, with 38.5% accepting a 10% increase and 25.8% accepting a 30% increase and 78.4% wanted more information first. Knowledge was low in 62.3% and high in 8.4% and acceptance was significantly associated with multiple sociodemographic variables. **Conclusion:** Saudi adults showed a clear preference for non-surgical AOT, with pain-related concerns and orthodontist recommendation shaping acceptance. Patient education addressing benefits, risks and realistic expectations may improve informed choice and appropriate uptake of AOT.

Key Words Accelerated Orthodontics, Preferences and Acceptance, Laser, Corticotomy, Piezocision, Saudi Population

INTRODUCTION

Modern orthodontic treatments focus on comfort, aesthetics, function and efficiency, while prioritizing he patient's quality of life during treatment [1].

Side effects such as pain, cavities, gum recession and prolonged treatment duration often motivate patients and orthodontists to seek faster tooth movement. Acceleration techniques are divided into non-surgical methods, like Low-Level Laser Therapy (LLLT) and vibration devices and surgical methods, such as micro-osteoperforations, which enhance bone remodeling and speed up tooth movement [2]. Since the 1890s, efforts have been made to accelerate tooth movement, which closely corresponds to Angle's groundbreaking work in contemporary orthodontics. Rapid orthodontics can now be performed using various approaches, including surgical and nonsurgical techniques. It has been effectively shown that these methods can reduce treatment duration by up to 70% [3]. In 2021, a study reported that 86.4% of participants preferred non-surgical accelerated orthodontic procedures, mainly to avoid anxiety, while surgical options were chosen to reduce treatment time. A statistically significant difference was found regarding opinions on time reduction when using accelerated modalities ($p<0.001$) [4]. Another 2021 study revealed 50.8% of orthodontists and 38.4% of patients favored customized appliances, while 49.2% of orthodontists and 38.1% of patients preferred vibration devices. Willingness to pay up to 40% more was noted among orthodontists and 20% among patients [5].

According to research conducted in 2019, 83% of participants thought orthodontic treatment took too long and 55.5% wanted it to take less than six months. FDA-approved vibrating devices came in second (40.5%), with customized wires being the most popular option (52.5%). Of the participants, 47.5% expressed a willingness to pay and 59% agreed with a charge increase of up to 40% for vibrating gadgets. There was a significant difference ($p<0.05$) between income and gender [6]. There is a lack of research in Saudi Arabia specifically exploring patient preferences between surgical and non-surgical accelerated orthodontic treatments. Existing studies often have small sample sizes and focus more on clinical outcomes than on patient-centered concerns like anxiety, cost and comfort. Factors such as perceived pain and psychological readiness remain underexplored. Given the rising demand for faster and more comfortable orthodontic care, it is essential to understand what influences patient choices to support more personalized and satisfactory treatment approaches.

The purpose of this study was to ascertain the opinions of patients and orthodontists on orthodontic treatment duration and methods for quickening the pace of tooth movement. Additionally, the study was designed to assess the most widely used acceleration technique selected by patients and orthodontists, as well as the amount of additional fees they are willing to spend [7].

Objectives

This study aims to evaluate patient Knowledge, awareness and preferences for surgical and non-surgical accelerated orthodontic treatment options, to identify the main factors influencing acceptance, especially perceptions related to pain, cost and treatment duration.

METHODS

Study Design and Setting

This study utilized a cross-sectional design to assess patient awareness and preferences and acceptance of surgical versus nonsurgical approaches in accelerated orthodontic treatment. The cross-sectional design was chosen to collect data at a single point in from a Saudi population, allowing for the evaluation of current attitudes and preferences. The study was conducted at data collection took place over a period of 3 months, from September 2025 to December 2025. The setting provided access to a diverse group of patients currently undergoing or considering accelerated orthodontic treatment.

Subject: Participants, Recruitment and Sampling Procedure

Participants in this study included male and female patients aged between 18 and 65 years who were undergoing or considering orthodontic treatment in dental clinics across Saudi Arabia. A sample recruiting approach relied on social media platforms such as X, Snapchat, Instagram, WhatsApp and Facebook.

Sample Size

From September 2025 to December 2025 was the beginning of data collecting. Data collection involved a target sample of 384 patients (confidence level: 95%; margin of error: 5%). The sample size was estimated using the formula:

$$n = P(1-P) * Z\alpha\ 2 / d\ 2 \text{ with a 95\% confidence level}$$

n = Calculated sample size
Z = The z-value for the selected level of confidence (1- a) = 1.96
P = An estimated prevalence of knowledge.
Q = (1- 0.50) = 50%, i.e., 0.50
D = The maximum acceptable error = 0.05

Therefore, the minimum target sample size (n = 384) was calculated using the formula: n = (1.96)2 X 0.50 X 0.50/(0.05) 2 = 384.

Inclusion and Exclusion Criteria

Inclusion criteria were Saudi population, males and females aged between 18-65 years from all provinces of the Kingdom of Saudi Arabia, patients who are currently undergoing or planning to undergo orthodontic treatment and those who agree to participate in this study and complete the questionnaires.

Exclusion criteria were dental practitioners, patients under 18 years old, patients with chronic systemic diseases affecting oral or bone health and those unable or unwilling to provide informed consent.

Method for Data Collection, Instrument

The questions were adapted from previously validated questionnaires in the literature. Data were collected through participants' responses to a self-administered questionnaire, which consisted of five main parts:

- **Part 1** involved the selection of each researcher's data collector number
- **Part 2** provided a brief description of the study objectives, followed by a consent statement to ensure voluntary participation
- **Part 3** collected demographic information, including age, gender, nationality, educational level and previous experience with orthodontic treatment
- **Part 4** assessed participants' knowledge and awareness of accelerated orthodontic treatment options. This section covered both surgical and non-surgical methods, sources of information, perceived benefits, potential risks and factors influencing treatment choice-such as pain, duration and cost
- **Part 5** explored participants' preferences and acceptance of accelerated orthodontic treatments

Scoring System

The questionnaire used in this study consists of a total of 33 statements, divided into three main sections. Six of these statements gather demographic information and are not scored. The remaining 27 items assess respondents' knowledge and awareness regarding surgical and non-surgical accelerated orthodontic treatment modalities and treatment preferences and acceptance. Specifically, three items measure knowledge, while eight assess awareness. Treatment preferences and acceptance consists of 16 statements. The scoring system is straightforward: each correct answer is awarded one point, while incorrect responses or answers marked as "I don't know" receive zero points. For questions using Likert scales-whether dichotomous, three-point, or quality scales-the same scoring principle is applied.

The maximum possible score for the knowledge section is 3 points, while the awareness section has a maximum of 8 points, while the treatment preferences and acceptance section is 80 points. Resulting in a total possible score of 91 points. To interpret the scores, Bloom's taxonomy cut-off levels are used. Overall scores are categorized for the knowledge-specific section, scores are further classified into low (1 points or zero), moderate (2 points) and high (3 points). Similarly, awareness levels are categorized as low (0-4 points), moderate (5-6 points) and high (7-8 points). Similarly for treatment preferences and acceptance section as low (less than 60%, 47 points or fewer) and moderate (60-79%, approximately 48-64 points) and high (80-100%, approximately more than 65 points).

Pilot Test

The questionnaire was distributed to 15 individuals and asked to fill it. This was done to test the simplicity of the questionnaire and the feasibility of the study. Data from the pilot study were excluded from the final data of the study.

Analyzes and Entry Method

The "Microsoft Office Excel Software" was utilized with Windows (2021) to enter the data into the device. The acquired data was then sent to the Statistical Package for the Social Sciences Software (SPSS) tool, version 21 (IBM SPSS Statistics for Microsoft Windows, Version 21.0), for statistical analysis. Descriptive statistics were used to summarize the numerical variables for baseline characteristics. For categorical variables, frequencies and percentages were calculated. The Chi-square test was used to identify associations between categorical variables.

RESULTS

Table 1 displays various demographic parameters of the participants with a total number of (652). The average age was 33.4±12.7 years and there was a comparatively balanced distribution of the age group. Most of them were female (61.7%). The sample was comprised of Saudi nationals 61.7%.

Table 1: Sociodemographic Characteristics of Participants (n = 652)

Parameter		No.	Percentage
Age (Mean: 33.4, STD: 12.7)	23 or less	135	20.7
	24 to 26	133	20.4
	27 to 29	137	21.0
	30 to 45	106	16.3
	46 or more	141	21.6
Gender	Female	402	61.7
	Male	250	38.3
Nationality	Saudi	402	61.7
	Non-Saudi	250	38.3
Educational level	Elementary	2	.3
	Intermediate	7	1.1
	Secondary	101	15.5
	Bachelor	465	71.3
	Master's	47	7.2
	Doctorate	30	4.6
Residential area	Northern region	38	5.8
	Southern region	239	36.7
	Central region	62	9.5
	Eastern region	64	9.8
	Western region	249	38.2
Monthly income	Less than 5,000	233	35.7
	5,000–9,999	182	27.9
	10,000–14,999	117	17.9
	15,000 or above	120	18.4

Table 2: Parameters Related to Knowledge and Awareness of Surgical Versus Nonsurgical Approaches in Accelerated Orthodontic Treatment (n = 652)

Parameter		No.	Percent
Do you currently have braces or are you planning orthodontic treatment?	No	421	64.6
	Yes	231	35.4
Have you ever heard of simple surgical methods that help speed up orthodontic treatment? (For example, making small incisions or scratches in the bone around the teeth to move them faster)	No	341	52.3
	Yes	311	47.7
Have you heard of non-surgical methods to speed up orthodontic treatment? (Such as laser or vibration devices)	No	431	66.1
	Yes	221	33.9
If it were possible to cut the duration of orthodontic treatment in half, which of these methods would you prefer?	Traditional approach	70	10.7
	Surgical approach	86	13.2
	Non-surgical approach	359	55.1
	It makes no difference to me	137	21.0
In terms of rating factors, choose the one that is most important to you:	Pain	160	24.5
	Cost	106	16.3
	Effectiveness	230	35.3
	Risk	84	12.9
	Recovery time	72	11.0
In terms of rating factors, choose the one that is least important to you	Pain	110	16.9
	Cost	185	28.4
	Effectiveness	72	11.0
	Risk	105	16.1
	Recovery time	180	27.6
If the surgical method was faster but caused more pain, would you agree to undergo it?	No	419	64.3
	Yes	233	35.7
If the non-surgical method is slower but less painful, would you prefer it?	No	177	27.1
	Yes	475	72.9
Do you have concerns about pain after surgical procedures?	No	187	28.7
	Yes	465	71.3
What prevents you from choosing the surgical method to speed up the healing process?	Pain	243	37.3
	Cost	83	12.7
	Fear	194	29.8
	I have no objection	123	18.9
	I don't have enough knowledge	9	1.4
How willing are you to bear the additional cost for a treatment that reduces the orthodontic treatment time by 30%?	Not willing to bear any additional cost	174	26.7
	Willing to bear a small additional cost of 10%	251	38.5
	Willing to bear a medium additional cost of 30%	168	25.8
	Willing to bear a large additional cost of 50%	59	9.0

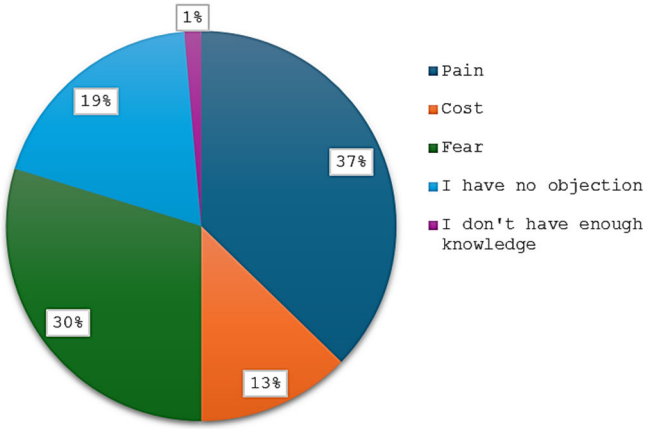

Figure 1: Illustrates Barriers to Surgical Method among Participants

Most of the participants were bachelors (71.3%), which shows that the population is educated. The major regions represented by the participants were the Western (38.2%) and Southern (36.7%). On income, more than a third indicated having a monthly income of below 5,000 with the rest of the population fairly spread out in the higher income brackets.

As shown in Figure 1, among 652 participants, pain was the main barrier to choosing surgical acceleration (37.3%), followed by fear (29.8%) and cost (12.7%). However, 18.9% reported no objection, while only 1.4% said that they have insufficient knowledge.

Table 2 shows the knowledge and awareness about accelerated orthodontic treatment in terms of knowledge and preference of the participants. Most of the respondents were not undergoing or intending to undergo orthodontic treatment (64.6). Knowledge of the surgical acceleration techniques was

moderate (47.7%) and the knowledge of the non-surgical ones was less (33.9%). On these conditions, more than half had a choice of non-surgical (55.1%), surgical (13.2%) and traditional (10.7%). The most significant consideration by 35.3% of participants was effectiveness and cost (28.4) and recovery time (27.6) were rated as important the least often. Most of them were not willing to undergo quick and excruciating procedures (64.3%) and were worried about pain after surgery (71.3%). On the other hand, 72.9 percent preferred slower and less painful non-surgical ones.

As shown in Figure 2, most participants (64.3%) agreed or strongly agreed that non-surgical accelerated orthodontic methods are preferred, while 26.5% were neutral and 9.2% disagreed.

Table 3 below describes the preferences of the participants in terms of treatments to be used, cost and the perception of pain. There was also a strong inclination towards non-surgical acceleration methods with 64.3% agreeing with it or strongly agreeing. They were less willing to subject themselves to surgery so that only 41.5% agreed and 25.7% were opposed. Minimal intervention was preferred by most participants despite the length of treatment being prolonged (50.9%). The 61.2% decisions were made depending on the approach irrespective of the treatment effectiveness. The recommendation of the orthodontist was a significant factor and 75.4% agreed with it. Cost-related issues also mattered, with 56.9% of them only deciding to accelerate treatment when it is affordable and 47.2% of this group of users considering cost as a major factor.

Table 3: Participants' Treatment Preferences, Cost Considerations and Pain and Discomfort Perception (n = 652)

Parameter		No.	Percent
I prefer non-surgical methods (lasers, vibration devices) for accelerated orthodontic treatment	Strongly disagree	14	2.1
	Disagree	46	7.1
	Neutral	173	26.5
	Agree	225	34.5
	Strongly agree	194	29.8
I am willing to undergo surgical procedures (e.g., corticotomy, piezocision) if they significantly reduce treatment time	Strongly disagree	48	7.4
	Disagree	119	18.3
	Neutral	214	32.8
	Agree	158	24.2
	Strongly agree	113	17.3
I would choose the least invasive method available, even if the treatment takes longer	Strongly disagree	32	4.9
	Disagree	69	10.6
	Neutral	219	33.6
	Agree	229	35.1
	Strongly agree	103	15.8
I would choose a treatment based on its effectiveness regardless of whether it is surgical or non-surgical	Strongly disagree	33	5.1
	Disagree	71	10.9
	Neutral	149	22.9
	Agree	220	33.7
	Strongly agree	179	27.5
My decision depends on the advice and recommendation of my orthodontist	Strongly disagree	22	3.4
	Disagree	44	6.7
	Neutral	95	14.6
	Agree	267	41.0
	Strongly agree	224	34.4
I would only choose accelerated treatment if it is covered by insurance or is affordable	Strongly disagree	21	3.2
	Disagree	69	10.6
	Neutral	191	29.3
	Agree	213	32.7
	Strongly agree	158	24.2
Cost is the most important factor influencing my treatment decision	Strongly disagree	29	4.4
	Disagree	117	17.9
	Neutral	198	30.4
	Agree	184	28.2
	Strongly agree	124	19.0
I am concerned about the pain associated with surgical acceleration techniques	Strongly disagree	25	3.8
	Disagree	60	9.2
	Neutral	140	21.5
	Agree	259	39.7
	Strongly agree	168	25.8
I would avoid surgical options due to fear of pain or complications	Strongly disagree	27	4.1
	Disagree	70	10.7
	Neutral	136	20.9
	Agree	238	36.5
	Strongly agree	181	27.8
I believe non-surgical options are less painful and more comfortable	Strongly disagree	25	3.8
	Disagree	48	7.4
	Neutral	124	19.0
	Agree	276	42.3
	Strongly agree	179	27.5

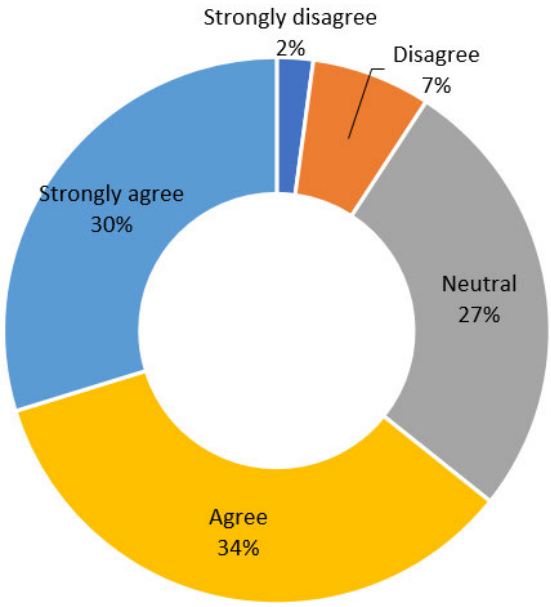

Figure 2: Illustrates Participants Preference for Non-Surgical Methods for Accelerated Orthodontic Treatment

Table 4: Participants' Treatment Duration and Decision-Making Confidence (n = 652)

Parameter		No.	Percent
Shortening orthodontic treatment time is important to me	Strongly disagree	26	4.0
	Disagree	88	13.5
	Neutral	150	23.0
	Agree	235	36.0
	Strongly agree	153	23.5
I would choose a more invasive method if it reduced treatment time significantly	Strongly disagree	22	3.4
	Disagree	69	10.6
	Neutral	191	29.3
	Agree	236	36.2
	Strongly agree	134	20.6
I am willing to accept some discomfort for a shorter overall treatment duration	Strongly disagree	35	5.4
	Disagree	108	16.6
	Neutral	176	27.0
	Agree	219	33.6
	Strongly agree	114	17.5
I feel I have enough information to make a decision between surgical and non-surgical options	Strongly disagree	23	3.5
	Disagree	108	16.6
	Neutral	218	33.4
	Agree	202	31.0
	Strongly agree	101	15.5
I would like to learn more about the risks and benefits of each acceleration method before deciding	Strongly disagree	18	2.8
	Disagree	37	5.7
	Neutral	86	13.2
	Agree	252	38.7
	Strongly agree	259	39.7

Surgical pain was a source of concern and 65.5% of them expressed that they were concerned, whereas 64.3% of them stated that they avoid surgery because they are scared or because of complications.

Table 4 indicates a high degree of interest in the shortening of orthodontic treatment period with 59.5% of the respondents agreeing or strongly agreeing with the importance of shortening treatment. Likewise, 56.8 would consider more invasive and 51.1 had no objection to a bit of discomfort to reduce the time of treatment. Although over 46.5% believed they had sufficient information to choose between both alternatives, only a significant percentage (78.4) of the respondents said they wanted to know more of the risks and benefits before making a final choice.

Table 5 shows the score levels regarding knowledge of accelerated orthodontic approaches, with most participants demonstrating low knowledge (62.3%), while fewer participants showing moderate knowledge (29.3%) and only a small proportion showing high knowledge levels (8.4%).

Table 6 shows the awareness level of accelerated orthodontic approaches, with most participants showing low awareness (74.5%), fewer having moderate awareness (23.6%) and only 1.8% showing high awareness.

Table 5: Shows Knowledge of Surgical Versus Nonsurgical Approaches in Accelerated Orthodontic Treatment Score Results

	Frequency	Percent
High knowledge level	55	8.4
Moderate knowledge level	191	29.3
Low knowledge level	406	62.3
Total	652	100.0

Table 6: Shows Awareness of Surgical Versus Nonsurgical Approaches in Accelerated Orthodontic Treatment Score Results

	Frequency	Percent
High awareness level	12	1.8
Moderate awareness level	154	23.6
Low awareness level	486	74.5
Total	652	100.0

Table 7: Shows Treatment Preferences and Acceptance of Surgical Versus Nonsurgical Approaches in Accelerated Orthodontic Treatment Score Results

	Frequency	Percent
High level	73	11.2
Moderate level	433	66.4
Low level	146	22.4
Total	652	100.0

Table 8: Relation between Knowledge Level of Accelerated Orthodontic Treatment and Sociodemographic Characteristics

Parameters		Knowledge level		Total (N = 652)	P value
		High or moderate knowledge	Low knowledge level		
Gender	Female	131	271	402	0.001
		53.3%	66.7%	61.7%	
	Male	115	135	250	
		46.7%	33.3%	38.3%	
Age	23 or less	66	69	135	0.0001
		26.8%	17.0%	20.7%	
	24 to 26	64	69	133	
		26.0%	17.0%	20.4%	
	27 to 29	70	67	137	
		28.5%	16.5%	21.0%	
	30 to 45	19	87	106	
		7.7%	21.4%	16.3%	
	46 or more	27	114	141	
		11.0%	28.1%	21.6%	
Nationality	Saudi	235	374	609	0.089
		95.5%	92.1%	93.4%	
	Non-Saudi	11	32	43	
		4.5%	7.9%	6.6%	
Educational level	Elementary	0	2	2	0.253
		0.0%	0.5%	0.3%	
	Intermediate	1	6	7	
		0.4%	1.5%	1.1%	
	Secondary	42	59	101	
		17.1%	14.5%	15.5%	
	Bachelor	181	284	465	
		73.6%	70.0%	71.3%	
	Master's	14	33	47	
		5.7%	8.1%	7.2%	
	Doctorate	8	22	30	
		3.3%	5.4%	4.6%	
Residential region	Northern region	21	17	38	0.0001
		8.5%	4.2%	5.8%	
	Southern region	110	129	239	
		44.7%	31.8%	36.7%	
	Central region	34	28	62	
		13.8%	6.9%	9.5%	
	Eastern region	25	39	64	
		10.2%	9.6%	9.8%	
	Western region	56	193	249	
		22.8%	47.5%	38.2%	
Monthly income	Less than 5,000	94	139	233	0.082
		38.2%	34.2%	35.7%	
	5,000–9,999	71	111	182	
		28.9%	27.3%	27.9%	
	10,000–14,999	48	69	117	
		19.5%	17.0%	17.9%	
	15,000 or above	33	87	120	
		13.4%	21.4%	18.4%	

*P value was considered significant if ≤0.05

Table 9: Awareness Level of Accelerated Orthodontic Treatment in Association with Sociodemographic Characteristics

Parameters		Awareness level		Total (N = 652)	P value
		High or moderate awareness	Low awareness level		
Gender	Female	112	290	402	0.074
		67.5%	59.7%	61.7%	
	Male	54	196	250	
		32.5%	40.3%	38.3%	
Age	23 or less	39	96	135	0.001
		23.5%	19.8%	20.7%	
	24 to 26	25	108	133	
		15.1%	22.2%	20.4%	
	27 to 29	21	116	137	
		12.7%	23.9%	21.0%	
	30 to 45	34	72	106	
		20.5%	14.8%	16.3%	
	46 or more	47	94	141	
		28.3%	19.3%	21.6%	
Nationality	Saudi	156	453	609	0.731
		94.0%	93.2%	93.4%	
	Non-Saudi	10	33	43	
		6.0%	6.8%	6.6%	
Educational level	Elementary	0	2	2	0.063
		0.0%	0.4%	0.3%	
	Intermediate	0	7	7	
		0.0%	1.4%	1.1%	
	Secondary	21	80	101	
		12.7%	16.5%	15.5%	
	Bachelor	116	349	465	
		69.9%	71.8%	71.3%	
	Master's	17	30	47	
		10.2%	6.2%	7.2%	
	Doctorate	12	18	30	
		7.2%	3.7%	4.6%	
Residential region	Northern region	6	32	38	0.085
		3.6%	6.6%	5.8%	
	Southern region	67	172	239	
		40.4%	35.4%	36.7%	
	Central region	11	51	62	
		6.6%	10.5%	9.5%	
	Eastern region	11	53	64	
		6.6%	10.9%	9.8%	
	Western region	71	178	249	
		42.8%	36.6%	38.2%	
Monthly income	Less than 5,000	61	172	233	0.005
		36.7%	35.4%	35.7%	
	5,000–9,999	32	150	182	
		19.3%	30.9%	27.9%	
	10,000–14,999	30	87	117	
		18.1%	17.9%	17.9%	
	15,000 or above	43	77	120	
		25.9%	15.8%	18.4%	

*P value was considered significant if ≤0.05

Table 10: Acceptance Level of Accelerated Orthodontic Treatment in Association with Sociodemographic Characteristics

Parameters		Acceptance level		Total (N = 652)	P value
		High or moderate level	Low level		
Gender	Female	332	70	402	0.0001
		65.6%	47.9%	61.7%	
	Male	174	76	250	
		34.4%	52.1%	38.3%	
Age	23 or less	124	11	135	0.0001
		24.5%	7.5%	20.7%	
	24 to 26	90	43	133	
		17.8%	29.5%	20.4%	
	27 to 29	66	71	137	
		13.0%	48.6%	21.0%	
	30 to 45	100	6	106	
		19.8%	4.1%	16.3%	

Table 10: Continue

Parameters		Acceptance level		Total (N = 652)	P value
		High or moderate level	Low level		
	46 or more	126	15	141	
		24.9%	10.3%	21.6%	
Nationality	Saudi	466	143	609	0.012
		92.1%	97.9%	93.4%	
	Non-Saudi	40	3	43	
		7.9%	2.1%	6.6%	
Educational level	Elementary	2	0	2	0.001
		0.4%	0.0%	0.3%	
	Intermediate	6	1	7	
		1.2%	0.7%	1.1%	
	Secondary	64	37	101	
		12.6%	25.3%	15.5%	
	Bachelor	364	101	465	
		71.9%	69.2%	71.3%	
	Master's	42	5	47	
		8.3%	3.4%	7.2%	
	Doctorate	28	2	30	
		5.5%	1.4%	4.6%	
Residential region	Northern region	16	22	38	0.0001
		3.2%	15.1%	5.8%	
	Southern region	211	28	239	
		41.7%	19.2%	36.7%	
	Central region	36	26	62	
		7.1%	17.8%	9.5%	
	Eastern region	43	21	64	
		8.5%	14.4%	9.8%	
	Western region	200	49	249	
		39.5%	33.6%	38.2%	
Monthly income	Less than 5,000	202	31	233	0.0001
		39.9%	21.2%	35.7%	
	5,000–9,999	129	53	182	
		25.5%	36.3%	27.9%	
	10,000–14,999	75	42	117	
		14.8%	28.8%	17.9%	
	15,000 or above	100	20	120	
		19.8%	13.7%	18.4%	

*P value was considered significant if ≤0.05

Table 7 shows treatment preferences and acceptance of accelerated orthodontic approaches, with most participants showing a moderate level (66.4%), followed by low (22.4%) and high levels (11.2%).

Table 8 shows that knowledge level of accelerated orthodontic treatment has statistically significant relation to gender (p = 0.001), age (p = 0.0001) and residential region (p = 0.0001). It also shows statistically insignificant relation to nationality, educational level and monthly income.

Table 9 shows that awareness level of accelerated orthodontic treatment has statistically significant relation to age (p = 0.001) and monthly income (p = 0.005). It also shows statistically insignificant relation to gender, nationality, educational level and residential region.

Table 10 shows that acceptance level of accelerated orthodontic treatment has statistically significant relation to gender (p = 0.0001), age (p = 0.0001), nationality (p = 0.012), educational level (p = 0.001), residential region (p = 0.0001) and monthly income (p = 0.0001).

DISCUSSION

This study was conducted to determine the evaluation of the awareness of patients about surgical and non-surgical AAT modalities, preference of patients between these modalities, as well as the important factors in acceptance such as perceived pain, cost of treatment and estimated treatment duration. The research was done among 652 individuals of the Saudi Arabian population. The findings give important insights on patient-centered decision-making on accelerated orthodontics in this regional context.

Regarding patient preferences for treatment modalities, our findings showed a significant preference for non-surgical approaches as 55.1% of the participants preferred non-surgical acceleration methods over surgical approaches which were preferred by only 13.2% participants. This preference is in close accordance with past international research. Uzair *et al.* [8] reported that 86.4% of participants preferred to use the non-surgical accelerated orthodontic procedures, mainly for fear of anxiety and surgical options were selected mainly in reducing treatment time. Similarly, a systematic review of surgical and non-surgical methods for enhancing orthodontic tooth movement showed that of surgical methods, corticotomy showed the greatest acceleration potential and was highly invasive with substantial pain and discomfort [9]. On the other hand, non-surgical methods such as vibration and photobiomodulation were the most promising because of their non-invasive and effective [9]. Our

results support these results and suggest that non-invasiveness is a foremost consideration in the choice of treatment for a patient and often surgical methods may have a quicker outcome.

The levels of knowledge among our sample were significantly lower than awareness level and 62.3% showed low knowledge and 8.4% showed high knowledge about accelerated orthodontic treatment approaches. This finding has particular importance for clinical practice. A study on evaluating patient-reported outcome measures with surgically-assisted acceleration of orthodontic treatment noted that the widespread introduction of surgically-assisted acceleration of orthodontic treatment requires careful evaluation of patient-reported outcomes prior to the introduction of any acceleration procedure [10]. The low knowledge levels in our study, therefore, suggest a critical need for better patient education about the different methods of acceleration, the mechanism of the different methods, the benefits and limitations of the different methods.

Pain appeared to be the most significant barrier to the selection of surgical techniques in our population with 37.3% of subjects reporting pain as the main deterrent followed by fear (29.8%) and cost (12.7%). These results are in line with past studies both in the Saudi Arabian context as well as globally. Linjawi and colleagues carried out a study in Saudi Arabia to assess patient perceptions on the reduction of orthodontic treatment period and found that pain and discomfort are major concerns affecting treatment decisions [11]. Another seminal study to examine patient acceptance of corticotomy assisted orthodontics found that fear from surgery (53.2%) was the most common reason for treatment refusal, followed closely by fear of pain (36.9%) [12]. The high prevalence of pain related concerns in our cohort (71.3% expressed concerns about pain after surgical procedures) suggests the importance of pre-operative counseling and anesthesia management in surgical acceleration protocols.

Interestingly, 72.9% of our participants preferred slower, less painful non-surgical methods to faster but more painful surgical options suggesting that treatment comfort takes precedence over treatment velocity to most patients. This finding is in line with the growing agreement in the literature in orthodontics towards less invasive acceleration techniques. Gabada and colleagues reviewed the area of accelerated orthodontics, noting that recent technological advances have radically changed the scope of orthodontic care, with non-invasive methods now providing clear benefits in terms of patient comfort, while simultaneously delivering meaningful acceleration [13].

Regarding the effectiveness factor, 35.3% of the participants identified effectiveness as the most important consideration in the choice of treatment methods, 28.4% considered cost and 27.6% considered recovery time as least important factors. These proportions reflect a patient population with a focus on clinical outcomes more than other considerations, but cost was an important secondary consideration. In a cross-sectional survey of young adult patients on their preferences for invasive and non-invasive methods of acceleration performed in Saudi Arabia about 47.5% of the sample population showed a willingness to pay extra fees, 59% of which agreed to pay an increase of 20% on the price of treatment for the FDA approved vibrating devices [11]. Our study showed similar trends with 38.5% being willing to pay small extra costs of 10 and 25.8% being willing to accept medium additional costs of 30% for treatment acceleration. This willingness to pay pattern can give valuable information to orthodontists who are developing accelerated treatment protocols for use in private practice settings.

The predominate influence of orthodontist recommendations on patient decision-making was apparent with 75.4% of the students in our cohort agreeing their treatment decisions are dependent on their orthodontist's advice. This places an emphasis on the importance of the dentist-patient relationship and the importance of evidence-based discussions about treatment options. Low level laser therapy is one particularly promising, non-surgical option. Recent research has shown that LLLT was significantly effective in reducing pain perception with patients receiving laser bio stimulations showing reduced pain intensity and lower pain duration than control groups [14]. Furthermore, several clinical trials have identified that a negative effect on periodontal health is not experienced with LLLT and that it can easily be incorporated into normal orthodontic protocols [15].

Cost considerations played a major role in treatment acceptance with 56.9% of respondents saying that they would only select accelerated treatment when it was affordable or covered by insurance. This finding highlights the inequities in access to healthcare and the need to develop cost-effective strategies for accelerating them. The Iraqi study of perception of orthodontists and patients to accelerated orthodontics has shown that most of the orthodontists have been willing to pay up to 40% of treatment income to purchase acceleration procedures, on the other hand, the patient has been generally willing to pay only 20% [16]. These financial considerations are particularly relevant in the Saudi Arabian context where as we noted in our demographic data, 35.7% of participants reported making less than 5000 SAR per month.

Regarding treatment duration preferences, 59.5% of the participants agreed that reducing orthodontic treatment time is important and 51.1% of them were fond of accepting some discomfort in order to have less overall treatment duration. However, a significant 78.4% wanted to have more information on risks and benefits of various methods of acceleration before making final treatment decisions. This finding suggests that although patients are influenced by time factors, they would like available, comprehensive and evidence-based information upon which to make truly educated decisions. A Cochrane systematic review on non-surgical adjunctive interventions for the acceleration of tooth movement stated that orthodontic treatment takes on average 20 months and acceleration may minimize undesirable effects such as root resorption, demineralization and decreased patient motivation [17].

The demographic relations between knowledge and acceptance levels showed that gender, age and residential region were statistically significant factors ($p = 0.001$, $p = 0.0001$ and $p = 0.0001$ respectively) in order to tailor patient education programs to these demographic characteristics. The fair to moderate degree of treatment preferences and acceptance in 66.4% of participants could indicate that although patients had a baseline interest in acceleration, information on the details and clinical experience may help to modify treatment preference to a higher acceptance level.

There are some important limitations of this study. First, the cross-sectional design gives a cross-section of preferences at one point in time and fails to reflect changes in attitudes over time. Second, the recruitment of participants on social media platforms may be associated with selection bias because people using these platforms may not be representative of the entire Saudi population. Third, the questionnaire was based on self-report, which can be vulnerable to self-reporting bias.

CONCLUSION

In conclusion, this study shows that Saudi Arabian patients show high preferences for accelerated orthodontic non-surgical methods, where pain perception and surgical anxiety are the determinants that determine its choice. While patient awareness of acceleration techniques is still less than ideal, willingness to pay for treatment acceleration in a significant percentage of the population exists. Future research should be aimed at developing patient education programs for specific concerns as identified in this study and assessing the long-term clinical outcome and patient satisfaction of different acceleration protocols in the Saudi Arabian setting.

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Conflicts of Interest

The authors declare that there are no conflicts of interest.

Informed Consent

Written informed consent was obtained from all study participants.

Data and Materials Availability

All data generated or analyzed during this study are included in this published article.

Ethical Statement

The study was fully explained to all participants and it was emphasized that participation was voluntary. Written informed consent was obtained from each participant prior to enrollment. All collected information was securely stored and used exclusively for research purposes.

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