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Comparision of the Perception of Orthodontist and Dental Practitioner for Clinical Implementation of Recent Advancement of Orthodontics: A Cross-Sectional Study

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Abstract:
Background: *With growing emphasis on dental aesthetics in India, orthodontics has witnessed a surge in demand, accompanied by rapid technological advancements such as CBCT, 3D printing, and digital diagnostics. However, the extent to which these innovations are perceived and implemented by orthodontists versus general dental practitioners remains underexplored.*
Aim: *This study aimed to assess the perceptions and clinical adoption of recent orthodontic advancements among orthodontists and general dental practitioners, and to evaluate the resulting patient benefits.*
Methodology: *A cross-sectional, questionnaire-based study was conducted over 12 months (August 2022–July 2023) involving 127 participants (56 orthodontists and 71 general dentists). A validated 25-item questionnaire assessed knowledge, usage, and attitudes towards advancements like intraoral scanners, clear aligners, and gene therapy. Data were statistically analyzed using SPSS v16.0.*
Results: *Orthodontists showed significantly higher awareness and adoption of digital tools compared to general dentists (p = 0.043). Technologies like digital cephalometric analysis and 3D printing were more frequently utilized by specialists, with 80.35% of orthodontists using digital cephalometry versus 12.67% of general dentists. Orthodontists also reported greater perception of patient benefits such as improved comfort, reduced chair time, and enhanced aesthetic outcomes.*
Conclusion: *While both groups acknowledge the value of recent orthodontic innovations, orthodontists demonstrate greater clinical integration due to specialized training and urban practice concentration. The study highlights the need for broader education, training, and support for general practitioners to bridge the technology adoption gap and optimize patient care in modern orthodontics.*
Keyword: *Orthodontist; Dental Practitioner; Recent Advancement in Orthodontist; Clinical Implementation; Modern Orthodontic Practices.*

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I. Introduction

With the increasing emphasis on personal aesthetics among the Indian population, dental aesthetics has gained considerable attention. Orthodontic treatment, which includes procedures like braces, aligners, and smile correction, is among the most commonly pursued options. In India, orthodontics is a recognized dental specialty requiring three years of postgraduate education at institutions approved by the Dental Council of India .[1]

Recent advancements have significantly transformed orthodontic practices. Innovations in artificial intelligence, robotic systems, new biomaterials, pharmaceuticals, and genetic research have enhanced diagnostic accuracy and treatment efficacy. Notably, technologies such as Cone Beam Computed Tomography (CBCT) and other 3D imaging methods are now essential in diagnosis and treatment planning .[2]

General dentists often receive minimal training in orthodontics during their undergraduate education. While some pursue further training through continuing education, concerns remain regarding their ability to deliver comprehensive orthodontic care. Patients may assume that general dentists offering such treatments are specialists, despite evidence suggesting increasing reliance on general practitioners for orthodontic solutions like Invisalign .[3,4]

Studies have examined how many general dentists offer orthodontic services. Koroluk et al. (1997) found that 17.9% of general dentists in Indiana provided full orthodontic treatment. Similarly, Wolsky and McNamara (1996) reported that 19.3% of general dentists in Michigan did so, a figure that has remained consistent over time (Galbreath et al., 2006).[5 ,6 ,7]

Digital tools such as CBCT, intraoral scanners, and 3D printing now play a critical role in orthodontics. These technologies allow for virtual simulations, enhanced treatment planning, and even in-office appliance fabrication, improving patient outcomes and reducing chair time.[8,9,10,11]

There is growing concern over role confusion between specialists and non-specialists, not only in dentistry but in other fields such as cosmetic and plastic surgery. Public awareness remains low, often resulting in misconceptions about provider qualifications .[12,13,14]

Given the differences in training between general dentists and orthodontists, this study explores how each group perceives advancements in orthodontics and assesses patient benefits from their clinical application

II. Aim And Objectives

Aim

To assess the perception of orthodontist and dental practitioner for clinical implementation of recent advancement of Orthodontics.

Objectives

1. To assess the perception of orthodontist and Dental practitioner for acceptance of recent advancement.
2. To assess patient benefits after clinical implementation of recent orthodontic advancement.

III. Material And Methods

The present study was carried out to evaluate the perception of orthodontist and dental practitioner for clinical implementation of recent advancement of Orthodontics.

Study Design:

Configuration:

The study design is cross-sectional design.

Duration:

The study was scheduled for a period of 12 months (1st August 2022 to 31st July 2023).

Methodology: The following procedure was adapted to carry out the present study:

1. Obtaining the ethical clearance
2. Obtaining the permission
3. Obtaining study group consent
4. Inclusion criteria
5. Exclusion criteria
6. Questionnaire designing and validation
7. Scheduling the study
8. Data collection
9. Statistical analysis

Ethical Approval:

The ethical clearance for present study was obtained from the Ethical Committee of People's University, Bhopal, Madhya Pradesh, India.

Sampling Procedure:

Study subjects were selected using convenient sampling technique. The survey based study was conducted in India between registered Orthodontist and dental practitioner. Convenience sampling was used to obtain the data. Web based questionnaire are mail to Orthodontists registered in Indian orthodontic society (IOS) and Dental Practitioners registered in Indian dental association (IDA). The questionnaire was mailed to the registered dentists and registered orthodontists. The responses received were then analyzed.

Inclusion Criteria

1. Registered as member in Indian orthodontic society or Indian dental association.
2. Minimum 10 year of clinical practicing.

Exclusion Criteria

1. Post graduate students.
2. Unregistered practitioner.
3. Practitioners who are not performing orthodontic treatment.

Questionnaire:

A self-designed, self-administered, pretested and validated questionnaire deigned to access theperception of orthodontist and dental practitioner for clinical implementation of recent advancement of Orthodontics. The questionnaire was designed after reviewing the literature about recent advancement in orthodontics. Questionnaire included general characteristics of the study subjects including age, gender, education, experience and location. A total of 25 questions comprises of both close ended questions as well as open ended questions regarding knowledge of advancement in orthodontics and patients related benefits were included. The questionnaire based on the practices of the dentists in daily routine. The questions related to advancement were focussed on the recent advances like use of digital software, CBCT, advances in orthodontic bracket, intra-radicular mini-implants, advances in orthodontics archwire, 3D printing, Insignia software, 3D printed customized appliance, gene therapy etc. It also comprises of questions regarding patient related benefits like reduction in treatment time, chair-side time, patient visit, treatment charges, improving patient results and increase in patient comfort, awareness, patient understanding, patient aesthetic.

Construction and Validation of Questionnaire

The questionnaire was prepared in English for ensuring comprehension by all Dental practitioners. Questionnaire was tested for its face validity by research guide and modifications were made accordingly. The test for content validity was carried out in a panel expert and among 10 experts in the subjects and modification as per subject experts were done.

A pilot study was conducted among 10 dental practitioners regarding their knowledge on orthodontic treatment with the help of questionnaire consisting of 25 questions in which 15 questions were on advancement and 10 on patient benefit on questions to test construct validity. Results of the pilot study assessment were used:

- To test and modify the questionnaire to be used for collection of data in the main study.
- To check the feasibility of the questionnaire.
- For proper planning and execution of main study.

After pilot study, difficulties were assessed in understanding and answering of the questions by dental practitioners. Modifications were made in questionnaire without disturbing its content validity. Those dental practitioners who were involved in the pilot study were excluded from the final study.

The test-retest analysis was done to estimate the reliability of questionnaire. The ability of the questionnaire to yield similar results when administered to the same person on two separate occasions. The more reliable the questionnaire the higher the correlation between the results. Good reliability of 0.7 of the questionnaire was found by test-retest analysis.

Data Collection

For the purpose of data collection regarding the advancement in orthodontics, the emails were sending to all the dental practitioner registered in IDA and orthodontist registered in IOS. Sufficient time was given to the dentists to answer the question. The two follow up mail were send them to remind the dentist for giving response after 5 months interval. The investigator gave required information and clarified doubts wherever necessary. The responses received were subjected to analysis.

Statistical Analysis:

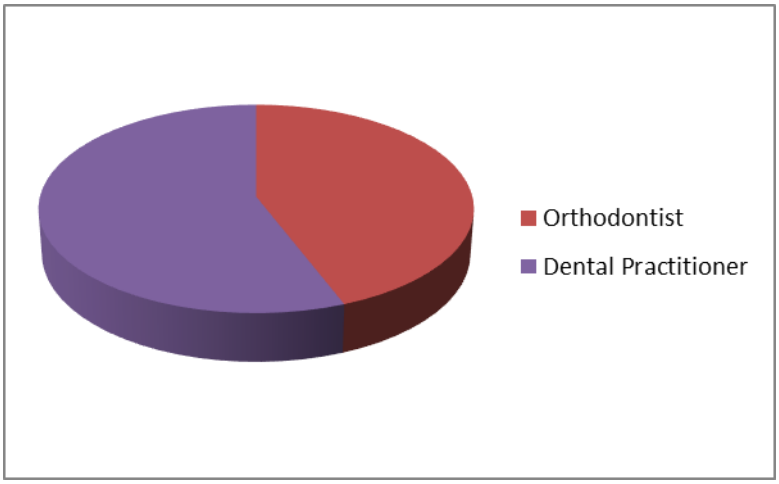
The data collected was entered into MS Office Excel Sheet 2007 and subjected to statistical analysis using the Statistical Software SPSS version 16.0. Descriptive statistics with frequency and percentage were calculated and were used to summarize the results. The chi square test was used to compare the knowledge between orthodontist and general practitioner. Significance for all statistical tests was predetermined at a probability (p) value of 0.05 or less at 95% Confidence Interval. Probability value of $p \leq 0.05$ was considered statistically significant (S); p value<0.01 was considered to be highly significant (HS) and p value>0.05 considered to be not significant (NS).

IV. Result

Questionnaires sent to 1000 participant dentists including Orthodontist and DP. A total of 600 responses were received for the questionnaire which was filled thoroughly and returned to the investigator. Among them 473 were excluded due to exclusion criteria. Among those dentists 56 were Orthodontists while 71 were DP**.(Table 1, Graph 1)**

Table 1:- Descriptive statistics for no of dentists respondent

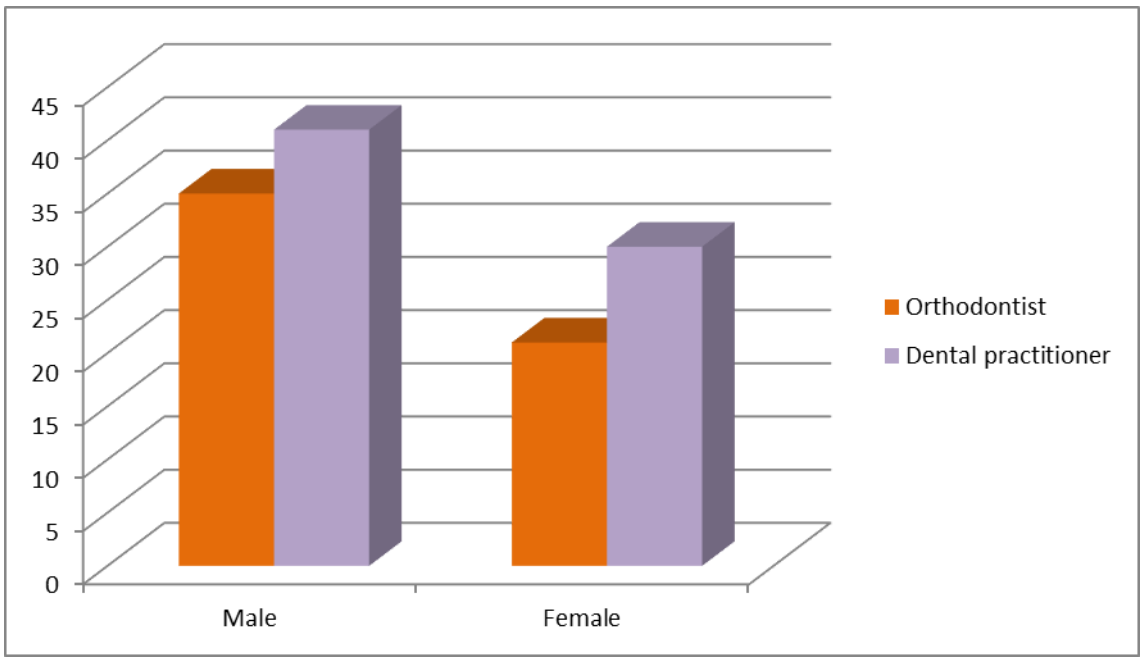
Group	No. of study participants	Percentage
Orthodontist	56	44.1%
Dental Practitioner	71	55.9%
Total	127	100%



Graph 1:- Descriptive statistics for number of dentist's respondent

Table 2: - Descriptive statistics for gender-wise distribution of orthodontist and dental practitioner

Gender	Orthodontist	Dental practitioner
Male	35(27.55%)	41(32.28%)
Female	21(16.53%)	30(23.62%)
Total	56(44.1%)	71(55.9%)



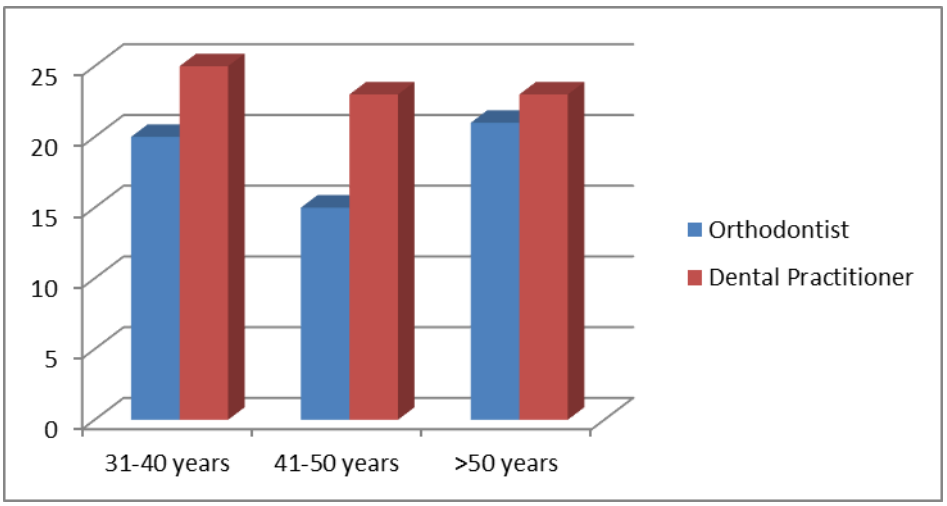
Garph 2- Gender-wise distribution of respondent dentists

Among those 56 orthodontist 35 were males and 21 were females. 71 participants were dental practitioner in which 41 were males while 30 were females. **(Table 2, Graph 2)**

Table 3:- Descriptive statistics showing age wise distribution in the study participants

Age	Orthodontist	Dental practitioner
31-40 years	20(15.74%)	25(19.68%)
41-50 years	15(11.81%)	23(18.11%)
>50 years	21(16.53%)	23(18.11%)

Total	56(44.1%)	71(55.9%)

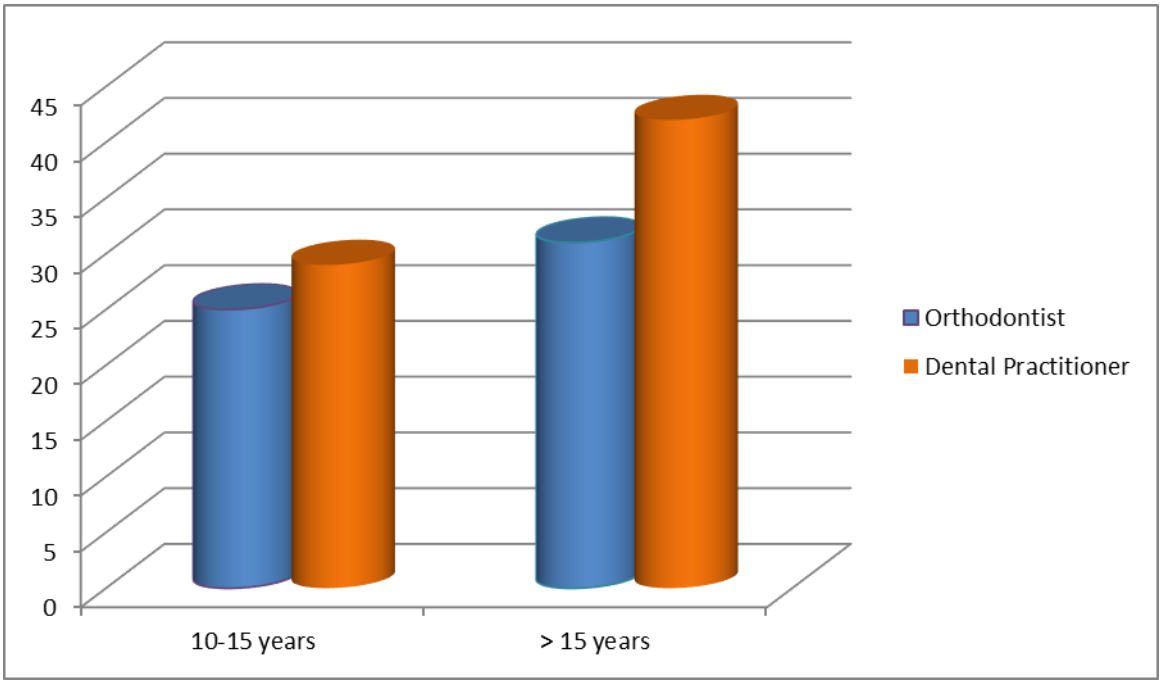


Graph 3:- Descriptive statistics showing age wise distribution in the study participants

Table 3 and Graph 3 show age-wise distribution in the study participants. Among orthodontists, 20 participants belong to age group of 31-40 years, 15 were of age group of 41-50 years while 21 participants were of age group above 50 years. Among dental practitioners, 25 participants belong to age group of 31-40 years, 23 were of age group of 41-50 years while 23 participants were of age group above 50 years.

Table 4:- Descriptive statistics showing years of practicing in the study participants

Years of practicing	Orthodontist	Dental practitioner
10-15 years	25(19.68%)	29(22.83%)
>15 years	31(24.40%)	42(33.07%)
Total	56(44.1%)	71(55.9%)

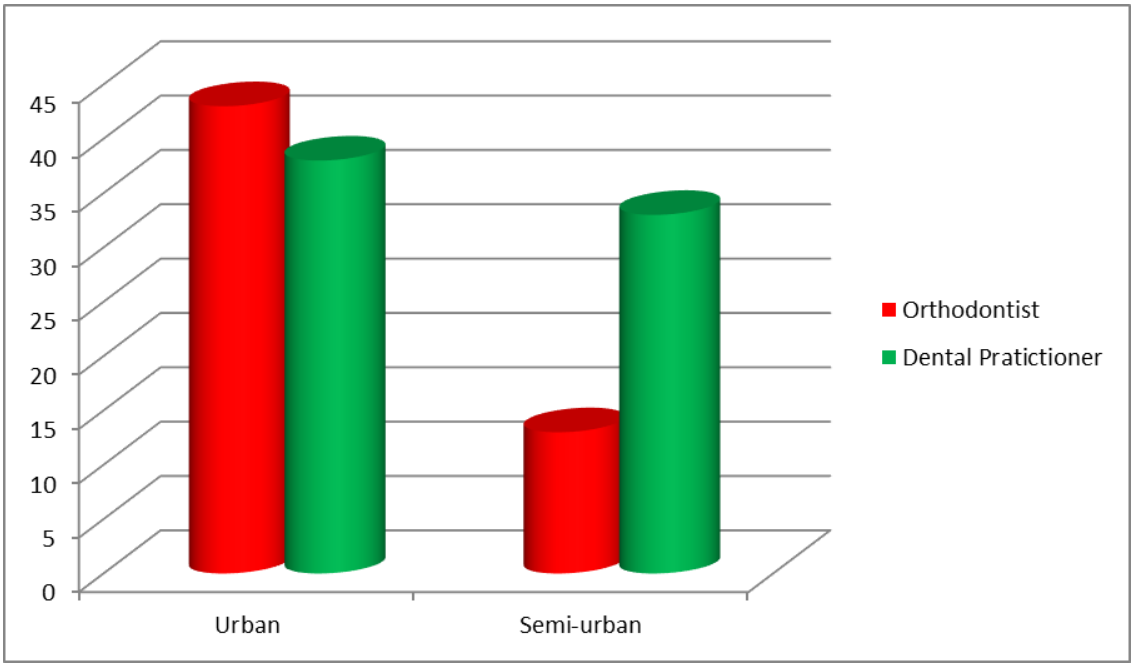


Graph 4:- Descriptive statistics showing years of practicing in the study participants

Among those 56 orthodontists 25 were practicing from 10-15 years while 31 were practicing from more than 15 years. Among those 71 dental practitioners 29 were practicing from 10-15 years while 42 were practicing from more than 15 years. **(Table 4, Graph 4)**

Table 5:- Descriptive statistics showing practice location of the study participants

Practice location	Orthodontist	Dental practitioner
Urban	43(33.86%)	38(29.92%)
Semi-urban	13(10.24%)	33(25.98%)
Total	56(44.1%)	71(55.9%)



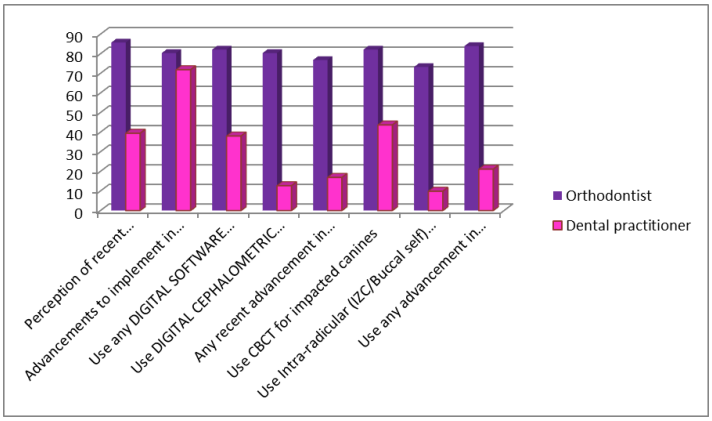
Graph 5:- Descriptive statistics showing practice location of the study participants

Among those 56 orthodontists 43 were practicing in urban area while 13 were working in semi-urban area. 71 participants were dental practitioner in which 38 were practicing in urban area while 33 were practicing in semi-urban area.**(Table 5, Graph 5)**

Table 6: - Comparison for questions related to recent advances in orthodontics

Questions	Orthodontist		Dental practitioner		P-value
	Yes	No	Yes	No	
Perception of recent advancements in orthodontics	48 (85.71%)	8 (14.29%)	28 (39.44%)	43 (60.56%)	**0.043***
Advancements to implement in clinical practice	45 (80.35%)	11 (19.65%)	51 (71.84%)	20 (28.16%)	0.343
Use any DIGITAL SOFTWARE TECHNOLOGY	46 (82.14%)	10 (17.86%)	27 (38.02%)	44 (61.98%)	**0.049***
Use DIGITAL CEPHALOMETRIC analysis	45 (80.35%)	11 (19.65%)	9 (12.67%)	62 (87.33%)	**0.02***
Any recent advancement in orthodontic brackets	43 (76.78%)	13 (23.22%)	12 (16.90%)	59 (83.10%)	**0.015***
Use CBCT for impacted canines	46 (82.14%)	10 (17.86%)	31 (43.66%)	40 (56.33%)	0.057
Use Intra-radicular (IZC/Buccal self) mini implants	41 (73.22%)	15 (26.78%)	7 (9.85%)	64 (90.14%)	**0.01***
Use any advancement in orthodontic archwire	47 (83.92%)	9 (16.03%)	15 (21.12%)	56 (78.88%)	**0.024***

Chi-square test, *- Statistically significant



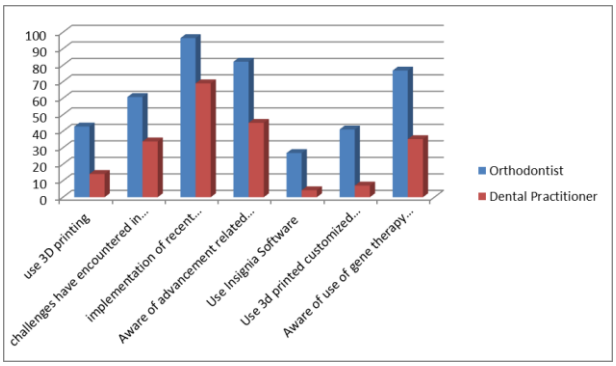
Graph 6: - Descriptive statistics for questions related to recent advances in orthodontics

Table 6 and Graph 6show comparison for questions related to recent advances in orthodontics. On comparing between the responses of the orthodontist and dental practitioners in questions related to recent advances like questions on perception of recent advancement in orthodontics(p=0.043), use of any digital software technology(p=0.049), use of digital Cephalometric analysis (p=0.02), recent advancement in orthodontic brackets (p=0.015), use of intra-radicular mini- implants(p=0.01) and use of any advancement in orthodontic archwire (p=0.024) showed statistically significant difference while questions like advancement to implement in dental practice (p=0.343) and use of CBCT for impacted canine (p=0.057) didn't showed any statistically significant difference.

Table 7: - Comparison for questions related to recent advances in orthodontics

Questions	Orthodontist		Dental practitioner		p-value
	Yes	No	Yes	No	
use 3D printing	24 (42.85%)	32 (57.15%)	10 (14.08%)	61 (85.91%)	0.115
challenges have encountered in implementing recent advancements	34 (60.72%)	22 (39.28%)	47 (66.20%)	24 (33.80%)	0.163
implementation of recent advancements will affect the future of orthodontics and dentistry as a whole	54 (96.42%)	2 (3.58%)	49 (69.01%)	22 (30.99%)	**0.042***
Aware of advancement related antibacterial coating onto orthodontic appliance	46 (82.14%)	10 (17.86%)	32 (45.07%)	39 (54.92%)	**0.049***
Use Insignia Software	15 (26.78%)	41 (73.22%)	3 (4.22%)	68 (95.78%)	**0.037***
Use 3d printed customized orthodontic appliance	23 (41.07%)	33 (58.93%)	5 (7.05%)	66 (92.95%)	**0.031***
Aware of use of gene therapy advancement in orthodontics	43 (76.78%)	13 (23.22%)	25 (35.21%)	46 (64.79%)	**0.012***

Chi-square test - Statistically significant



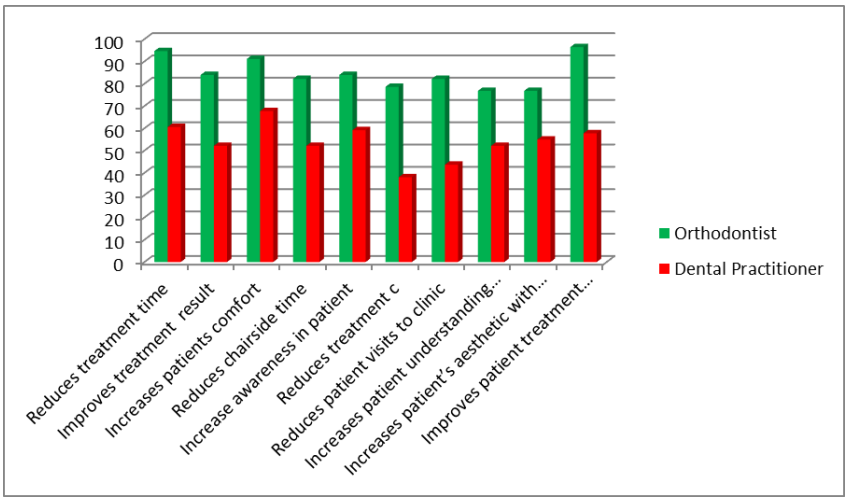
Graph 7: - Descriptive statistics for questions related to recent advances in orthodontics

Table 7 and Graph 7show comparison for questions related to recent advances in orthodontics. On comparing between the responses of the orthodontist and dental practitioners in questions related to recent advances like questions on implementation of recent advancements and its affect the future of orthodontics and dentistry as a whole (p=0.042), awareness of advancement related antibacterial coating onto orthodontic appliance (p=0.049), use of insignia software (p=0.037), use of 3d printed customized orthodontic appliance (p=0.031) and awareness of use of gene therapy advancement in orthodontics (p=0.012) showed statistically significant difference while questions like use of 3D printing (p=0.115) and challenges they have encountered in implementing recent advancements (p=0.163) didn't showed any statistically significant difference.

Table 8:- Comparison showing the questions of patients related benefit after using advancement in orthodontics in study participants

Questions	Orthodontist		Dental practitioner		p-value
	Yes	No	Yes	No	
Reduces treatment time	53 (94.64%)	3 (5.36%)	43 (60.56%)	28 (39.44%)	**0.042***
Improves treatment result	47 (83.92%)	9 (16.08%)	37 (52.11%)	34 (47.89%)	**0.038***
Increases patients comfort	51 (91.08%)	5 (8.92%)	48 (67.70%)	23 (32.30%)	0.254
Reduces chairside time	46 (82.14%)	10 (17.86%)	37 (52.11%)	34 (47.89%)	0.215
Increase awareness in patient	47 (83.92%)	9 (16.08%)	42 (59.15%)	29 (40.85%)	**0.047***
Reduces treatment charges	12 (21.42%)	44 (78.58%)	27 (38.02%)	44 (61.98%)	**0.021***
Reduces patient visits to clinic	46 (82.14%)	10 (17.86%)	31 (43.66%)	40 (56.34%)	**0.045***
Increases patient understanding about treatment	43 (76.78%)	13 (23.22%)	37 (52.11%)	34 (47.89%)	0.075
Increases patient's aesthetic with appliance during treatment	43 (76.78%)	13 (23.22%)	39 (54.92%)	32 (45.08%)	**0.032***
Improves patient treatment planning	54 (96.42%)	2 (3.58%)	41 (57.74%)	30 (42.26%)	**0.021***

Chi-square test - Statistically significant



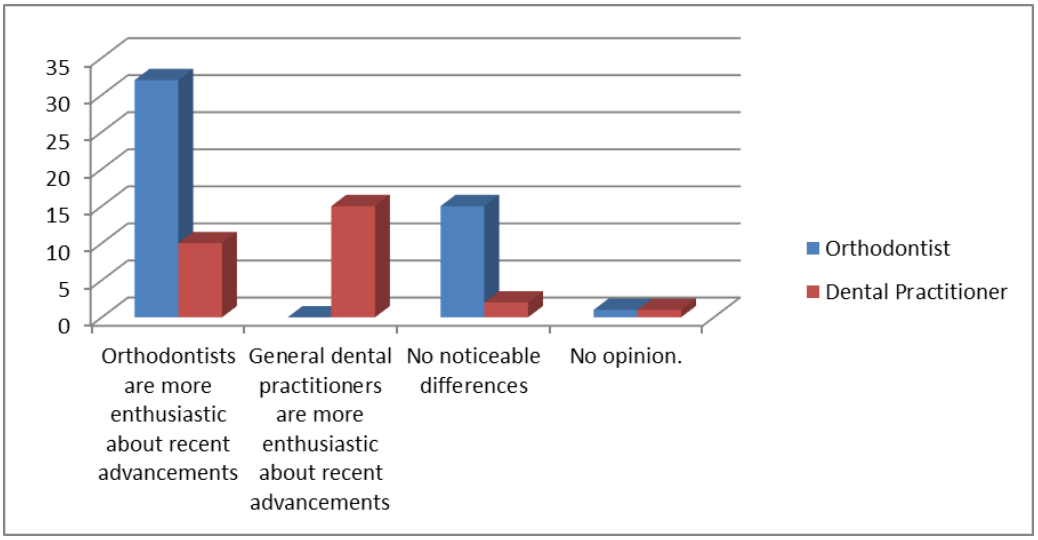
Graph 8:- Descriptive statistics showing the questions of patient's related benefit after using advancement in orthodontics in study participants

Table 8 and Graph 8 showed comparison showing the questions of patient's related benefit after using advancement in orthodontics in study participants. On comparing between the responses of the orthodontist and dental practitioners in questions related to patient related benefit the question like reduces treatment time (p=0.042), improves treatment result (p=0.038), increase awareness in patient (p=0.047), reduces treatment charges (p=0.021), reduces patient visit to clinic (p=0.045), increases patient aesthetic with appliance during treatment (p=0.032) and improves patient treatment planning (p=0.021) showed statistically significant difference while questions like increases patient comfort(p=0.254), reduces chair side time(p=0.215) and increases patients understanding about treatment (p=0.075) didn't showed any statistically significant difference.

Table 9:- Comparison showing the response of orthodontist and dental practitioner in Perception of recent advancements in orthodontics

	Orthodontist	Dental practitioner	p-value
Orthodontists are more enthusiastic about recent advancements	32	10	**0.020***
General dental practitioners are more enthusiastic about recent advancements.	0	15	
No noticeable differences	15	2	
No opinion.	1	1	

Chi-square test - Statistically significant



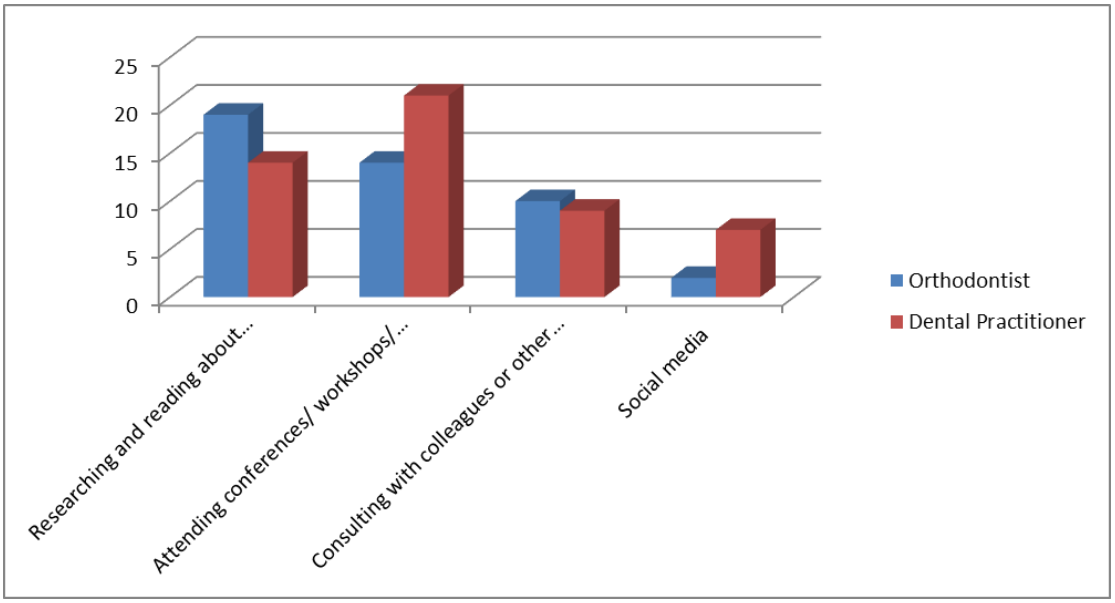
Graph 9:- Descriptive statistics showing the response of orthodontist and dental practitioner in Perception of recent advancements in orthodontics

Table 9 and Graph 9 shows comparison showing the response of orthodontist and dental practitioner in perception of recent advancements in orthodontics and it showed that there is statistically significant difference (p=0.020) on comparing responses of orthodontists and dental practitioners .

Table 10:- Comparison showing the response of orthodontist and dental practitioner in advancements to implement in clinical practice

	Orthodontist	Dental practitioner	p-value
Researching and reading about advancements in orthodontics from journals/publications.	19	14	0.214
Attending conferences/ workshops/ continuing educational courses	14	21	
Consulting with colleagues or other professionals	10	9	
Social media	2	7	

Chi-square test



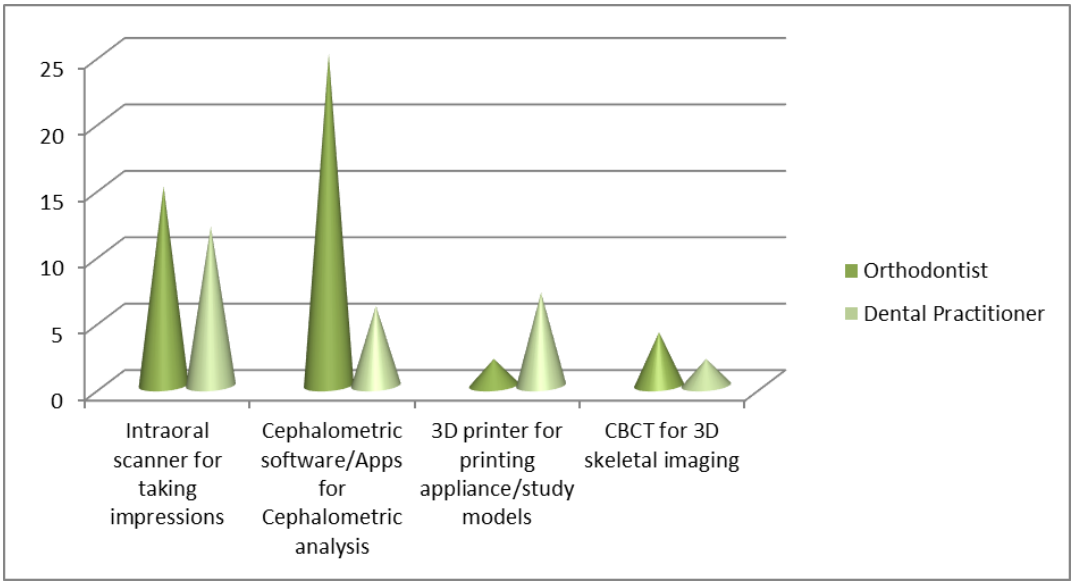
Graph10:- Descriptive statistics showing the response of orthodontist and dental practitioner in advancements to implement in clinical practice

Table 10 and Graph 10 shows comparison showing the response of orthodontist and dental practitioner in advancements to implement in clinical practice and it showed that there is no significant difference (p=0.214) on comparing responses of orthodontists and dental practitioners

Table 11:- Comparison showing the response of orthodontist and dental practitioner in use any DIGITAL SOFTWARE TECHNOLOGY in your orthodontic practice.

	Orthodontist	Dental practitioner	p-value
Intraoral scanner for taking impressions.	15	12	0.274
Cephalometric software/Apps for Cephalometric analysis.	25	6	
3D printer for printing appliance/study models.	2	7	
CBCT for 3D skeletal imaging.	4	2	

Chi-square test



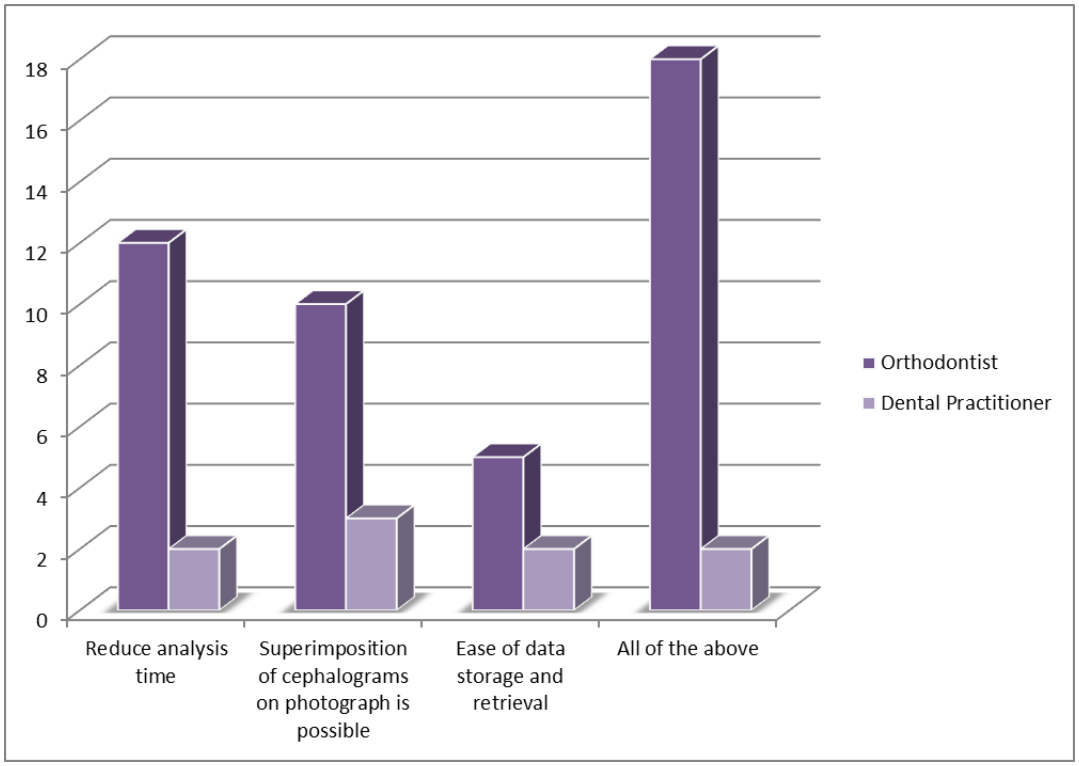
Graph 11:- Descriptive statistics showing the response of orthodontist and dental practitioner in use any DIGITAL SOFTWARE TECHNOLOGY in your orthodontic practice

Table 11 and Graph 11 shows comparison showing the response of orthodontist and dental practitioner in use any digital software technology in your orthodontic practice and it showed that there is no significant difference (p=0.274) on comparing responses of orthodontists and dental practitioners.

Table 12:- Comparison showing the response of orthodontist and dental practitioner in use DIGITAL CEPHALOMETRIC analysis in your practice

	Orthodontist	Dental practitioner	p-value
Reduce analysis time	12	2	**0.001***
Superimposition of cephalograms on photograph is possible	10	3	
Ease of data storage and retrieval	5	2	
All of the above	18	2	

Chi-square test - Statistically significant



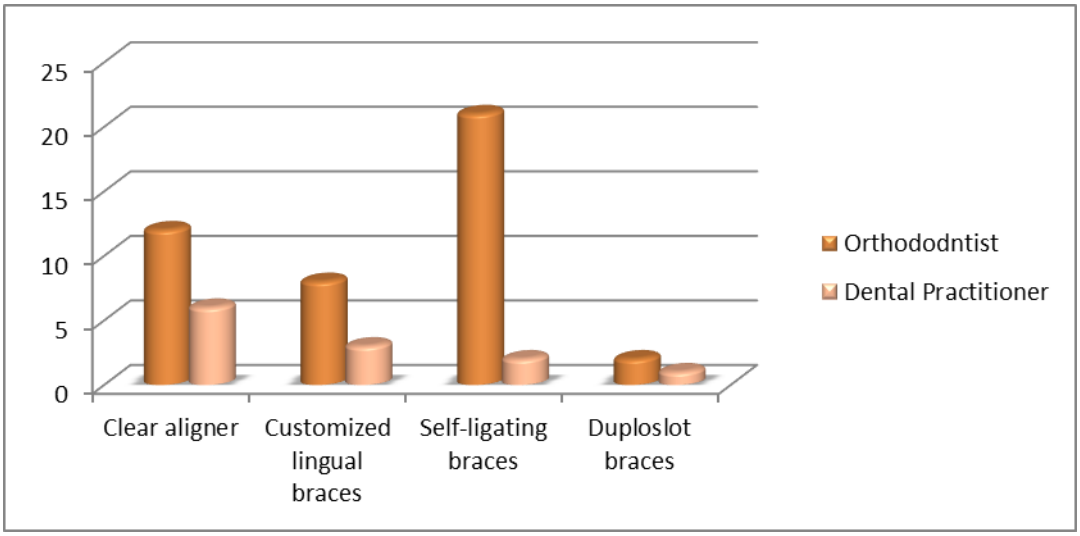
Graph 12:- Descriptive statistics showing the response of orthodontist and dental practitioner in use DIGITAL CEPHALOMETRIC analysis in your practice

Table 12 and Graph 12 shows comparison showing the response of orthodontist and dental practitioner in use digital cephalometric analysis in your practice and it showed that there is highly statistically significant difference (p=0.001) on comparing responses of orthodontists and dental practitioners .

Table 13:- Comparison showing the response of orthodontist and dental practitioner in implement any recent advancement in orthodontic brackets

	Orthodontist	Dental practitioner	p-value
Clear aligner	12	6	**0.002***
Customized lingual braces	8	3	
Self-ligating braces	21	2	
Duploslot braces	2	1	

Chi-square test - Statistically significant



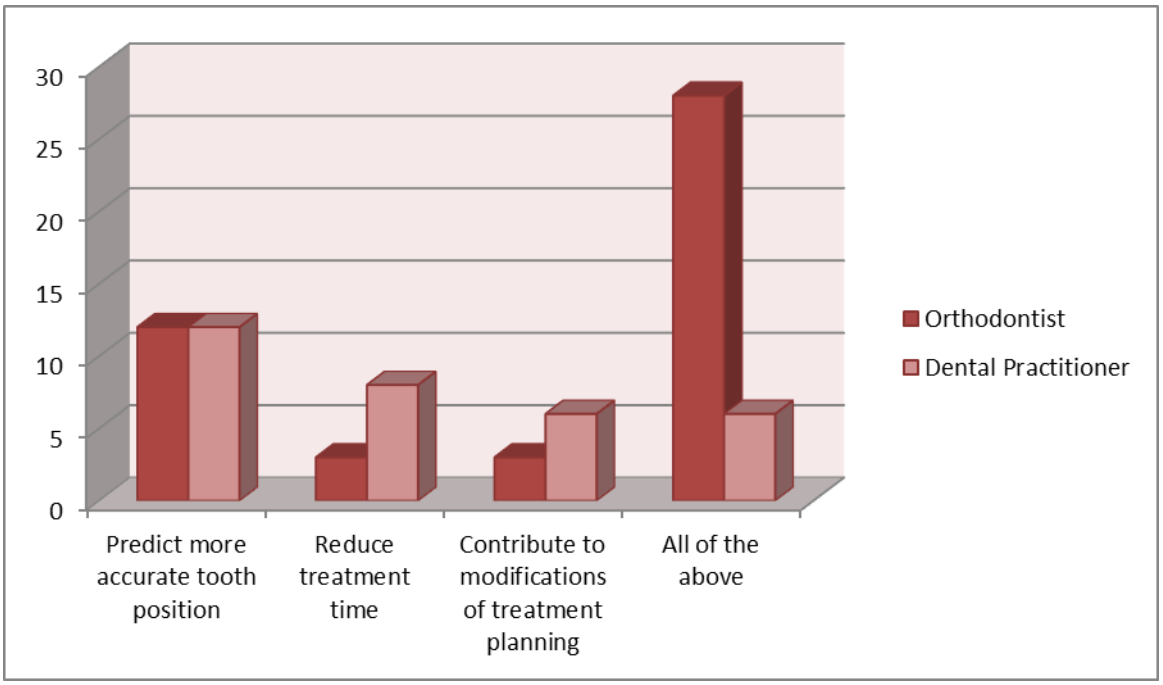
Graph 13:- Descriptive statistics showing the response of orthodontist and dental practitioner in implement any recent advancement in orthodontic brackets

Table 13 and Graph 13 shows comparison showing the response of orthodontist and dental practitioner in implement any recent advancement in orthodontic brackets and it showed that there is highly statistically significant difference (p=0.002) on comparing responses of orthodontists and dental practitioners .

Table 14:- Comparison showing the response of orthodontist and dental practitioner in use of CBCT for impacted canines in your practice

	Orthodontist	Dental practitioner	p-value
Predict more accurate tooth position.	12	12	**0.047***
Reduce treatment time.	3	8	
Contribute to modifications of treatment planning	3	5	
All of the above	28	6	

Chi-square test - Statistically significant



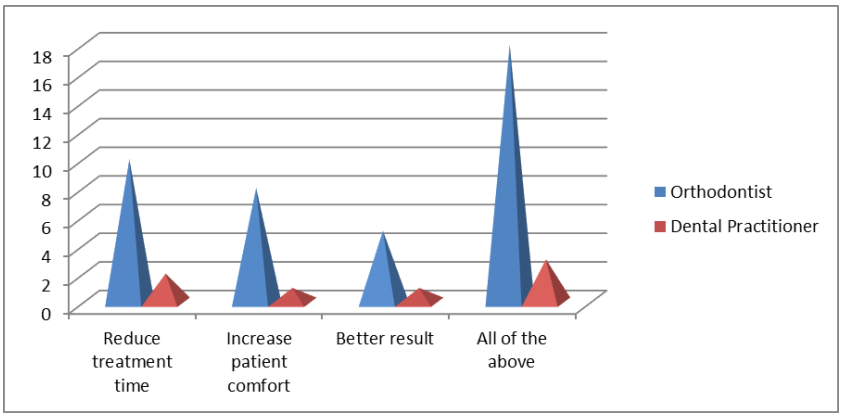
Graph 14:- Descriptive statistics showing the response of orthodontist and dental practitioner in use of CBCT for impacted canines in your practice

Table 14 and Graph 14 shows comparison showing the response of orthodontist and dental practitioner in use of CBCT for impacted canines in your practice and it showed that there is statistically significant difference (p=0.047) on comparing responses of orthodontists and dental practitioners .

Table 15:- Comparison showing the response of orthodontist and dental practitioner inuse of Intra-radicular (IZC/Buccal self) mini implants in your practice

	Orthodontist	Dental practitioner	p-value
Reduce treatment time	10	2	
Increase patient comfort	8	1	
Better result	5	1	
All of the above	18	3	**0.001***

Chi-square test - Statistically significant



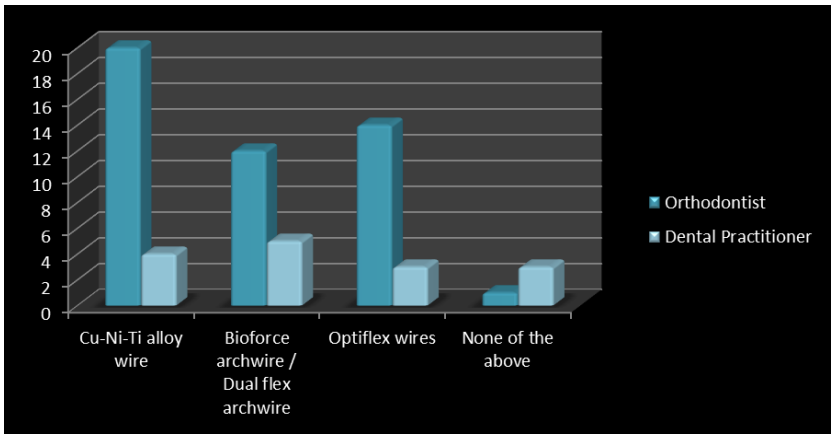
Graph 15:- Descriptive statistics showing the response of orthodontist and dental practitioner in use of Intra-radicular (IZC/Buccal self) mini implants in your practice

Table 15 and Graph 15 showed comparison showing the response of orthodontist and dental practitioner in use of Intra-radicular (IZC/Buccal self) mini implants in your practiceand it showed that there is highly statistically significant difference (p=0.002) on comparing responses of orthodontists and dental practitioners .

Table 16:- Comparison showing the response of orthodontist and dental practitioner in use of any advancement in orthodontic archwire in your practice

	Orthodontist	Dental practitioner	p-value
Cu-Ni-Ti alloy wire	20	4	
Bioforce archwire / Dual flex archwire	12	5	
Optiflex wires	14	3	
None of the above	1	3	**0.032***

Chi-square test- Statistically significant



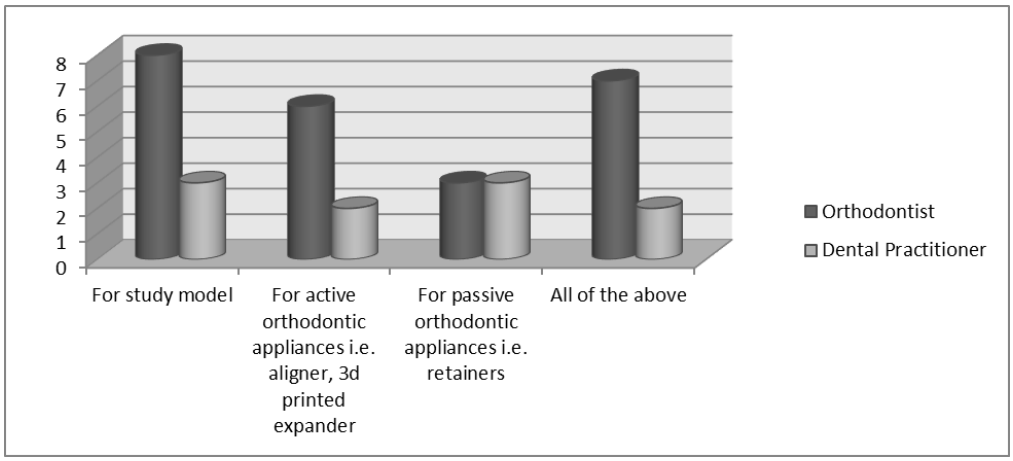
Graph 16:- Descriptive statistics showing the response of orthodontist and dental practitioner in use of any advancement in orthodontic archwire in your practice

Table 16 and Graph 16 shows comparison showing the response of orthodontist and dental practitioner in use of any advancement in orthodontic archwire in your practice and it showed that there is statistically significant difference (p=0.032) on comparing responses of orthodontists and dental practitioners .

Table 17:- Comparison showing the response of orthodontist and dental practitioner in use of 3D printing in your practice

	Orthodontist	Dental practitioner	p-value
For study model	8	3	**0.024***
For active orthodontic appliances i.e. aligner, 3d printed expander	6	2	
For passive orthodontic appliances i.e. retainers	3	3	
All of the above	7	2	

Chi-square test, *- Statistically significant



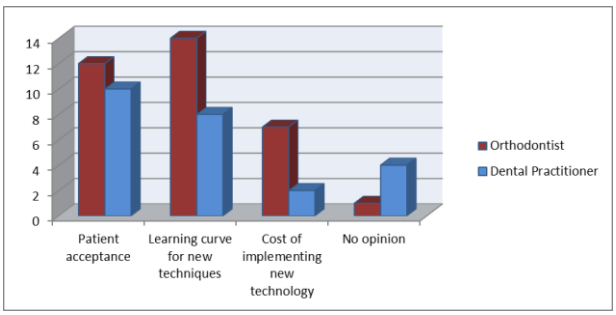
Graph 17:- Descriptive statistics showing the response of orthodontist and dental practitioner in use of 3D printing in your practice

Table 17 and Graph 17 shows comparison showing the response of orthodontist and dental practitioner in use of 3D printing in your practice and it showed that there is statistically significant difference (p=0.024) on comparing responses of orthodontists and dental practitioners

Table 18:- Comparison showing the response of orthodontist and dental practitioner in some challenges have encountered in implementing recent advancements in orthodontics in your clinical practice

	Orthodontist	Dental practitioner	p-value
Patient acceptance	12	20	**0.016***
Learning curve for new techniques	14	12	
Cost of implementing new technology	7	10	
No opinion	1	5	

Chi-square test - Statistically significant



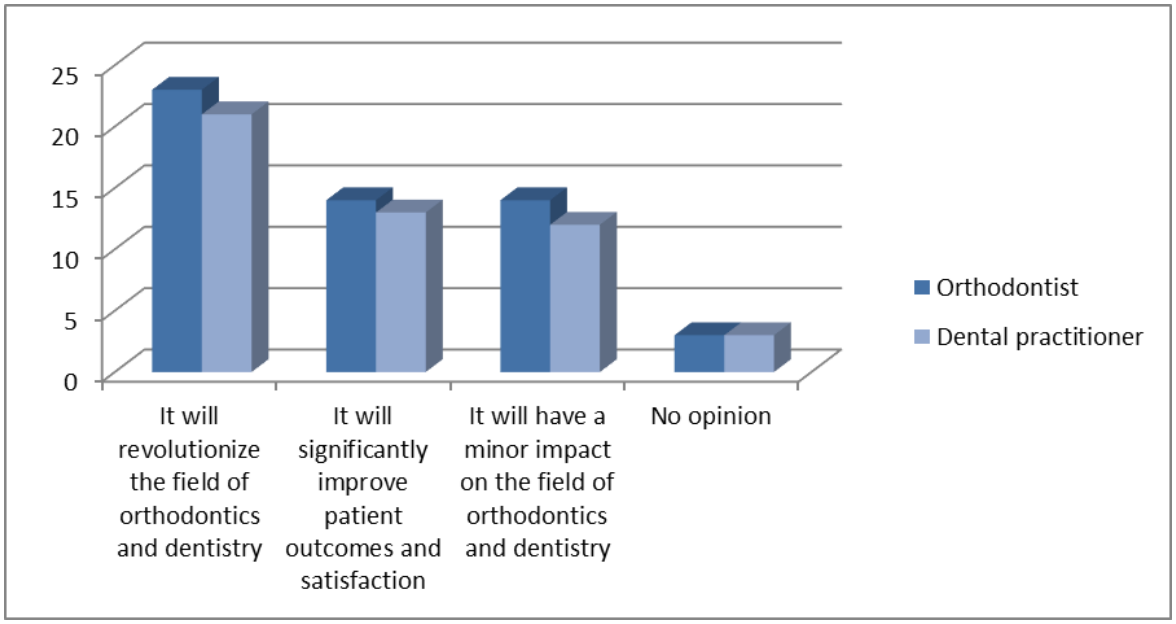
Graph 18:- Descriptive statistics showing the response of orthodontist and dental practitioner in some challenges have encountered in implementing recent advancements in orthodontics in your clinical practice

Table 18 and Graph 18 shows comparison showing the response of orthodontist and dental practitioner in some challenges have encountered in implementing recent advancements in orthodontics in your clinical practice and it showed that there is statistically significant difference (p=0.016) on comparing responses of orthodontists and dental practitioners.

Table 19:- Comparison showing the response of orthodontist and dental practitioner in use of the implementation of recent advancements in orthodontics will affect the future of orthodontics and dentistry as a whole

	Orthodontist	Dental practitioner	p-value
It will revolutionize the field of orthodontics and dentistry	23	21	0.075
It will significantly improve patient outcomes and satisfaction	14	13	
It will have a minor impact on the field of orthodontics and dentistry	14	12	
No opinion	3	3	

Chi-square test



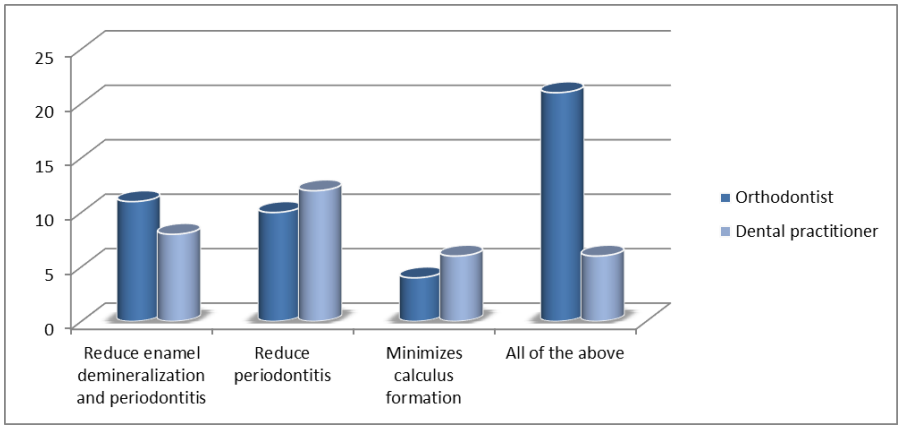
Graph 19:- Comparison showing the response of orthodontist and dental practitioner in use of the implementation of recent advancements in orthodontics will affect the future of orthodontics and dentistry as a whole

Table 19 and Graph 19 shows comparison showing the response of orthodontist and dental practitioner in use of the implementation of recent advancements in orthodontics will affect the future of orthodontics and dentistry as a whole and it showed that there is no statistically significant difference (p=0.075) on comparing responses of orthodontists and dental practitioners.

Table 20:- Comparison showing the response of orthodontist and dental practitioner in awareness of advancement related antibacterial coating onto orthodontic appliance

	Orthodontist	Dental practitioner	p-value
Reduce enamel demineralization and periodontitis.	11	8	**0.002***
Reduce periodontitis.	10	12	
Minimizes calculus formation	4	6	
All of the above	21	6	

Chi-square test - Statistically significant



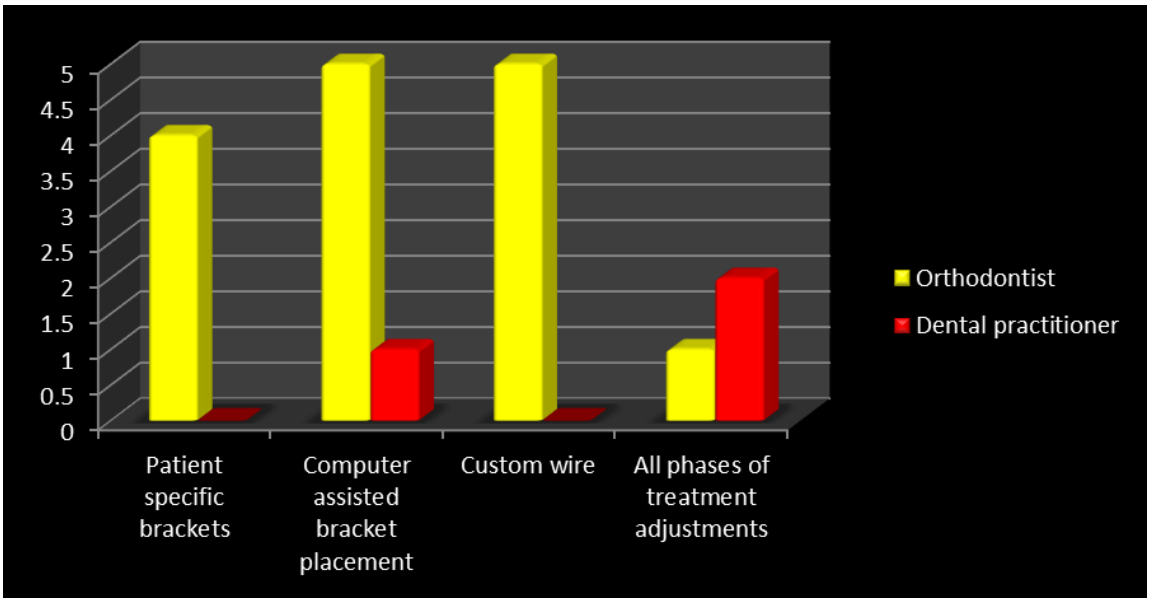
Graph 20:- Descriptive statistics showing the response of orthodontist and dental practitioner in awareness of advancement related antibacterial coating onto orthodontic appliance

Table 20 and Graph 20 shows comparison showing the response of orthodontist and dental practitioner in awareness of advancement related antibacterial coating onto orthodontic appliance and it showed that there is highly statistically significant difference (p=0.002) on comparing responses of orthodontists and dental practitioners.

Table 21:- Comparison showing the response of orthodontist and dental practitioner in use of Insignia Software in your practice

	Orthodontist	Dental practitioner	p-value
Patient specific brackets	4	0	
Computer assisted bracket placement	5	1	
Custom wire	5	0	
All phases of treatment adjustments	1	2	**0.025***

Chi-square test - Statistically significant



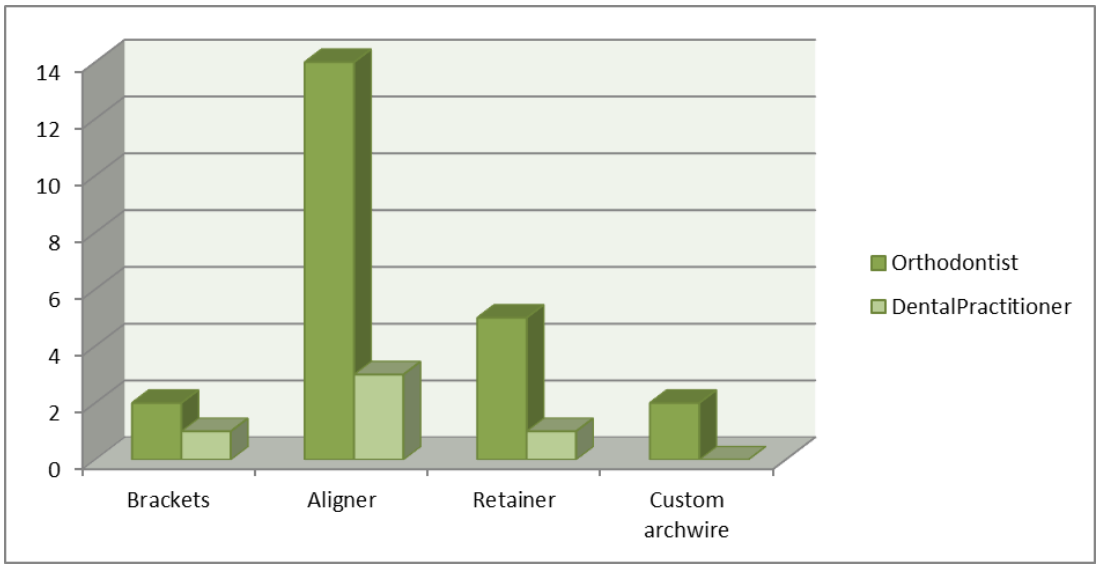
Graph 21:- Descriptive statistics showing the response of orthodontist and dental practitioner in use of Insignia Software in your practice

Table 21 and Graph 21 shows comparison showing the response of orthodontist and dental practitioner in use of Insignia Software in your practice and it showed that there is highly statistically significant difference (p=0.025) on comparing responses of orthodontists and dental practitioners.

Table 22:- Comparison showing the response of orthodontist and dental practitioner in use of 3d printed customized orthodontic appliance

	Orthodontist	Dental practitioner	p-value
Brackets	2	1	
Aligner	14	3	
Retainer	5	1	
Custom archwire	2	0	**0.027***

Chi-square test- Statistically significant



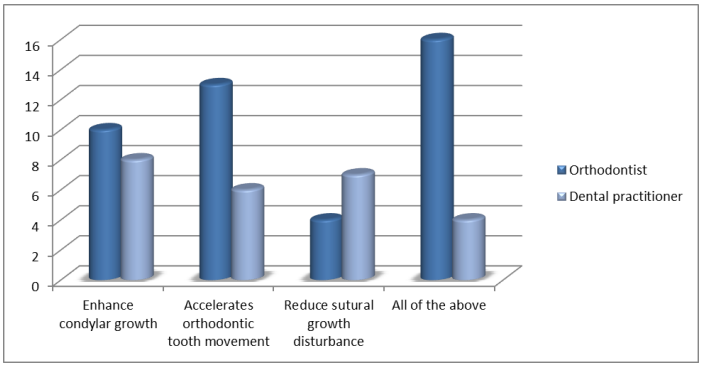
Graph 22:- Descriptive statistics showing the response of orthodontist and dental practitioner in use of 3d printed customized orthodontic appliance

Table 22 and Graph 22 shows comparison showing the response of orthodontist and dental practitioner in use of 3d printed customized orthodontic appliance and it showed that there is highly statistically significant difference (p=0.027) on comparing responses of orthodontists and dental practitioners.

Table 23:- Comparison showing the response of orthodontist and dental practitioner in awareness of use of gene therapy advancement in orthodontics

	Orthodontist	Dental practitioner	p-value
Enhance condylar growth	10	8	
Accelerates orthodontic tooth movement	13	6	
Reduce sutural growth disturbance	4	7	
All of the above	16	4	**0.032***

Chi-square test, *- Statistically significant



Graph 23:- Descriptive statistics showing the response of orthodontist and dental practitioner in awareness of use of gene therapy advancement in orthodontics

Table 23 and Graph 23 shows comparison showing the response of orthodontist and dental practitioner in awareness of use of gene therapy advancement in orthodontics and it showed that there is highly statistically significant difference (p=0.032) on comparing responses of orthodontists and dental practitioners.

V. Discussion

This study aimed to assess how orthodontists and general dental practitioners perceive and implement recent advancements in orthodontics. Through an analysis of professional experience, geographic distribution, and technological adoption, the findings provide a comprehensive overview of the contemporary orthodontic landscape.

Demographic Profile and Experience

The study involved 127 respondents, including 56 orthodontists and 71 general dental practitioners. The higher number of dental practitioners mirrors the broader reach of general dentistry relative to the specialized domain of orthodontics. A majority of respondents across both groups were aged between 31-40 years—a demographic typically familiar with digital tools and evolving clinical technologies.

Notably, orthodontists had more years of professional experience than dental practitioners, with a higher proportion practicing for over a decade. This likely correlates with the extended education and focused training orthodontists undergo, which fosters deeper engagement with evolving orthodontic technologies.

Urban vs Rural Practice

More orthodontists reported working in urban centers compared to general dentists. This aligns with existing trends, as specialized services tend to be concentrated in urban locales due to higher patient volumes and increased demand .[15] Meanwhile, general practitioners' higher presence in rural areas underscores ongoing disparities in access to specialized dental care .[16]

Perception of Technological Advancements

Orthodontists demonstrated a significantly stronger perception and understanding of recent innovations than general practitioners. Approximately 85.71% of orthodontists versus 39.44% of dental practitioners expressed high awareness of emerging technologies ($p = 0.043$). This gap reflects orthodontists' active engagement in adopting innovations that enhance precision and outcomes in their clinical workflows.[9,17,18]

Digital Technology Adoption

Orthodontists have integrated digital tools—such as cephalometric analysis software, intraoral scanners, and Cone Beam Computed Tomography (CBCT)—at a higher rate than general dentists. These tools are known to significantly improve diagnostic accuracy and treatment planning. For example, intraoral scanners provide more accurate impressions and are less invasive.[19] Similarly, CBCT offers enhanced 3D imaging that is invaluable for complex cases.[20,21]

Digital Cephalometric Analysis

A notable 80.35% of orthodontists use digital cephalometric analysis, compared to just 12.67% of general practitioners. This highlights the role of digital analysis in facilitating accurate assessment and planning in orthodontic care. Digital cephalometry enhances treatment precision by enabling superimposed visualizations of craniofacial structures .[22] Such accuracy aids in tracking treatment progress and ensuring predictable outcomes .[23,24]

3D Printing in Orthodontics

Orthodontists also reported more frequent use of 3D printing, particularly for fabricating study models and appliances. This technology increases efficiency and customization while reducing production time .[25] It enables orthodontists to create patient-specific appliances, resulting in improved fit and comfort .[26]

Advanced Orthodontic Appliances

Specialized appliances like clear aligners and self-ligating braces were more commonly used by orthodontists. These appliances are preferred for their aesthetic and clinical benefits. Clear aligners, for example, are discreet and removable, making them highly appealing to patients.[27] Their rise in popularity is tied to increased patient satisfaction and compliance.[28]

Self-ligating braces offer benefits such as reduced friction and fewer adjustment appointments, leading to shortened treatment durations.[29] These features align with findings from Jahanbin et al. (2019), who noted improved patient experience and reduced clinical workload .[30]

Patient Benefits: Comfort, Time, and Aesthetics

Orthodontists perceived that recent technologies enhance treatment efficiency and patient comfort more than general practitioners. Digital impressions, for instance, require less chairside time and are more comfortable for patients.[31,] Intraoral scanners, specifically, are user-friendly and accurate, which further streamlines aligner fabrication.[32,29]

Aesthetic advancements, such as clear aligners and ceramic brackets, increase patient satisfaction due to their discreet appearance .[33] The capacity for customized treatment planning through CAD/CAM and 3D imaging also improves visual outcomes and compliance .[34,35] Furthermore, aesthetic brackets meet the growing demand for invisible orthodontic options .[36]

Challenges in Adopting New Technologies

Despite these benefits, several challenges persist. Patient acceptance can be hindered by unfamiliarity with newer technologies or concerns about efficacy. Safi et al. (2018) emphasized the need for robust patient education to overcome such reluctanc.[37]

A steep learning curve also poses a barrier. Technologies like CBCT and 3D printing require specialized training. Surendran et al. (2024) emphasized the need for continuous education to facilitate smooth integration into practice.[38]

High upfront costs remain another deterrent, particularly for general dental practitioners. Gracco et al. (2023) noted that the cost of equipment can delay adoption despite long-term benefits.[39]

Future Directions

Orthodontists are optimistic about future developments, especially in digital technologies and 3D printing. These tools are expected to further refine diagnosis, appliance customization, and treatment outcomes (Thawri et al., 2023).[40]

Emerging innovations like teleorthodontics offer the potential for remote consultations and follow-ups.[41] Research by Homsi et al. (2023) indicates that teleorthodontics can reduce clinic visits while maintaining treatment efficacy. [42,43]

Awareness is also increasing around antibacterial coatings and gene therapy. Antibacterial coatings help reduce plaque accumulation and enamel demineralization, enhancing oral hygiene during treatment .[44]Gene therapy, while still experimental, may one day expedite tooth movement and improve orthodontic outcomes. [45]

VI. Conclusion

This study explored how orthodontists and general dental practitioners perceive, adopt, and implement recent orthodontic advancements. Data from 127 professionals (56 orthodontists, 71 general practitioners) revealed notable differences in technology use and attitudes. Orthodontists demonstrated greater adoption of innovations such as CBCT, 3D printing, and digital cephalometric analysis. While both groups recognized the benefits—improved outcomes and patient comfort—they also cited barriers like cost and training needs. The study highlights a technology adoption gap, influenced by specialization and resources, and emphasizes the importance of enhancing access, education, and support to ensure widespread integration of advanced orthodontic practices.

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