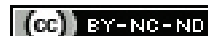# Orthodontic Diagnostic Tools and Material Usage in Saudi Arabia

LAILA FAWZI BAIDAS[1], LUBNA FALEH ALFALEH[2]

ABSTRACT

Introduction: The evaluation of changes in orthodontic practice over the years, is essential for defining treatment efficacy. Accordingly, shedding light on the profile of orthodontic practice in Saudi Arabia is crucial.

Aim: To investigate current trends in orthodontic practice in Saudi Arabia and the factors affecting choices regarding materials and techniques among orthodontists.

Materials and Methods: This cross-sectional study was conducted from July 2019 to December 2019 at the College of Dentistry, King Saud University, Riyadh, Saudi Arabia. An electronic survey of 29 objective questions was sent to 1,500 orthodontic members of the Saudi Orthodontic Society. The survey collected demographic data, diagnostic records and information on the fixed orthodontic appliances used by the respondents. Frequency and percentages were calculated for all variables. Chi-square test was used to determine the effects of factors, including years of experience and place of work, on the choice of diagnosis protocol and fixed appliance material, with the significance set at p-value ≤0.05.

Results: Two hundred and nine respondents completed the survey. The respondents reported a highly significant use of computers for digitising cephalometric analysis, with the traditional method of obtaining study models reported as highly significant (p<0.001). Orthodontists routinely used the MBT preadjusted bracket system (52.6%) and performed direct bonding of the bracket (91.4%). Bonding of the first molars was preferred by 36.4% of the clinicians. Glass ionomer cement was the most frequently used band cement (55.5%), and the most popular archwire material was nickel–titanium shape memory. Clinicians with less than five years of experience used significantly more postcephalometric radiographs (p=0.006) and postorthodontic treatment models (p=0.028). Senior orthodontists (10-15 years of experience) had a higher use of indirect bonding techniques (p=0.05).

Conclusion: This study provides information on the relevant aspects of orthodontists in Saudi Arabia in terms of their individuality, training and techniques used. The findings can be used as a reference for future national surveys to evaluate changes in orthodontic practice in Saudi Arabia.

INTRODUCTION

Over the past 10 years, many developments have occurred in orthodontic appliances and components. These comprises of improvement in the bracket system, archwire materials and bonding systems. Rapid progress in the orthodontic field has encouraged orthodontists to select proper treatment mechanics and materials in their practice for patients' comfort. Therefore, orthodontic knowledge and the assessment of orthodontic procedures and outcomes are essential for defining treatment efficacy [1].

Several studies have presented practitioners' profiles in many countries with the goal of creating an essential basis for the evaluation of changes in orthodontic practice trends over the years [2-12]. Most of the surveys were conducted in the US and aimed to provide a profile of orthodontists in various aspects [2-7]. These surveys revealed significant changes in the requested diagnostic documentation, work philosophy and usage of technology in orthodontists' offices. However, to date, no data in Saudi Arabia have been published.

In parallel, there has been an increase in the number of postgraduate programs that educate the young generation of orthodontists whose characteristics and beliefs differ from those of the older generation. Therefore, shedding light on the profile of orthodontic practice in Saudi Arabia is crucial. The first part of this study was conducted using a national survey to evaluate current trends in orthodontic practice in Saudi Arabia. The survey included diagnostic analysis tools and the use of fixed appliance materials, such as bracket selection, banding and bonding materials and archwire types. The factors affecting orthodontists' diagnosis protocol and choice of materials were also investigated.

MATERIALS AND METHODS

This was a cross-sectional study conducted from July 2019 to December 2019 at the College of Dentistry, King Saud University, Riyadh, Saudi Arabia. Ethical approval was obtained from the Institutional Review Board (IRB) of the College of Medicine Research Center at King Saud University (#20/0938/IRB) and study followed the STROBE statement protocol.

Sample size calculation: All orthodontists practicing in Saudi Arabia who were members of the Saudi Orthodontic Society (N=1,500) were included in this cross-sectional survey of orthodontic practice. Using the G-power program at an alpha of 0.05 with an effect size of 0.25 and a power of 0.95, authors determined the overall sample size to be at least 197 participants [13].

Inclusion and Exclusion criteria: Respondents Master's Degree, PhD or Board certification in Orthodontics who work in an academic institution, private practice or the government sector were eligible to participate, but dentists who practice orthodontics were excluded.

A digital survey in English was created using Google Forms, which was then distributed via social media platforms and the Saudi Orthodontic Society to improve response rates. A reminder was sent to the respondents after six to eight weeks through the same social media platforms.

The survey's questions were developed with the intent of eliciting data on orthodontic practice trends in Saudi Arabia. The survey was adapted with modifications from the studies conducted by O'Connor BM and Keim RG et al., [1,4,5]. The authors reviewed each question to ensure that the survey questions were clear and had appropriate phrasing. A pilot study was conducted on a sample of 10 orthodontists (not included in the sample size) to determine the questionnaire's reliability; basing on their responses, the

researchers made relevant changes to some questions. Validation with Cronbach's α=0.08 indicated reasonable internal consistency and acceptable reliability (0.89).

The survey questionnaire included seven sections and 45 questions. The results were divided into two parts. The first part consisted of three sections and 29 objective questions, including demographic data (gender, nationality, qualification, country from where the orthodontic degree was obtained, years in practice, workplace/sector of practice), diagnostic records and fixed orthodontic appliances (bracket prescription, banding and bonding, archwire selection). The second part (not yet been published) will includes 16 questions including functional appliance and headgear, extraction trends, retention protocol and current approaches for orthodontic treatment.

STATISTICAL ANALYSIS

The responses were transformed and analysed using the Statistical Package for the Social Sciences, version 21.0 (Chicago, IL, USA). Descriptive statistics were conducted for all variables; percentages and frequencies were calculated. Chi-square test was used to determine the effect of factors, including years of experience and place of work, on the choice of diagnosis protocol and fixed appliance material, with the significance set at p-value ≤0.05.

RESULTS

A total of 209 (13.9%) responses were received and included in the study. The significance level for the responses to the different questions was set at p-value ≤0.05.

Sociodemographic profile, academic qualification and place of work: [Table/Fig-1] showed that 61.24% of the respondents were Saudi nationals, whereas 38.8% were non-Saudis. With regard to gender, 60.29% of the respondents were male, whereas 39.71% were female. One hundred (47.8%) orthodontists had a board qualification, 78 (37.3%) had a master's degree in orthodontics and 31 (14.8%) had a PhD. Sixty-six (31.6%) of the respondents completed their residency programme in Saudi Arabia, whereas 50 (23.9%) completed it in Europe. Approximately one-fourth of the
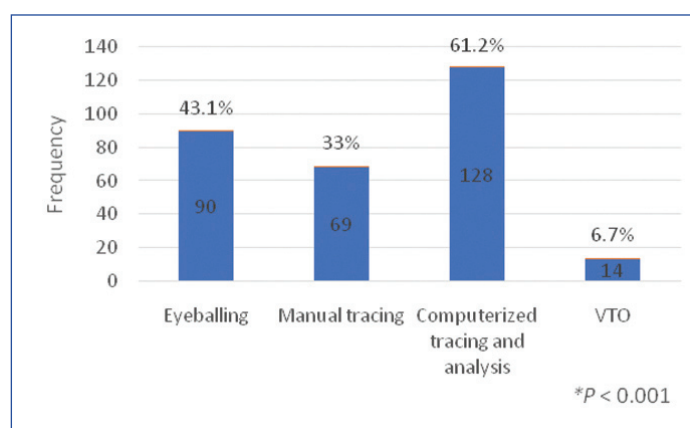
participants (26.8%) had more than 15 years of experience, and most (54%) were from the central region. Regarding their place of work, 37% worked in government hospitals, 34.5% worked in private practice and 28.7% were affiliated with academic institutes.

Diagnostic records: The most popular pre-treatment and post-treatment radiographic records were cephalometric and panoramic films. However, pre-treatment cephalometric (91.4%) and panoramic (99%) radiograph records were used more frequently than post-treatment cephalometric (50.2%) and panoramic (65.6%) radiograph records. Bitewings, periapical and occasionally Cone-Beam Computed Tomography (CBCT) radiographs were taken, as needed. Most participants (93.8%) used pre-treatment orthodontic study casts, whereas only 57.9% used post-treatment casts. This study revealed that diagnostic records were taken more frequently as pre-treatment than post treatment records. More than 68.9% of the participants routinely used intraoral and extraoral photographs in their practice [Table/Fig-2].

| Questions	Routinely		Occasionally		Never	
	n	%	n	%	n	%
8. How frequent do you take cephalometric radiograph as a pre-treatment record?	191	91.4	18	8.6	-	-
9. How often do you take post-treatment cephalometric radiograph?	105	50.2	79	37.8	25	12.0
10. How often do you perform cephalometric analysis for your patients?	95	45.5	103	49.3	11	5.2
12. Do you take panoramic X-ray as a pre-treatment record?	207	99	2	1	-	-
13. Do you take panoramic X-ray as a post-treatment record?	137	65.6	60	28.7	12	5.7
14. Do you take bitewings and periapical radiographs?	34	16.3	125	59.8	50	23.9
15. How often do you take CBCT radiograph?	6	2.87	187	89.49	16	7.65
16. Do you take pre-treatment orthodontic models?	196	93.8	13	6.2	-	-
17. Do you take post-treatment orthodontic models?	121	57.9	55	26.3	33	15.8
19. Do you take 5 intraoral and 3-to-4 extraoral photographs?	144	68.9	57	27.3	8	3.8

[Table/Fig-2]: Distribution of respondents according to diagnostic records used.

Of the respondents, 45.5% routinely performed cephalometric analysis, whereas 49.3% did so only occasionally [Table/Fig-2]. The results showed a highly significant use of computer digitising (61.2%, p<0.001) compared with other methods [Table/Fig-3]. Regarding the methods of obtaining study models, the analysis revealed that the poured study model was the most common and highly significant method amongst the respondents {95.70%, p<0.001; [Table/Fig-4]}.

Questions	Factors	n	(%)
1. Gender	Male	126	60.29
	Female	83	39.71
2. Nationality	Saudi	128	61.24
	Non-Saudi	81	38.8
3. Academic qualification	Master	78	37.3
	Board	100	47.8
	PhD	31	14.8
4. Country from where orthodontic degree was obtained?	Saudi Arabia	66	31.6
	USA +Canada	44	21.1
	Europe	50	23.9
	Other	49	23.4
5.How many years in orthodontic practice?	<5	53	25.36
	5-9	54	25.84
	10-15	46	22.01
	>15	56	26.8
6. Geographic region	Central	113	54.07
	Eastern	25	11.96
	Western	55	26.32
	Northern	6	2.87
	Southern	10	4.79
7. Where do you work?	Academic institute	60	28.71
	Governmental hospital	77	36.84
	Private practice	72	34.45

[Table/Fig-1]: Sociodemographic, academic, and qualification profile of the respondents.

[Table/Fig-3]: Question 11. Distribution of cephalometric analysis methods used by respondents.
*Chi-square test, Significant at p-value ≤0.05

[Table/Fig-4]: Question 18. Distribution of obtaining the study model methods used by respondents.
*Chi-square test, Significant at p-value ≤0.05
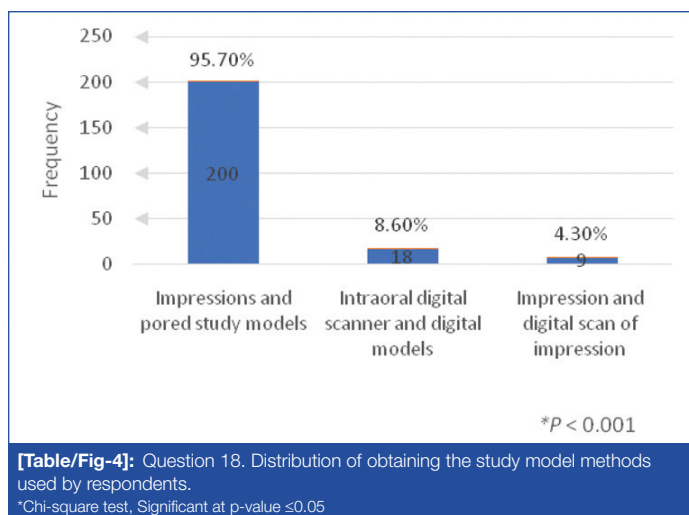
Fixed appliances used and techniques: The prescription preference for preadjusted straight wire orthodontic brackets was 52.6% for MBT, followed by 44% for Roth and only 3.4% for other prescriptions. Regarding the type of brackets used, most orthodontists (97.1%) reported that a stainless steel (SS) brackets was their first choice in their practice, followed by a ceramic brackets (21.5%). With regard to the most commonly used bracket slot size, most of the respondents reported a preference for the 0.22-inch size (80.9%), and only a few preferred to use the 0.18-inch size (8.6%). The other 10.5% of the participants preferred to use both bracket slot sizes [Table/Fig-5].

Questions	Techniques	n	%
20. What is the most commonly used pre-adjusted bracket prescription in your practice?	MBT	110	52.6
	Roth	92	44.0
	Others	7	3.4
21. What is the most commonly used bracket type/s in your practice?	Stainless-steel*	203	97.1
	Ceramic*	45	21.5
	Clear*	28	13.4
	Gold*	6	2.9
	Combination*	16	7.7
22. What is the most commonly used bracket slot size in your practice?	0.018"-inch	18	8.6
	0.022"-inch	169	80.9
	Both	22	10.5

[Table/Fig-5]: Distribution of respondents according to bracket prescription and type used.
*Multiresponse answer

Regarding the type of bonding technique used, most participants (91.4%) performed direct bonding of the brackets, whereas 3.3% performed indirect bonding only and 5.3% practiced both. Likewise, 87.6% of the participants used light-cured adhesives for bonding, whereas only 5.3% used chemical-cured adhesives and 7.2% used both. Regarding molar attachments, 40.7% of the participants used molar bands and buccal tube attachments, 36.4% used only a buccal tube attachment and 23% used only molar bands. The most frequently used band cement material was glass ionomer cement (55.5%), followed by light-cured glass ionomer (32.5%). The orthodontists showed a low preference for one-paste compomer cement and zinc phosphate cement [Table/Fig-6].

[Table/Fig-7] provides the details of the preferred orthodontic wires used in the early and finishing stages of treatment and the preferred type of space closure mechanics. Most of the participants chose nickel–titanium (NiTi) shape memory (90%) in the early stage of treatment, followed by thermally activated NiTi (27.8%). The frequency of use of multi-strand SS archwire was very close to that of SS archwire (8.1% and 10.5%, respectively). The most commonly used archwire in the finishing stage was SS (73.2%), followed by beta-titanium (TMA; 37.3%), and only a few participants used shape memory (NiTi;

Questions	Techniques	n	%
23. What type of adhesive do you use in your practice?	Chemical cure adhesive	11	5.3
	Light-cured adhesive	183	87.6
	Both	15	7.2
24. What type of bonding technique do you use?	Direct bonding	191	91.4
	Indirect bonding	7	3.3
	Both	11	5.3
25. What type of band cements do you use?	Glass ionomer cement	116	55.5
	Light-cured glass ionomer	68	32.5
	One-paste compomer (light-cured)	20	9.6
	Others	5	2.4
26. What type of molars attachments do you most commonly use?	Molar bands	48	23
	Buccal tube attachment	76	36.4
	Both	85	40.7

[Table/Fig-6]: Distribution of respondents according to the type of bonding techniques and molar attachments used.

10.5%). Most respondents (81.8%) reported that they carried out space closures using a power chain; 38.8% used loops and 27.8% used an NiTi coil spring to a lesser extent.

Questions	Techniques	n	%
27. What are the most commonly used orthodontic archwires in the early stage of your treatment?	Shape memory NiTi*	188	90
	Thermally activated NiTi*	58	27.8
	Multi-strand/Braided SS*	17	8.1
	Stainless-steel*	22	10.5
28. What are the most commonly used orthodontic archwires in the finishing stage of your treatment?	Shape memory NiTi*	22	10.5
	Thermally activated NiTi*	12	5.7
	Multi-strand/Braided SS*	8	3.8
	Stainless-steel*	153	73.2
	TMA*	78	37.3
29. What is your most commonly used method of space closure?	Power chain*	171	81.8
	NiTi coil spring*	58	27.8
	Active tie back*	39	18.7
	Loops*	81	38.8
	Others*	7	3.3

[Table/Fig-7]: Distribution of respondents according to archwire preference and type of space closure method used.
*Multiresponse answer. SS: Stainless-steel; NiTi: Nickel titanium; TMA: Beta-titanium

Association between the respondents' years of experience/ place of work and the choice of diagnostic records and fixed appliance technique: A Chi-square test was performed to explore the influence of demographic factors (years of experience and place work) on the choice of diagnostic records and fixed appliance technique. The significant values are presented in [Table/Fig-8,9].

When the respondents were asked about the likelihood of using post-treatment cephalometric analysis, a significant difference emerged amongst the responses based on the orthodontists' place of practice and years of experience. Those who were working in an academic institute and had less than five years of experience tended to routinely use post-treatment cephalometric analysis.

The relationship between years of experience and taking post-treatment models indicated that orthodontists with less than five years and more than 15 years of experience tended to take postorthodntic models routinely (p=0.028). Most respondents stated that they routinely took intraoral and extraoral photographs. However, those who worked in academic institutes or in private practice (p<0.001) were significantly likelier to take photographs of their patients [Table/Fig-8].

[Table/Fig-9] showed that the bonding techniques of the respondents had a significant association with the increase in years of experience (p=0.05), as senior orthodontists (i.e., those with 10-15 years of

Diagnostic records		Routinely		Occasionally		Never		
Factors	Level	n	%	n	%	n	%	p-value
	How often do you take post-orthodontic treatment cephalometric radiograph for your patients?							
Place of practice	Academic (University)	43	71.7	11	18.3	6	10	
	Governmental hospital	37	48.1	30	39	10	13	0.001*
	Private practice	25	34.7	38	52.8	9	12.5	
Years of experience	<5	38	71.7	14	26.4	1	1.9	
	5-9	27	50	18	33.3	9	16.7	0.006*
	10-15	20	43.5	19	41.3	7	15.2	
	>15	20	35.7	28	50	8	14.3	
	Do you take post-treatment orthodontic models for your patients?							
Years of experience	<5	34	64.2	14	26.4	5	9.4	
	5-9	29	53.7	13	24.1	12	22.2	0.028*
	10-15	24	52.2	9	19.6	13	28.3	
	>15	34	60.7	19	33.9	3	5.4	
	Do you take 5 intraoral and 3-to-4 extraoral photographs?							
Place of practice	Academic (University)	53	88.3	7	11.7	0	0.0	
	Governmental hospital	37	48.1	36	46.8	4	5.2	<0.001*
	Private practice	54	75.0	14	19.4	4	5.6	

[Table/Fig-8]: Association between the choice of diagnostic records and selected sociodemographic factors (years of experience, and place of practice) using Chi-square test.
*Significant at p-value ≤0.05

		Type of bonding technique most commonly used						
		Direct		Indirect		Both		p-value
Factors	Level	n	%	n	%	n	%	
Years of experience	<5	48	90.6	1	1.9	4	7.5	
	5-9	51	94.4	1	1.9	2	3.7	0.05*
	10-15	40	87.0	5	10.9	1	2.2	
	>15	52	92.9	0	0.0	4	7.1	
		Type of molars attachments most commonly used						
		Molar bands		Buccal tube		Both		
Factors	Level	n	%	n	%	n	%	p-value
Place of practice	Academic (university)	16	26.7	17	28.3	27	45	
	Governmental hospital	24	31.2	19	24.7	34	44.2	0.001*
	Private practice	8	11.1	40	55.6	24	33.3	

[Table/Fig-9]: Association between the type of bonding techniques, the molar attachments used, and the selected sociodemographic factors (years of experience, and place of practice) using Chi-square test.
*Significant at p-value ≤0.05

experience) seemed to have an increased use of indirect bonding techniques compared with others. We also found a significant difference in the use of a different molar attachment, with orthodontists working in private practice having a tendency to use buccal tube attachments (p=0.001).

DISCUSSION

This study aimed to evaluate information and data on a broad spectrum of issues on orthodontists in Saudi Arabia compared with those in other countries. The findings of this study may be used as a reference for future surveys to identify changes in orthodontic practices in the Kingdom.

General Information

A total of 209 orthodontists responded to the survey, with a response rate of 13.9%. Although a follow-up reminder was sent at different intervals via social media and other methods, the response rate was low. The findings were consistent with other studies undertaken amongst orthodontists in Saudi Arabia [14,15]. The low response rate may be attributed to the busy schedules of orthodontists, which prohibited them from answering the survey. Nevertheless, the main strength of our study is that it is the first research conducted on orthodontic practice profiles in Saudi Arabia.

The respondents were mostly men (60.28% vs. 39.72% women), with an unequal male-female ratio of orthodontists; this result is in line with other studies conducted under the same circumstances in Saudi Arabia [14,15]. Of the orthodontists, 61.24% were Saudis; this highlighted the Government's plan to recruit Saudi Orthodontists into practice. When asked about their qualifications, about one-third of the respondents said that they had completed their residency program in Saudi Arabia. Those trained in Europe, North America (US and Canada) and others (Middle East or Asia) had almost the same distribution, which might explain the practitioners' diversity of training, which is reflected in their clinical practice.

More than half of the respondents were from the central region of Saudi Arabia, which is attributed to the large population in this region. In addition, most government and private practice centres are concentrated in this region. When the respondents were asked about their place of work, 36.84% said that they worked at government hospitals; 28.71%, at academic institutes and only 34.45% at a private practice. A study by Alqahtani ND et al., and Halwany HS et al., also showed that most respondents worked in government settings. Individuals may prefer government and university based jobs because these are secure and stable with fixed retirement income [14,16].

Diagnostic Records

Most of the participants preferred taking pre-treatment cephalometric and panoramic radiographs more frequently than post-treatment records, which is similar to the results of other studies. The orthodontist pays closer attention to pre-treatment rather than post-treatment records for medicolegal reasons [5,8,9]. However, in a Brazilian study [9], almost half of the orthodontists routinely requested post-treatment cephalometric radiographs. We found a significant correlation between orthodontists working in academic institutes or those who had less than five years of experience and taking post-treatment cephalometric radiographs. This was attributed to the importance of taking these complementary radiographs at the end of treatment to show the results, as well as for legal reasons.

In the present study, the participants used CBCT radiographs. In comparison, a study conducted by Keim RG et al., showed that the use of CBCT has increased dramatically in the last six years [5]. The other important finding was that the use of computerised cephalometric tracing and analysis was significantly higher than that of other methods. A possible explanation is the availability of cephalometric software tracing programmes in hospitals and private clinics. Moreover, the present study demonstrated that many participants still relied on eyeballing, and this finding is in line with the results of previous researches [4,5].

Similar to the results of a previous study [5,8,17], we found that a diagnostic study cast was more commonly taken before treatment. There was also a highly significant use of poured study models compared with intraoral scanner and digital models, but this finding was not in agreement with that of Keim RG et al., [5]. The cost and availability of digital intraoral cameras are possible reasons for their limited use despite the ease of storage and record keeping capability of digital models compared with poured casts.

Statistical analysis showed that 68.2% of the respondents stated that they routinely take intraoral and extraoral photographs, with significant usage reported amongst those who worked in an academic institute or

private practice (p-value <0.001). This could be related to the standard protocol followed by university staff and postgraduate students for quality patient care and better documentation. However, the Brazilian study showed a better rate, with 93.4% of the respondents declaring that they routinely used photographs [9].

Fixed Appliances Used and Techniques

i. Bracket prescription, material and slot size

In this study, MBT followed by Roth bracket prescription was the most preferred preadjusted straight-wire orthodontic system. Previous studies have shown the same preference [5,12]. Roth's philosophy works on the patient's functional occlusion and on the facial type and reaction to treatment mechanics. The Roth prescription would place the teeth in an overcorrected position, which would later settle down into an idealised position. However, the MBT prescription works on additional palatal root torque for the upper incisors, which improves the incisors' position after retraction, and adds labial root torque for the lower incisors to prevent forward tipping during levelling [18]. However, no clear scientific evidence exists to support this assumption, and there is no difference between MBT and Roth prescription in terms of final tooth position [19-21].

Metal (SS) was the most commonly used bracket by the respondents. Based on the data, the quality of the material, clinical efficiency, cost and convenience were the factors that affected the selection of bracket type. Amongst all types of brackets, metal brackets demonstrate rigidity, good friction and low cost [22].

Regarding bracket slot size, we found that 80.9% of the respondents used the 0.022-inch slot, and only 8.6% used the 0.018-inch slot, confirming the outcomes of similar national surveys conducted in the US and UK [3-5,17]. Despite the higher preference for the 0.022-inch-slot bracket, no scientific evidence exists to support one system over the other, aside from the perception of a better treatment outcome [17,23]. The preference for one system over the other can be explained by the fact that orthodontists continues to use the system on which they were trained or that they have not found a convincing reason to change systems. Moreover, most of the orthodontic specialty training programmes in different countries uses a 0.022-inch-slot bracket system.

ii. Bonding and banding techniques

In this study, many orthodontic specialists chose the direct bonding of brackets, a finding that agrees with previous studies [3-5]. The comparison of the effectiveness (accuracy of bracket positioning) and efficiency (total working time and chair time) of the direct and indirect bonding techniques has been widely studied [17]. The findings of the present study also showed a significant relation between years of experience and choice of bonding technique. Orthodontists with varying levels of experience sought to preserve their conventional approach of using the direct bonding technique, whereas senior orthodontists (10-15 years of experience) showed the use of indirect bonding technique, which is similar to the results reported by Keim RG et al., [6]. The preference for direct over indirect bonding could be due to orthodontists' unfamiliarity with indirect bonding techniques and the requirements for the laboratory stage and skilled technicians.

Light-cured adhesive was the most preferred material for bonding by the respondents; this finding is in line with the results of Keim RG et al., and Banks P et al., [5,17]. The popularity of a light cure over a chemical cure is attributed to the following benefits: unlimited working time to position the bracket and clean up the flash, immediate archwire placement and more efficient staff utilisation. However, no scientific evidence exists to support the difference in bracket failure rates between adhesive systems [24].

The findings showed a greater preference for using buccal tube attachments over molar bands. In addition, a significantly large number of orthodontists working in private practice favoured the use of molar

buccal tube attachments over molar bands. Reduced chair time, a lower risk of periodontal problems, convenience in simultaneous placement with brackets and quicker time to position were the factors that influenced clinicians' preference for bonding attachments for molars [25,26]. Nevertheless, evidence from randomised clinical trials showed the success of molar bands over tubes in terms of failure rates and post-treatment demineralisation [27,28].

The most frequently used band luting material was glass ionomer cement, set by an acid-base reaction and light cure. Failure rate and decalcification were the outcome measures for band adhesive. The failure rates of both adhesives were low, and there was no statistically significant difference in enamel decalcification [29,30]. Still, because of insufficient evidence in the literature, there are no firm recommendations for one adhesive over the other [31].

iii. Archwires

Orthodontic treatment includes three main stages: levelling, retraction/ space closure and finishing. In terms of preference for levelling archwires, our results showed that NiTi shape memory was favoured by most of the participants, followed by thermally activated NiTi. This result is consistent with that of other studies [5,8,11,12]. As this stage of the treatment necessitates a flexible, resilient and highly elastic wire, NiTi wire is highly recommended [32].

Space closure mechanics is the most significant and challenging stage in orthodontics because it requires comprehensive knowledge and understanding of the biomechanical basis of space closure. In the case of extraction or spaced malocclusion cases, space closure mechanics can be classified into two forms: friction mechanics through sliding of the archwire on the bracket slot and frictionless mechanics by loop action. The results of the present study are the same as those of a Brazilian study and a British one, in which most orthodontists used power chain [17,33]. However, the respondents also stated that they used loops at a rate of 38.8%, which contradicts the results of the British study in which loops were not used for space closure [19].

During the last stage of orthodontic treatment, the finishing stage, minor wire bending may be needed to obtain maximum intercuspation of the teeth and maintain the arch form. Thus, the choice of TMA wire can result in more wire bending, and the choice of SS wire can result in more stiffness and torque expression. In this study, the SS archwire was maintained by the respondents at a rate of 73.2%, whereas more flexible wires, such as TMA or NiTi, were used to a lesser extent. The findings of this study agree with those of other research conducted in San Paulo and Malaysia [11,12]. However, our results are not consistent with those of a study done by Keim RG et al., in the US [5], in which they reported that TMA is the common finishing archwire.

Limitation(s)

Although this is the first study to explore and gather information regarding the profile of orthodontic practices in Saudi Arabia, there are a few limitations to be considered. As this was a cross-sectional descriptive study, authors were unable to assess the cause-and-effect relationship related to the country's progress of orthodontic practice. Another limitation was the small sample size; future studies should be performed with a larger sample that's representative of all parts of the Kingdom. Finally, the subjective assessment using questionnaires constitutes another study limitation.

CONCLUSION(S)

In this study, most of the orthodontists routinely used the 0.022-inch MBT pre-adjusted edgewise system and an SS bracket, conventionally bonded using a light-cured composite and mostly performed direct bonding of the bracket. Bonding of the first molars was preferred to banding, and the most commonly used band cement was glass ionomer. NiTi shape memory and SS archwires were amongst the main archwires used, and the power chain was predominantly used to close the space. Furthermore, all diagnostic

records were taken more commonly prior to orthodontic treatment. Orthodontists believed that the use of computers for digitising cephalometric analysis was more efficient despite the fact that the conventional method of obtaining study models was still used. This study provides a clear picture of the trends in orthodontic practice in Saudi Arabia, which may serve as the basis for future research. Additional studies are needed to evaluate changes and shifts in trends in orthodontic practice in Saudi Arabia.

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PARTICULARS OF CONTRIBUTORS:
1. Consultant and Associate Professor, Department of Paediatric Dentistry and Orthodontic, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.
2. Assistant Professor, Department of Dental Health, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Laila Fawzi Baidas,
Consultant and Associate Professor, Department of Paediatric Dentistry and Orthodontic, College of Dentistry, King Saud University, P.O. Box 5967, 11432 Riyadh, Saudi Arabia.
E-mail: lbaidas@ksu.edu.sa

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