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Clinical and Laboratory Survey Regarding Modern Tooth-Supported Fixed Partial and Implant-Supported Prosthetics in Sana'a City

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ABSTRACT

Background and aims: The study assessed the success rates of correct work performed by dentists and their collaboration with technicians in implant-supported prosthetic treatments. It analyzed preferred techniques, treatment plans, and materials used in fixed prosthetics and implants, while also identifying daily clinical challenges. Ultimately, the aim was to understand, apply, and keep pace with technological advancements in restorative dentistry. **Methods:** The study is a cross-sectional study in Sana'a, Yemen, using an online self-designed questionnaire. The questionnaire was developed using Google Forms and reviewed by experts from the Prosthetics department at Sana'a University to ensure content validity and accuracy. The questionnaires were designed using previous studies and reference books for fixed prosthodontics. They have five primary axes, each focusing on different research goals. **Results:** The study surveyed 101 dentists in Sana'a, Yemen, revealing a gender distribution of 61.4% males and 38.6% females, with varying academic qualifications: 24.8% bachelor's, 43.6% master's, and 31.7% doctorate. Experience levels included 36.6% with 1–5 years, 25.7% with 5–10 years, and 37.7% with over 10 years. Implant procedures showed that 48 dentists performed fewer than 10, 20 performed 10-20, and 32 performed over 20. Panoramic radiographs were always used by 57.5%, while alginate impressions were used consistently by 35%. The usage of diagnostic waxup included 11.9% always, 45.6% sometimes, and 5.9% never; digital images were used always by 12.9% and never by 9.9%. Smile design and digital color matching were less frequently adopted. A significant association was found between male dentists and those performing over 20 implants (OR 5.5, p=0.001), while female dentists had a negative correlation. Dentists with a doctorate had an odds ratio of 7.9 for more than 20 implants ($p < 0.0001$), contrasting with those holding a bachelor's degree showing a negative association ($p = 0.0006$). Additionally, dentists with over 10 years' experience had an odds ratio of 9.2 for performing more than 20 implants ($p < 0.0001$), while less experienced dentists showed significant negative correlations.

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Conclusions: Based on study data, 49.5% of the surveyed dentists do not practice implant-supported restorations, despite a high percentage of practitioners having similar levels of academic qualifications (bachelor's, master's, or doctorate) and comparable experience.

Keywords: Dental Education, Dental Materials, Fixed Partial Implant, Prosthodontics, Sana'a City, Survey, Yemen.

INTRODUCTION

The spectrum of fixed prosthetic treatment options has expanded since osteointegrated dental implants have proven to be effective. Additionally, the production and diversity of implant systems have grown, becoming the main focus of the dentistry field throughout the past century. Current in vitro and in vivo research is trying to keep up with the rapid changes in techniques, materials, and different types of fixed prosthesis designs that need implant support. Current data is variable and even conflicting with regard to the right number of implants [1], implant design, impression technique, loading and tightening operation of implant abutment, prosthetic process, and essential materials [2].

Even as the dental industry continues to innovate and introduce new materials to the market, and new technologies like CAD-CAM (Computer added Design-Computer added manufacturing) gained popularity, the prosthodontic team—which consists of a dentist and a dental technician—often faces the challenge of choosing and implementing complex restorative solutions. The success of the prosthetic therapy with implant support depends on the collaboration of the lab technician and the doctor in addition of clinical factors as bone quality, surgical planning, etc. To guarantee a rehabilitation with a good prognosis, each member is responsible for validating the execution phases. In this conversation, poor communication is mentioned as a major problem that prevents the patient from getting the best care possible. Prosthodontics experts' preferred techniques for implant-supported dental restorations have not been thoroughly surveyed in the field of dental laboratory technology [3]. Furthermore, only a small number of research identify the preferred techniques used by prosthodontics specialists for implant-supported dental restorations in particular parts of the world, and some of these studies do not include information about professional experience [4,5].

Dental implants are primarily used to support dental prostheses, or artificial teeth. The physiological mechanism by which bone adheres firmly to the surface of certain materials, such titanium and certain ceramics, is how modern dental implants function. When bone and implant are integrated, physical loads can be supported for decades without experiencing any problems [6].

From 0.7% of patients who lost at least one tooth in 1999–2000 to 5.7% in 2015–2016 and possibly up to 26% in 2026, dental implants have become more and more common in the US. Implants can be used to reconstruct edentulous (toothless) dental arches (implant-supported overdenture, implant-retained fixed bridge), replace numerous missing teeth (single tooth restorations), or both. Although dental implants have become more popular in the United States, there are alternative methods of treating tooth loss [7,8].

In orthodontics, dental implants are also utilised to give anchorage (orthodontic micro implants). Before a dental implant is placed, orthodontic treatment may be necessary. Furthermore, orthodontic implants, prosthetics, and facial prosthetics are merged without clear separation of domains. The use of implants to hold onto obturators removable prosthesis that bridge a gap between the nasal or maxillary cavities is a developing field. Facial prosthetics can involve attachments to implants inserted into the facial bones to address facial defects (such as those caused by cancer treatment or trauma). A fixed or detachable prosthetic that replaces a portion of the face may be retained by the implant, depending on the circumstances [9].

Dental research in Yemen focuses heavily on assessing dental and oral health, education, and practice under the ongoing crisis [10-14]. Key studies include: "Immediate implantation in a tooth cavity with periapical lesions: A study of the immediate implantation procedure in patients" [15], "Effects of low-level laser in the treatment of myofascial pain and temporomandibular joint disorder" [16], "Prevalence and colonization factors of Staphylococcus aureus in the oral cavity of adults" [17], "Comparison between piezoelectric and conventional osteotomy for impacted mandibular third molar" [18], Analysis of the prevalence and clinical characteristics of ameloblastoma in the Yemeni population [19], Oral reactive hypertrophic lesions [20], Effect of dental implantation on increased aerobic bacterial colonization rate [21], Oral and maxillofacial lesions [22], Periodontal health and its relationship to khat chewing, Musculoskeletal disorders among practitioners, and oral cancer screening practices [23,24]. However, no study has addressed the evaluation of the level of clinical services provided to patients with regard to fixed dental prostheses supported by teeth and implants, in light of modern technological development. Therefore, the current study objectives were first to evaluating the level of clinical services provided to

patients regarding fixed dentures supported by teeth and supported by implants, in light of technological development. Second, determine the preferred techniques of dentists in designing and manufacturing possess for fixed dental restorations supported by teeth and supported by implants. Third, determine the protocols followed by dentists to develop treatment plans for patients who require tooth-supported fixed partial and implant-supported prosthetic, and determine the most important and preferred materials used from the point of view of dentists. Finally, determine the challenges that dentists often face during daily practice and the complications related to tooth-supported and implant-supported fixed prosthodontics.

MATERIALS AND METHODS

Study design and location: A descriptive analytical cross-sectional study expressed quantitatively with the aim of achieving the study objectives. Some of its objectives are primary data in the city of Sana'a in Yemen.

Study population: Dentists practicing in the Yemeni capital Sana'a.

Sample size & sampling method:

Based on the survey monkey program, the number of the study population was entered with a confidence level of 95% and a margin of error of 15%. We conclude that the sample size required for scientific research is 100 practicing dentists in Sana'a city. This limited number of dentists was chosen due to the difficulty in reaching the target group, as dentists are a highly specialized profession, making them challenging to access. A smaller sample size is often necessary to ensure logistical feasibility in city-wide studies, where a complete registry of all practitioners may not be available or accessible. Secondly, there were time and resource constraints; larger samples require more time and financial resources, which were limited in this study.

Inclusion criteria: Dentists working in the Yemeni capital, Sana'a city.

Exclusion criteria: Dentists working outside the Yemeni capital, Sana'a city.

Tool of the study: An online self-designed questionnaire was developed, written in the Arabic language, using the Google Forms application. After the initial pool of questionnaire items, qualified experts from the department of Prosthetics, Faculty of Dentistry, Sana'a University, review them to evaluate content validity, make sure questions are accurate, free of item construction problems, with no content that may be perceived as offensive or biased by a particular subgroup of respondents. The questionnaires were created based on previous studies that dealt with the same subject of the study and reference books for fixed prosthodontics with five axes. Each of the five primary axes of the surveys is focused on accomplishing a different research goal. The first axis contains the respondent's personal data, including his gender, years of experience, and educational background. It also includes the number of implant-supported restorations he has completed throughout his career. In order to accomplish the first, second, and fourth goals of scientific research, the second axis comprises of the clinical techniques used in the two branches of fixed dental prosthetics supported by teeth and supported by dental implants. In order to accomplish the third objective of scientific study, the third axis focuses on the procedure that dentists use while creating the treatment plan that is delivered to the dental technician. In order to accomplish the fifth objective of scientific research, the fourth axis focuses on the most significant difficulties that dentists have when performing the laboratory procedures that are provided to them in clinical settings. The fifth and last axis addresses the most prevalent clinical issues in the field of fixed dental prosthesis and examines how frequently they arise in Sana'a clinical practice.

Pilot study: The pre-final version of the questionnaire was pilot tested on a small sample (10 participants), after completing the questionnaire the respondent was asked verbally by an interviewer (Prof Mohsen Al-Hamzi) to elaborate on what they thought each questionnaire item and their corresponding response meant. In November 2024 the questionnaire has been approved and validated.

Data collection: 101 dentists working in Sana'a, the capital of Yemen, received the questionnaire via email. Only dentists who have already completed fixed implant rehabilitation were listed. Online responses to the questionnaire were recorded for two months until 101 doctors responded, which is the study group size that corresponds to Schoenbaum's study4 for physicians. Multiple choice answers and the ability to describe additional possibilities were built into the questions. "Other" was offered as a choice in cases where uncertainty or unusual responses were anticipated, with a request for clarification from the respondent. An attempt was made to reduce the impact of response bias.

Data analysis: Data were downloaded as an Excel file and then submitted into a statistical analysis software (SPSS 5) where they were processed in descriptive analysis.

Ethics Statements: Before providing their written consent, all individuals who participated in this study received

a consent form and details regarding the experimental protocols. Approval for the study was obtained from the committee of postgraduate studies and scientific research of the Faculty of Dentistry, Sana'a University.

RESULTS

Table 1 details the demographics of the dental staff assessing clinical service levels for tooth-supported and implant-supported fixed dentures in Sana'a, Yemen. The study comprised 101 dentists, 61.4% of whom were male and 38.6% female. In terms of academic qualifications, 24.8% had a bachelor's, 43.6% a master's, and 31.7% a doctorate degree. Experience levels were distributed as follows: 36.6% had 1–5 years, 25.7% had 5–10 years, and 37.7% had over 10 years of experience. Table 2 indicates the preferences of dentists in techniques for diagnosing and designing fixed tooth-supported and implant-supported dental restorations, particularly in the context of technological advancements. Among 100 dentists surveyed, 48 performed fewer than 10 implants, 20 performed between 10 and 20, and 32 conducted over 20. In terms of digital dental impressions, only 3% always use them, with 8% often, 31% sometimes, 23% rarely, and 35% never. Conversely, 35% of dentists always use alginate impressions, 48% often, 10% sometimes, 3% rarely, and 4% never. Table 3 presents the preferences of dentists for techniques in diagnosing and designing fixed tooth-supported and implant-supported restorations. For panoramic radiographs, 57.5% of dentists always use them, while 38.6% often use them. Alginate impressions are utilized by 35% of dentists always and 48% often. Diagnostic waxup see 11.9% of dentists using them always or often, while 45.6% use them sometimes. Digital images are used always by 12.9% and often by 17.8% of dentists.

Table 4 details dentists' usage of smile design and digital color matching for fixed restorations. For smile design, 5.9% always used it, 9.9% often, 14.9% sometimes, 19.8% rarely, and 32.7% never. For digital color matching, the percentages were 3% always, 9.9% often, 14.9% sometimes, 19.9% rarely, and 52.5% never.

Table 5 illustrates the usage frequency of digital and alginate final impressions among dentists designing tooth-supported and implant-supported fixed restorations. For digital impressions, 3% always used it, 15.8% frequently, 30.7% sometimes, 9.9% rarely, and 27.7% never used it. In contrast, for alginate impressions, 9.9% always used it, 21.8% frequently, 30.7% sometimes, 9.9% rarely, and 27.7% never used it. Table 6 illustrates the usage frequency of A silicone and C-silicone final impressions by dentists in tooth-supported and implant-supported restoration procedures. For A silicone, 14.9% of dentists always used it, 39.6% often, 33.7% sometimes, while 5.9% reported rarely and 5.9% never used it. For C-silicone, 9.9% always used it, 16.8% often, 48.5% sometimes, with 21.8% rarely and 35% never using it.

Table 7 presents the frequency of restorations performed by dentists, highlighting the use of Zirconia restoration (PFZ), Metal ceramic restoration, and All ceramic restoration for tooth-supported and implant-supported fixed dentition. Specifically, 6.9% of dentists always used Zirconia restoration, 14.9% often, 50.8% sometimes, 22.8% rarely, and 5% never. For Metal ceramic restoration, 15.8% always used it, 67.3% often, 11.9% sometimes, 1% rarely, and 3% never. In terms of All ceramic restoration, 9.9% of dentists always used it, 30.7% often, 47.7% sometimes, 9.9% rarely, and 3% never. Table 8 presents the usage frequency of new adhesive systems, CBCT-x-ray, and open tray technologies by dentists in designing tooth-supported and implant-supported restorations. Specifically, 8.9% of dentists always use the new adhesive system, 23.8% often, 45.5% sometimes, 17.8% rarely, and 4% never. For CBCT-x-ray, 30.6% always use it, 14.8% often, 10.9% sometimes, 3% rarely, while 40.5% never use it. Meanwhile, the open tray technique sees 6.9% of dentists using it always, 19.8% often, 21.8% sometimes, 4% rarely, and 47.5% never. Table 9 presents the usage frequency of open-tray non-anchored, closed-tray, and screw-supported restorations by dentists for tooth-supported and implant-supported fixed restorations. For the open-tray anchored technique, 3% of dentists always used it, 7.9% often, 30.7% sometimes, 6.9% rarely, and 51.5% never. In the case of the closed-tray technique, 5% always used it, 17.8% often, 20.8% sometimes, 8.9% rarely, and 47.5% never. For screw-supported restorations, 4% always, 6.9% often, 9.9% sometimes, 11.9% rarely, and 67.3% never used this technique.

Table 10 outlines the usage frequency of cement-anchored, CAD/CAM zirconia, and titanium abutment restorations by dentists for tooth-supported and implant-supported fixed dental restorations. Specifically, 16.8% of dentists always used cement-anchored restorations, while 30.4% often, 3% sometimes, 1% rarely, and 48.5% never used them. For CAD/CAM zirconia, 5.9% always, 12.9% often, 25.7% sometimes, 7.9% rarely, and 47.5% never utilized them. Lastly, titanium abutments were always used by 9.9% of dentists, 24.7% often, 11.9% sometimes, 4.9% rarely, and 48.5% never used them. Table 11 presents data on dentists' inquiries regarding custom abutments, patient age, and gender when creating tooth-supported and implant-supported

fixed dental restorations. For custom abutments, 4.9% of dentists reported always using them, while 51.5% never used them. Regarding patient age, 37.8% always asked, and 9.9% never inquired. Concerning patient gender, 45.5% always asked, whereas 6.9% never did. Table 12 illustrates dentists' frequency in specifying porcelain type, color chart, and digital patient image for tooth-supported and implant-supported restorations. Specifically, 32.7% always specified porcelain type, 26.7% often, and 14.9% sometimes; 11.9% always used a color chart, with 34.7% never using it; and 9.9% always utilized digital patient images, while 21.8% never utilized them.

Table 13 illustrates dentists' use of bridge design and temporary prostheses in fixed tooth-supported and implant-supported restorations, revealing that 14.9% always use bridge design, with 21.8% often, 25.7% sometimes and rarely, while 11.9% never use it. For temporary prostheses, 10.9% always use them, 32.7% often, 20.8% sometimes, 23.7% rarely, and 11.9% never. Table 14 details the frequency of consultations with dental technicians, showing that 12.9% of dentists always consult, 29.7% often, 42.6% sometimes, 10.9% rarely, and 4% never consult. Additionally, 28.7% always call technicians to their office, 36.6% often, 20.8% sometimes, 6.9% rarely, and 6.9% never do so. Table 15 demonstrates a correlation between the number of dental implants (over 20) and factors such as gender, academic qualifications, and experience among clinical dentists, reflecting on the clinical services offered for tooth-supported and implant-supported dentures amid technological progress. Male dentists exhibited a significant positive association with a higher number of implants (OR 5.5, CI 1.7-17.7, X2 10.4, p=0.001), while female dentists showed a negative association (p=0.001). Dentists holding doctorate degrees had an even stronger association (OR 7.9, CI 2.8-23.1, X2 20.5, p<0.0001), whereas those with bachelor's degrees faced a significant negative association (p=0.0006). Additionally, dentists with over 10 years of experience had an association with higher implant numbers (OR 9.2, CI 3.2-27.2, X2 23.4, p<0.0001), while those with less experience similarly demonstrated a strong negative association (p<0.0001). Table 16 illustrates the correlation between the consistent use of digital diagnostics and factors such as gender, academic qualifications, and years of experience among clinical dentists assessing clinical services for tooth-supported and implant-supported fixed dentures. No significant association was found for male dentists, indicated by an odds ratio (OR) of 1.3 (CI: 0.09-36, X2 = 0.04, p = 0.8). Conversely, a significant negative effect was observed for academic qualifications and years of experience in relation to the constant use of digital diagnostics (p < 0.0001 for both). Table 17 presents a significant correlation between the use of panoramic radiographs by clinical dentists and various factors such as gender, academic qualifications, and years of experience. Male dentists who regularly use panoramic radiographs have an odds ratio of 3.1, while female dentists show a higher odds ratio of 5.4. For educational qualifications, a master's degree correlates with an odds ratio of 16.5, and a doctoral degree has an odds ratio of 31.6, both with p-values indicating high significance (<0.0001). In contrast, dentists with a bachelor's degree exhibited a negative but non-significant association (p = 0.3). Experience also influences usage, with those having over 10 years of experience showing an odds ratio of 41.3, while those with 5-10 years and 1-5 years of experience have odds ratios of 2.9 and 2.8, respectively, both with lower significance (p = 0.01).

Table 1. Gender, academic qualification and years of experience for clinical dental personal used for evaluating the level of clinical services provided to patients regarding fixed dentures supported by teeth and supported by implants, in light of technological development

Characters	Number	Percentage
Sex		
Male	62	61.4
Female	39	38.6
Academic qualification		
Bachelor degree	25	24.8
Master degree	44	43.6
PhD degree	32	31.7
Years of experience		
From 1 to less than 5 years	37	36.6
From 5 to less than 10 years	26	25.7
More than 10 years	38	37.6
Total	101	100

Table 2. Number of implants and frequency of techniques preferred by dentists in diagnosing and designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Implants		
Nil	1	1
Less than 10 implants	48	47.5
10 to 20 implants	20	19.8
More than 20 implants	32	31.7
Digital diagnosis impressions		
Always	3	3
Often	8	7.9
Sometime	31	30.7
Rare	23	22.7
Never	35	34.6
Alginate diagnosis impressions		
Always	35	34.6
Often	48	47.5
Sometime	10	9.9
Rare	3	3
Never	4	4

Table 3. Frequency of techniques preferred by dentists in diagnosing and designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Panoramic X-ray		
Always	58	57.5
Often	39	38.6
Sometime	2	2
Rare	1	1
Never	1	1
Diagnostics wax-up		
Always	12	11.9
Often	12	11.9
Sometime	46	45.6
Rare	25	24.7
Never	6	5.9
Digital photograph		
Always	13	12.9
Often	18	17.8
Sometime	33	32.7
Rare	27	26.7
Never	10	9.9

Table 4. Frequency of smile design and digital shade matching done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Smile design		
Always	6	5.9
Often	10	9.9
Sometime	15	14.9
Rare	20	19.8
Never	33	32.7
Digital shade matching		
Always	3	3
Often	10	9.9
Sometime	15	14.9
Rare	20	19.9
Never	53	52.5

Table 5. Frequency of digital final impressions and alginate final impressions done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Digital final impressions		
Always	3	3
Often	16	15.8
Sometime	21	20.8
Rare	30	29.7
Never	31	30.7
Alginate final impressions		
Always	10	9.9
Often	22	21.8
Sometime	31	30.7
Rare	10	9.9
Never	28	27.7

Table 6. Frequency of A silicon final impression and C-silicon final impression done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
A silicon final impression		
Always	15	14.9
Often	40	39.6
Sometime	34	33.7
Rare	6	5.9
Never	6	5.9
C-silicon final impression		
Always	10	9.9
Often	17	16.8
Sometime	49	48.5
Rare	22	21.8
Never	3	3

Table 7. Frequency of Zirconia restoration (PFZ), Metal ceramic restoration and All ceramic restoration done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Zirconia restoration (PFZ)		
Always	7	6.9
Often	15	14.9
Sometime	51	50.5
Rare	23	22.8
Never	5	5
Metal ceramic restoration		
Always	16	15.8
Often	68	67.3
Sometime	12	11.9
Rare	1	1
Never	3	3
All ceramic restoration		
Always	10	9.9
Often	31	30.7
Sometime	47	47
Rare	10	9.9
Never	3	3

Table 8. Frequency of new adhesive system, CBCT- x-ray and open tray with connected done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
New adhesive system		
Always	9	8.9
Often	24	23.8
Sometime	46	45.5
Rare	18	17.8
Never	4	4
CBCT- x-ray		
Always	31	30.6
Often	15	14.8
Sometime	11	10.9
Rare	3	3
Never	41	40.5
Open tray with connected		
Always	7	6.9
Often	20	19.8
Sometime	22	21.8
Rare	4	4
Never	48	47.5

Table 9. Frequency of open tray without connected, closed tray technique and screw retained restoration done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Open tray without connected		
Always	3	3
Often	8	7.9
Sometime	31	30.7
Rare	7	6.9
Never	52	51.5
Closed tray technique		
Always	5	5
Often	18	17.8
Sometime	21	20.8
Rare	9	8.9
Never	48	47.5
Screw retained restoration		
Always	4	4
Often	7	6.9
Sometime	10	9.9
Rare	12	11.9
Never	68	67.3

Table 10. Frequency of cemented retained restoration, CAD/CAM Zirconia and titanium abutment done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Cemented retained restoration		
Always	17	16.8
Often	31	30.7
Sometime	3	3
Rare	1	1
Never	49	48.5
CAD/CAM Zirconia		
Always	6	5.9
Often	13	12.9
Sometime	26	25.7
Rare	8	7.9
Never	48	47.5
Titanium abutment		
Always	10	9.9
Often	25	24.7
Sometime	12	11.9
Rare	5	4.9
Never	49	48.5

Table 11. Frequency of custom abutment, patient age, and gender asked by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Custom abutment		
Always	5	4.9
Often	15	14.9
Sometime	25	24.8
Rare	4	4
Never	52	51.5
Patient age		
Always	38	37.8
Often	35	34.8
Sometime	14	13.9
Rare	4	4
Never	10	9.9
Patient's gender		
Always	46	45.5
Often	28	27.8
Sometime	15	14.9
Rare	4	4
Never	7	6.9

Table 12. Frequency of determine the type of porcelain, coloring diagram, and digital picture of the patient's asked by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Determine the type of porcelain		
Always	33	32.7
Often	27	26.7
Sometime	15	14.9
Rare	15	14.9
Never	10	9.9
Coloring diagram		
Always	12	11.9
Often	10	9.9
Sometime	25	24.8
Rare	19	18.8
Never	35	34.7
Digital picture of the patient's		
Always	10	9.9
Often	22	21.8
Sometime	24	23.8
Rare	23	22.8
Never	22	21.8

Table 13. Frequency of pontic design and temporary prosthesis using done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Pontic design		
Always	15	14.9
Often	22	21.8
Sometime	26	25.7
Rare	26	25.7
Never	12	11.9
Temporary prosthesis using		
Always	11	10.9
Often	33	32.7
Sometime	21	20.8
Rare	24	23.7
Never	12	11.9

Table 14. Frequency of opinion of dental technician and call the technician to your clinic done by dentists in designing procedures for tooth-supported and implant-supported fixed dentition restorations in light of technological development

Techniques	No	%
Opinion of dental technician		
Always	13	12.9
Often	30	29.7
Sometime	43	42.6
Rare	11	10.9
Never	4	4
Call the technician to your clinic		
Always	29	28.7
Often	37	36.6
Sometime	21	20.8
Rare	7	6.9
Never	7	6.9

Table 15. Association of larger numbers (more than 20) of implants with and gender, academic qualification and years of experience for clinical dental personal used for evaluating the level of clinical services provided to patients regarding fixed dentures supported by teeth and supported by implants, in light of technological development

Characters	>20 imp N (%)	*OR*	*95% CI*	X^2	*P value*
Sex					
Male n=62	27	5.3	1.7-17.7	10.4	0.001
Female n=39	5	0.19	0.06-0.6	10.4	0.001
Academic qualification					
Bachelor degree n=25	1	0.06	0.0-0.46	11.7	0.0006
Master degree n=44	11	0.57	0.22-1.5	1.6	0.2
PhD degree n=32	20	7.9	2.8-23.1	20.5	<0.0001
Years of experience					
From 1 to less than 5 years n=37	3	0.11	0.02-0.4	14.9	<0.0001
From 5 to less than 10 years n=26	6	0.57	0.18-1.7	1.2	0.27
More than 10 years n=38	23	9.2	3.2-27.2	23.4	<0.0001

Table 16. Association of always Digital diagnosis impetration with gender, academic qualification and years of experience for clinical dental personal used for evaluating the level of clinical services provided to patients regarding fixed dentures supported by teeth and supported by implants, in light of technological development

Characters	Always Dig N (%)	*OR*	*95% CI*	X^2	*P value*
Sex					
Male n=62	2	1.3	0.09-36	0.04	0.8
Female n=39	1	0.79	0.03-11.7	0.03	0.8
Academic qualification					
Bachelor degree n=25	0	0	0-0.29	15.4	<0.0001
Master degree n=44	1	0.02	0.0-0.15	31.2	<0.0001
PhD degree n=32	2	0.09	0.01-0.42	14	<0.0001
Years of experience					
From 1 to less than 5 years n=37	0	0.0	0.0-0.14	27	<0.0001
From 5 to less than 10 years n=26	1	0.06	0.0-0.43	12.5	<0.0001
More than 10 years n=38	2	0.06	0.01-0.3	17	<0.0001

Table 17. Association of always panoramic x-ray used with gender, academic qualification and years of experience for clinical dental personal used for evaluating the level of clinical services provided to patients regarding fixed dentures supported by teeth and supported by implants, in light of technological development

Characters	Always N (%)	*OR*	*95% CI*	X^2	*P value*
Sex					
Male n=62	37	3.1	1.4-6.9	9.6	0.001
Female n=39	21	5.4	2.2-13.4	14.4	<0.0001
Academic qualification					
Bachelor degree n=25	6	0.61	0.19-1.88	0.91	0.3
Master degree n=44	27	16.5	4.9-58	31.7	<0.0001
PhD degree n=32	25	31.6	8.9-120	46.6	<0.0001
Years of experience					
From 1 to less than 5 years n=37	17	2.8	1.1-7.3	5.5	0.01
From 5 to less than 10 years n=26	13	2.9	1.1-8.3	5.5	0.01
More than 10 years n=38	28	41.3	10.6-178.7	49	<0.0001

DISCUSSION

In light of technical advancements, Table 1 presents the years of experience, gender, and educational background of the dental team that evaluates the clinical services offered to patients with relation to tooth-supported and implant-supported fixed dentures. 101 dentists who practiced in Sana'a, Yemen, were included in the study. There were 39 (38.6%) females and 62 (61.4%) males. Males had a greater rate of academic qualification than females, with 24.8% holding a bachelor's degree, 43.6% a master's degree, and 31.7% a doctorate (Table 1). Our findings are consistent with those seen in both developed and developing nations, where clinical dentists differ in terms of years of experience, gender, and educational background [25]. Nonetheless, becoming a dentist often requires completing an undergraduate program that lasts five to eight years, and many people continue on to obtain postgraduate degrees. Despite the growing number of women entering the sector, career routes still differ significantly. Higher leadership roles have traditionally been occupied by men, especially in specialised industries and academics, although this is beginning to change. According to the General Dental Council26, experience ranges from new graduates to highly skilled experts with decades of experience in the field.

Although conventional loading is still used by dentists worldwide (more than 50%), digital planning and emerging technologies are becoming more and more popular. In many areas, the number of implants that a dentist performs varies widely; some perform less than 10 implants annually, while others perform over 30. Sandblasted, acid-etched, large-grain (SLA) implant surfaces are becoming more and more popular, and screw-retained restorations are marginally more prevalent than cement-retained restorations [26,27].

Traditional, painful toothpaste moulds are replaced with digital dental impressions, which use intraoral scanners to build a 3D representation of the teeth and mouth. For patients, particularly those experiencing allergic responses, this approach is more precise, quicker, and more comfortable. Instantaneous transmission of the resultant digital data to labs for restoration creation increases accuracy and efficiency while decreasing waste and remanufacturing.

According to our survey, only 3% of dentists utilise digital dental impressions consistently, 8% frequently, 31% occasionally, 23% infrequently, and 35% never. In developing nations, where the majority of dentists employ digital dental imprints rather than traditional techniques, our rate is lower [28].

Alginate is one of the most popular dental materials in the world because of its quickness, affordability, and simplicity of usage. It is used by dentists for study casts, temporary crowns, and initial impressions; however, because of its weak tear resistance, its use in final impressions for permanent crowns and bridges is restricted. For many different uses, such as mouthguards, occlusal splints, and orthodontic models, it is a necessary part of routine dental care. Our survey found that 35% of dentists always use alginate dental impressions, 48% use them frequently, 10% use them occasionally, 3% use them infrequently, and 4% never use them. This is less than the UK, where the majority of dentists always use this approach [29].

According to the current study, 57.5% of dentists always utilised panoramic radiographs, 38.6% frequently used them, 2% occasionally used them, 1% infrequently used them, and 1% never used them. These findings are consistent with those seen elsewhere [30]. Because it depends on the patient's unique needs, dental health, and risk factors, there is no set suggested frequency for panoramic x-rays. It is advised that low-risk adults get x-rays every 18 to 36 months; however, individuals who are at higher risk, such as those over 40 or those with gum disease, may need yearly panoramic x-rays. In order to track tooth development, children might also need more frequent monitoring [30].

Of dentists, 35% always used alginate impressions, 48% frequently used them, 10% occasionally used them, 3% infrequently used them, and 4% never used them. Our findings are not as widely used as they are in the UK, where dentists always use them. Dentists utilise alginate, a ubiquitous, flexible, and non-reversible dental impression substance, to make moulds of mouths and teeth for different appliances and research models. It is a cost-effective and user-friendly material that is crucial for diagnostic moulds, initial impressions, and the production of appliances including whitening trays, mouthguards, and orthodontic models [31].

The phrase "diagnostic wax-up" is probably misleading. Instead of using "swabs," dentists utilise a diagnostic wax swab, which is a 3D replica of a patient's teeth made of wax. By producing a tangible and visual depiction of the outcome, this swab is used to plan dental procedures and discuss it with the patient and technician. For restorations like veneers or crowns, this swab aids in determining the proper bite, tooth length, and tooth width. 11.9% of dentists in the current study reported using diagnostic wax-up swabs always, 11.9% frequently, 45.6% occasionally, 24.7%

infrequently, and 5.9% never. Compared to the United States, this approach is used at a lower rate [32].

For digital images, 12.9% of dentists always use them, 17.8% often use them, 32.7% sometimes use them, 26.7% rarely use them, and 9.9% never use them. Digital radiography (such as intraoral and extraoral x-rays), cone-beam computed tomography (CBCT) for three-dimensional views, and digital dental photography are among the many digital images that dentists employ for diagnostic purposes. With the use of these technology, dentists may plan surgeries like dental implants and identify issues like bone loss and tooth rot. Instantaneous enhancement, storage, and sharing of digital images facilitates better patient communication and treatment planning. In contrast to other reports, our survey found that 12.9% of dentists always use digital photographs, 17.8% often use them, 32.7% occasionally use them, 26.7% seldom use them, and 9.9% never use them [33].

Male dentists and more than 20 implants were shown to be statistically significantly associated in the current study, with an odds ratio (OR) of 5.5 times, a confidence interval (CI) of 1.7–17.7, an X2 coefficient of 10.4, and a p-value of 0.001. The practice of performing dental implants was negatively correlated with female dentists (P=0.001). Those who practiced implant-supported dentures extensively differed significantly; just four female dentists performed more than 20 implant-supported dental treatments, while 22 male dentists did so. These findings are comparable to those previously published by Oancea, L. et al. [34].

The current study demonstrated no differences between dentists with an average of five to fewer than ten years of experience performing implant-supported restorations, despite a substantial association between short-term and long-term practitioners within the same category. Long-term practitioners, on the other hand, had a significantly greater number of implant-supported restorations, according to a Saudi Arabian study [35]. Long-term practitioners have a significantly higher rate of implant-supported restorations than practitioners with less experience, per a 2015 study by Hagiwara et al. [36]. However, given that the more seasoned dentists in this study reported that a significant portion of cases were managed by less seasoned dentists, some problems may develop due to the dentist's inexperience with implant restoration treatment planning. Among these are prosthetic issues that arise throughout the course of treatment [36].

A significant correlation was found between dentists with a doctorate degree and having more implants (more than 20), according to the current study, which examined the relationship between the number of implant-supported restorations and academic degrees. The odds ratio (OR) for dentists with a doctorate degree was 7.9 times, with a confidence interval (CI) of 2.8 - 23.1, and X2 = 20.5, $p < 0.0001$. In the meantime, there was a very statistically significant negative correlation ($p = 0.0006$) between implantology and dentists with a bachelor's degree.

The study found that only one dentist with a bachelor's degree performed implant-supported restorations in more than 20 clinical instances, compared to 21 dentists with the same degree who did not do implant-supported restorations. This amount is also equivalent to the number of dentists with master's degrees who did not use implant-supported restorations. Implants were performed by the most numerous groups of dentists, 18 of whom held doctorates. This conclusion was also reached by Chowdhary's study [5] and Al Saleh's study [37], which discovered that dentists with doctorates performed the most implants.

CONCLUSION

In Sana'a, Yemen, a higher number of male dentists exist compared to female dentists, with more advanced degrees being prevalent. Dentists' experience is balanced across various categories, though most perform fewer than 20 procedures. Commonly used techniques include panoramic radiographs, while alginate impressions and advanced methods like digital imaging are less frequent. Male dentists have a strong correlation with high implant counts, while female dentists have a negative correlation. Those with a doctorate are more likely to perform over 20 implants, alongside those with over 10 years of experience. There is no significant link between male dentists and continuous digital diagnostics use, which is adversely affected by academic qualifications and experience. Panoramic radiograph use correlates positively with gender, degree, and experience, especially in dentists with more than 10 years of experience.

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CONFLICTS OF INTEREST

This study is not connected to any conflicts of interest.

AUTHOR'S CONTRIBUTION

Mohsen Ali Al-Hamzi writing original draft, methodology, investigation. Hassan Abdulwahab Al-Shamahy, Fuaad Ahmed Ali Al-kattaa: formal analysis, data curation, conceptualisation.

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