

# Professional and Demographic Influences on Impression Techniques and Soft Tissue Management Protocols in Contemporary Iraqi Dental Practice

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## Abstract

**Objective:** This study evaluated the effect of gender, dental specialty and clinical experience on impression practice decision and soft tissue management among Iraqi dentists using multivariable analytical methods.

**Methods:** A cross sectional survey was conducted among 345 Iraqi dentists. Data were collected from answer for questionnaire on impression materials, techniques, soft tissue management, and quality control practices. Chi-square tests measure bivariate associations, followed by multivariable binary and multinomial logistic regression analyses.

**Results:** Specialty demonstrated strong associations with impression material selection and soft tissue management decisions (likelihood-ratio  $\chi^2$  up to 50.438,  $P < 0.001$ ), whereas the effect of clinical experience varied across outcomes. Clinical experience was associated with impression material selection and soft tissue management in multivariable models but was not an independent predictor of digital impression adoption. Gender showed inconsistent associations across models. Digital impressions were used by 40.6% of participants; however, scanner use was not independently associated with impression task delegation (OR = 0.97,  $P = 0.921$ ). Impression material type emerged as the strongest factor associated with soft tissue management decisions (LR  $\chi^2 = 56.9$ ,  $P < 0.001$ ). Additionally, 4.1% of practitioners reported not routinely examining final impressions, a pattern observed predominantly among early-career dentists.

**Conclusion:** Impression-decision practice among the surveyed dentists were primarily associated with dental specialty and, to a variable extent, clinical experience, while gender showed limited and inconsistent effects. Impression material type emerged as the strongest practice-related factor associated with soft tissue management decisions.

**Keywords:** Dental impression materials, digital impression, prosthodontics, clinical experience, soft tissue management

## Introduction

Accurate final dental impressions are fundamental to the success of fixed prosthodontic, directly affected marginal fitness, occlusal accuracy, and long-term clinical survival. Errors in impression stage remain a major causes of prosthesis misfit, increased chairside adjustments and laboratory remakes, this underscoring the clinical importance of selection appropriate material and technique.<sup>1-3</sup>

Different type of impression materials and techniques is currently available, ranging from conventional hydrocolloids (alginate) and elastomeric systems to digital impression. While elastomeric materials demonstrate superior dimensional stability and detail reproduction, conventional materials (alginate) continue to be widely used due to low cost, operator familiarity and availability.<sup>4-6</sup> The adoption of digital impression systems (intra oral scanner) has increased globally; however, their utilization remains uneven and mostly dependent on dentist-related factors.<sup>7,8</sup>

Previous literature showed that practitioner characteristics, particularly dental specialty and clinical experience, affect impression-related decisions. Generally, Specialists and prosthodontists demonstrate higher adherence to recommended impression materials and structured techniques, whereas general practitioners and less experienced dentists tend to depend on simpler or more familiar approaches.<sup>9-12</sup> In contrast, the effect of gender on impression decisions has been inconsistent, with several studies observed minimal or no independent effect.<sup>13,14</sup>

In spite of these observations, the majority of previous studies are limited by small sample sizes, regional-based sampling and depend on simple univariate statistical analyses,

such as chi-square tests.<sup>11,12,15</sup> These methodological limitations do not allow making a significant evaluation of the relative effect of dental specialty, clinical experience, and gender as significant predictors. As a result, it is not yet clear which of these factors has the most significant impact on the choice of impression material and technique, especially in environments that may have disparate training backgrounds and resources.

Moreover, the evidence from Middle Eastern countries remains limited, and data from Iraq are especially limited. Since Iraqi dentists follow a variety of educational routes, clinical exposure, and availability of modern resources, a more detail analytical approach is needed to discover the independent influence of the practitioner-related variables.

Thus, the current study was designed to assess how dentist-related and practice-related factors influence impression-related clinical decision-making among Iraqi dentists using structured analytical methods to evaluate which factors most strongly shape clinical decision-making.

## Materials and Methods

### Study Design and Setting

This study was conducted as a cross-sectional survey to assess the impact of dental specialty, clinical experience, gender on impression material selection, impression techniques, soft-tissue management techniques, and use of digital impressions by Iraqi dentists. The data was collected between a period from 15/1/2025 to 15/2/2025, from the dentists working in specialized dental centers and private clinics in Baghdad/ Iraq.

## Population and Sampling of the Study

The target population include licensed Iraqi dentists who have been worked as general practitioner or specialist. Eligibility criteria, first: dentist with Bachelor of Dental Surgery (BDS) degree or either possession of Master of Science (M.Sc.) in conservative dentistry, prosthodontists. Second: current clinical practice within Iraq at the time of the study.

An exploratory cross-sectional design with convenience sampling was used, whereby eligible dentists who were available during the data collection period were invited to participate. In spite of this approach facilitated data collection, we acknowledge it carries an inherited risk of bias. A total of 550 eligible Iraqi dentist had been invited to enrolled in the study, however, only 345 were completed the survey, therefore the response rate was 62.7% for this survey. Non-participation was due to non-response during the data collection period. No a priori sample size or power calculation was done, as this study was designed as an exploratory survey aiming to describe the current clinical practices and discover associated factors among Iraqi dentists. Therefore, all eligible practitioners who answered the questionnaire during the study period were included in the analysis.

## Questionnaire Tools Validation and Development

The questionnaire was designed depend on a comprehensive review of literature and existing surveys on impression materials, and soft-tissue management. Its content validity was quantitatively assessed by five experts in conservative dentistry and prosthodontic, using the Content Validity Index (CVI). Each item was independently rated for relevance on a four-point Likert scale. The Item-Level CVI (I-CVI) was calculated as the proportion of experts rating an item as relevant (score 3 or 4), with a threshold of  $\geq 0.78$  for acceptance. The Scale-Level CVI (S-CVI/Ave), computed as the average of all I-CVI scores, was 0.933, indicating excellent content validity. Prior to main data collection, the questionnaire was pilot-tested by a group of 30 dentists to assess clarity, comprehensibility, and feasibility, leading to minor wording adjustments. As the instrument comprised discrete, categorical items measuring distinct clinical practices rather than a scale structure question, internal consistency reliability (e.g., Cronbach's alpha) was not applicable.

To understand the processes of decision-making, in relation to impression-taking processes in clinical practice, a structured self-administered questionnaire was created to measure clinical decision-making. There were four domains in the questionnaire: First, professional characteristics and demographic: gender and age and dental specialty and years of clinical experience. Second, impression making practices: frequency of impression-taking, impression material type, techniques and the use of digital impression systems. Third, soft tissue management: application of gingival retraction cords technique, management of thin gingival biotypes and how to deal with subgingival finishing line. Fourth, quality control and delegation practices: ways on how to examine final impression for errors and whether impression-taking was delegated of impression taking to dental assistants.

## Predictor Variable's Definition

Predictor variables consist of dentist-related factors which are (gender, dental specialty, and years of clinical experience) and practice-related factors which are (frequency of impression

taking, use of digital impression systems, and type of impression material used). Furthermore, Gender was recorded as male or female. Dental specialty was categorized as general practitioner, conservative dentistry specialist, or prosthodontist. Clinical experience was categorized into four groups ( $\leq 5$ , 6–10, 11–15, and  $>15$  years) based on clinical relevance and sample distribution.

Digital impression users were defined as practitioners who reported using intraoral scanners for final impressions. Delegation was dichotomized (always/sometimes vs. never) to facilitate regression modeling, acknowledging that this approach may reduce clinical nuance.

## Data Collection Procedure

Dentists who were eligible were invited to take part in this study After understanding the purpose of the study. Participation was voluntary and consent formed was received before starting the questionnaire answer. The responses were anonymous, and no personal information was gathered.

## Statistical Analysis

Questionnaires with missing outcome variables were excluded. The final dataset contained no missing data for the variables included in the statistical analyses.

Data were analyzed using IBM SPSS Statistics (version 26; IBM Corp., Armonk, NY, USA). Descriptive statistics were performed to obtain frequencies and percentages for categorical variables. A bivariate statistical analysis was done using chi-square tests of independence to find out unadjusted associations between demographic variables (gender, specialty, years of experience) and clinical decision outcomes.

Depending on the categorical structure of the outcome variables, various multivariate regression models were then used. In the case of binary outcome, such as delegation of impression taking was recorded as binary recorded (always, sometimes vs never) and choice of impression technique dichotomized into (one-step, two-step, monophasic: conventional vs digital), binary logistic regression equations were developed to estimate adjusted odds ratios (ORs) with *P*-value. These models were employed to determine independent predictors with the adjustment of possible confounding factors.

Multinomial logistic regression models were used for outcome variables with more than two nominal categories, which are impression material type, routine soft tissue management protocols, thin biotype management strategies and subgingival finishing line management approaches. The analysis was interpreted based on likelihood-ratio chi-square tests in order to identify the overall contribution of each predictor to the model fit, without comparison of categories.

## Predictor Selection in Multivariable Models

Predictor selection for multivariable models was selected based on clinical relevance and statistical considerations (significant in bivariate test). Dentist-related variables (gender, specialty, experience) were included across models, while practice-related variables (scanner use, impression material type, and impression frequency) were incorporated selectively according to outcome-specific clinical relevance.

## Ethical Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki and was reviewed and approved by the Research Ethics Committee of Mustansiriyah University under approval number Muopr 52.

## Results

### Sample Characteristics

A total of 550 eligible Iraqi dentists were invited to participate in the study; however, only 345 completed the survey, result in a response rate of 62.7%. Non-participation was due to non-response during the data collection period. No missing data were present in the variables included in the analysis. Females represented 52.2% of the sample, while males accounted for 47.8%. Approximately half of respondents were general practitioners (47.8%), followed by prosthodontic specialists (27.8%) and conservative dentistry specialists (24.3%). Most participants reported 0–5 years of experience (65.5%), with progressively smaller proportions reporting 6–10 years (18.0%), 11–15 years (6.7%), and more than 15 years of experience (9.9%). The over-representation of early-career dentists is a recognized characteristic of the accessible sampling frame and is addressed as a limitation in the discussion (Table 1).

### Bivariate Associations

Chi-square analyses demonstrated significant associations between dentist-related characteristics and impression-related practices. Impression material selection and impression technique differed significantly by gender, specialty, and clinical experience (all  $P < 0.001$ ) (Table 2). Similarly,

routine soft tissue management, thin biotype management, and subgingival margin handling showed significant variation across specialty and experience groups (all  $P \leq 0.05$ ) (Table 3). Quality control practices also differed significantly by gender, specialty, and experience (all  $P < 0.001$ ) (Table 4). Variables demonstrating significant bivariate associations, together with clinically relevant practice-related variables

Table 1. Descriptive characteristics of the study sample (N = 345)

Variable	Category	N	%
Gender	Male	165	47.8
	Female	180	52.2
Specialty	General Practitioner	165	47.8
	Conservative Specialist	84	24.3
	Prosthodontic Specialist	96	27.8
Years of Experience	0–5 years	226	65.5
	6–10 years	62	18.0
	11–15 years	23	6.7
	>15 years	34	9.9
Impression Material Used	Alginate	55	15.9
	Addition Silicone	81	23.5
	Condensation Silicone	32	9.3
	Silicone (general)	37	10.7
	Intraoral Scanner	140	40.6
Impression examination	By Eye	253	73.3
	By Magnification	78	22.6
	I don't examine it	14	4.1

Table 2. Chi-Square associations between dental related factors vs Impression material type and technique

	Gender			Specialty			Experience					
	Male%	Female%	P-value	GP %	C.%	P.%	P-value	A%	B%	C%	D%	P-value
<b>Which impression materials do you most commonly used for final impression?</b>			.001				.001					.001
Alginate	12.7	18.9		27.3	7.1	4.2		19.9	3.2	26.1	5.9	
Addition silicon	20.6	26.1		15.2	28.6	33.3		20.4	37.1	8.7	29.4	
Condensation silicone	12.1	6.7		6.1	21.4	4.2		7.5	14.5	26.1	0.0	
Silicone	3.6	17.2		13.9	7.1	8.3		16.4	0.0	0.0	0.0	
Intra oral scanner	50.9	31.1		37.6	35.7	50.0		35.8	45.2	39.1	64.7	
<b>What is the type of technique used in crown and bridge</b>			.001				.001					.001
One-step	7.9	14.4		16.4	0.0	12.5		12.8	11.3	4.3	5.9	
Two-step	39.4	37.2		37.6	35.7	41.7		38.1	37.1	30.4	47.1	
Monophase	0.0	12.8		3.0	21.4	0.0%		4.0	22.6	0.0	0.0	
Intra oral scanner	52.7	35.6		43.0	42.9	45.8		45.1	29.0	65.2	47.1	

Note: G.P = general practitioners, C = Conservative dentistry specialists, P = prosthodontic specialists, A = ≤5 years of clinical experience, B = 6–10 years, C = 11–15 years, D = more than 15 years of experience.

(scanner use, impression frequency and impression material type), were entered into multivariable models to identify independent predictors.

### Multivariable Predictors of Impression Delegation

Binary logistic regression models to identify independent predictors of impression delegation (always/sometimes vs never) with never delegate used as the reference category. The overall model demonstrated good fit (Omnibus  $\chi^2 = 58.583$ ,  $P < 0.001$ ) and moderate explanatory power (Nagelkerke  $R^2 = 0.209$ ). This suggests that delegation practices are influenced by practitioner characteristics rather than occurring randomly.

Clinical experience was independently associated with impression delegation, with less experienced dentists showing substantially higher odds of delegating impression taking compared with those with more than 15 years of experience (all  $P < 0.001$ ), indicating that delegation is more common Dentists with fewer than 15 years of experience. The large odds ratios observed for clinical experience likely reflect the low prevalence of delegation among dentists with more than 15 years of experience, resulting in inflated relative estimates when compared with less experienced groups. The wide confidence intervals indicate variability in effect size but consistently demonstrate a strong association.

Table 3. Chi-Square associations between dentist related factors vs soft tissue management

	Gender			Specialty			Experience					
	Male%	Female%	P-value	GP %	C. %	P. %	P-value	A%	B%	C%	D%	P-value
<b>Which soft tissue management techniques do you routinely use?</b>			.012				.005					.001
I do not do gingival retraction	14.5	19.4		18.8	14.3	16.7		19.9	3.2	30.4	14.7	
Retraction cord (single cord)	46.1	48.9		46.1	57.1	41.7		45.1	41.9	60.9	64.7	
Double cord technique	35.2	21.1		25.5	21.4	37.5		27.4	41.9	8.7	17.6	
Retraction past (cordless)	1.8	1.1		3.0	0.0	0.0		1.8	1.6	0.0	0.0	
Electrosurgery	1.2	4.4		2.4	7.1	0.0		1.3	9.7	0.0	2.9	
Laser tissue management	1.2	5.0		4.2	0.0	4.2		4.4	1.6	0.0	0.0	
<b>In cases of thin biotype gingiva, which technique do you prefer?</b>			.543				.047					.001
Single cord technique	38.8	42.8		44.2	42.9	33.3		42.9	38.7	8.7	52.9	
Retraction paste	18.8	20.6		14.5	28.6	20.8		16.4	40.3	0.0	17.6	
Retraction-surgery or laser	17.6	12.2		13.9	14.3	16.7		15.9	1.6	60.9	0.0	
I don't used retraction	24.8	24.4		27.3	14.3	29.2		24.8	19.4	30.4	29.4	
<b>For subgingival margins, your preferred approach is:</b>			.314				.033					.001
Double cord technique	49.1	41.1		49.1	35.7	45.8		46.0	58.1	34.8	20.6	
Single cord with hemostatic agent	33.9	34.4		30.3	42.9	33.3		28.3	30.6	39.1	76.5	
Retraction past	6.7	10.0		7.9	14.3	4.2		10.2	9.7	0.0	0.0	
I don't used retraction	10.3	14.4		12.7	7.1	16.7		15.5	1.6	26.1	2.9	

Note: G.P = general practitioners, C = Conservative dentistry specialists, P = prosthodontic specialists, A =  $\leq 5$  years of clinical experience, B = 6–10 years, C = 11–15 years, D = more than 15 years of experience.

Table 4. Chi-Square associations between dentist related factors vs quality control practices

	Gender			Specialty			Experience					
	Male%	Female%	P-value	GP %	C. %	P. %	P-value	A%	B%	C%	D%	P-value
<b>Did you examine final impression for any errors?</b>			.001				.001					.001
By Eye	58.2	87.2		89.1	35.7	79.2		77.4	83.9	69.6	29.4	
By Magnification	37.6	8.9		8.5	57.1	16.7		16.4	16.1	30.4	70.6	
I don't examine it	4.2	3.9		2.4	7.1	4.2		6.2	0.0	0.0	0.0	

Note: G.P = general practitioners, C = Conservative dentistry specialists, P = prosthodontic specialists, A =  $\leq 5$  years of clinical experience, B = 6–10 years, C = 11–15 years, D = more than 15 years of experience.

Table 5. Multivariable binary logistic regression analyses for impression-related decisions

Predictor	Comparison	Delegation of Impression Taking OR (95% C.I.)	P-value	Impression Selection (conventional Vs digital) OR (95% C.I.)	P-value
Gender	Female vs Male	1.451 (0.185–0.836)	.185	1.995 (1.213–3.282)	.007
Dental specialty	Conservative vs GP	4.837 (2.235–10.467)	.001	1.352 (0.678–2.696)	.392
	Prosthodontist vs GP	0.784 (0.446–1.381)	.400	0.826 (0.474–1.439)	.500
Clinical experience	0–5 years vs >15 years	41.519(8.438–204.291)	.001	0.943 (0.409–2.175)	.890
	6–10 years vs >15 years	60.153 (11.464–315.62)	.001	2.004 (0.762–5.275)	.159
	11–15 years vs >15 years	36.793 (6.252–216.534)	.001	0.495 (0.158–1.550)	.227
Impression frequency	Daily vs less frequently	1.550(0.637–3.772)	0.334	0.986 (0.441–2.205)	.972
	2–3 times/week vs less frequently	0.813 (0.432–1.531)	0.521	1.155 (0.632–2.113)	.639
	Once/week vs less frequently	1.114 (0.528–2.350)	0.776	0.603 (0.298–1.222)	.160
Scanner use	Yes vs No	0.973 (0.564–1.678)	0.921	-----	
Model fit statistics		Nagelkerke R <sup>2</sup> = 0.209 Omnibus $\chi^2$ = 58.583 P = 0.001		Nagelkerke R <sup>2</sup> = .092 Omnibus $\chi^2$ = 24.473 P = 0.004	

\* Odds ratios greater than 1 indicate increased likelihood of delegation. \*\*Odds ratios greater than 1 indicate increased likelihood of conventional impression use.

Specialty also remained significant after adjustment, with conservative specialists showing higher odds of delegation compared with general practitioners. This indicates that conservative specialists are substantially more likely than general practitioners to delegate impression taking as part of their routine clinical workflow. Gender, impression frequency, and scanner use were not independently associated with delegation in the adjusted model (Table 5).

### Multivariable Predictors of Impression Technique Selection

A separate binary logistic regression model evaluated predictors of impression technique selection (conventional vs digital) with digital impression used as the reference category. The model was statistically significant (Omnibus  $\chi^2$  = 24.473,  $P$  = 0.004), although explanatory power was limited (Nagelkerke  $R^2$  = 0.092). This suggests that impression technique selection is only partially explained by dentist-related characteristics, additional clinical or contextual factors also play an important role which not include in our study.

Gender emerged as the only independent predictor. Female dentists demonstrated higher odds of using conventional impression techniques compared with male dentists, Specialty, clinical experience, and impression frequency were not independently associated with impression technique selection after adjustment (Table 5).

### Multinomial and Likelihood-Ratio Analyses

In multinomial logistic regression models assessing impression material selection, likelihood-ratio tests demonstrated significant independent effects of specialty, clinical experience, and gender. Frequency of impression taking did not significantly contribute to the model ( $P$  = 0.072) (Table 6). This indicates that impression material selection is primarily influenced by dentist related factors rather than by how frequently impressions are taken.

For soft tissue management decisions, likelihood-ratio tests indicated that specialty, clinical experience, impression

Table 6. Likelihood-ratio tests for multivariable models predicting impression material selection

Effect	Impression material type LR $\chi^2$ (df)	P-value
Specialty	60.874 (8)	.000
Gender	16.437 (4)	.002
Experience years	68.513 (12)	.000
Frequency of impression taking	19.772 (12)	.072

frequency, and impression material type were significant contributors across routine management, thin biotype management, and subgingival margin management models (all  $P \leq 0.05$ ). Gender showed a significant association only with routine soft tissue management (Table 7). This indicates that soft tissue management choices vary systematically according to dentist related factors and clinical related practices, while gender plays a limited role confined to routine management decisions.

## Discussion

The purpose of this study was to evaluate the impact of dentist related factors and practice related factors on impressions-based decisions and soft tissues management among Iraqi dentists. The finding suggest that experience and specialty together determine the pattern of final impression making among Baghdad – Iraq dentist.

Specialty was associated with differences in impression material selection, with specialists tending to prefer elastomeric materials, whereas general practitioners more frequently relied on alginate. This is consistent with the previous literature suggest that specialists are more likely to adopt material and techniques that facilitate achieved well defined finishing line compared with general practitioners, and specialty was closely associated with clear margins in fixed prosthesis impressions.<sup>11</sup> Similar trends have been observed in

Table 7. Likelihood-ratio tests for multivariable models predicting soft tissue management decisions

Effect	Routine soft tissue management choice LR $\chi^2$ (df)	P-value	Thin biotype management choice LR $\chi^2$ (df)	P-value	Subgingival finishing line management LR $\chi^2$ (df)	P-value
Specialty	18.964 (10)	0.041	18.032 (6)	0.006	9.574 (6)	0.144
Gender	14.684 (5)	0.012	0.797 (3)	0.850	6.879 (3)	0.076
Experience years	27.176 (15)	0.027	61.304 (9)	<0.001	50.438 (9)	<0.001
Frequency of impression taking	33.807 (15)	0.004	38.891 (9)	<0.001	24.900 (9)	0.003
Type of impression material	56.890 (20)	<0.001	43.614 (12)	<0.001	50.662 (12)	<0.001

studies from India, where advanced materials and techniques were greater used among prosthodontists compared to general practitioners.<sup>12</sup> These differences may reflect variation in postgraduate training, clinical exposure, and resource considerations, cost and availability, rather than inherent preference.

The regression analysis showed that dental specialty was associated with selection of material type and impression task delegation, with conservative specialists were more likely to delegate than general practitioners. However, the wide confidence interval indicates variability in delegation association, which may be partly attributable to reflecting differences in practice settings, workload, availability of trained auxiliary staff and imbalance in subgroup sample sizes. Accordingly, this finding should be interpreted cautiously, as it does not imply causality and may be influenced by unmeasured contextual factors.<sup>9,16</sup>

In bivariate comparison clinical experience was associated with impression material type choice, and soft tissue management. A higher proportion of dentists with more than 15 years of experience reported using digital impressions compared with early-career dentists. This descriptive pattern contrasts with reports from other countries, where younger dentists are expected to adopted new technologies.<sup>17</sup> Furthermore, previous research observed such association between experience, education and impression materials or techniques selection.<sup>10,18</sup>

However, bivariate analyses suggested higher digital impression use among dentists with more than 15 years of experience, such association did not remain significant after multivariable adjustment. This indicates that the appear experience-related difference is likely confounded by factors such as specialty and practice context rather than reflecting an independent effect of clinical experience. Furthermore, wide confidence intervals were observed in this associations, which indicate substantial variability and limited precision in the effect estimates. This imprecision may be partly due to differences in practice environments, workload distribution, availability of trained auxiliary staff, and imbalance in sample subgroup sizes, specially within > 15 year of experience category. Accordingly, these findings must be interpreted cautiously and shouldn't be consider as evidence of a strong or causal relationship.<sup>16,19</sup>

Furthermore, Dentists with fewer than 15 years of experience showed higher tendency of delegating impression taking than those with more than 15 years; however, the wide confidence intervals indicate limited precision, likely due to small subgroup sizes and practice-related heterogeneity rather than a true causal effect.<sup>9,16</sup>

Experience in multinomial analysis had associate to impression material selection and soft tissue management. These findings are aligned with previous literatures which suggest that more experienced clinicians may prefer multi-step and elastomeric procedures due to accumulate clinical familiarity and perceived reliability over time.<sup>15,17,20</sup> However, the predominantly of early-career dentists in our study sample may have influenced the observed experience patterns. Consequently, findings may not fully represent the practices of dentists with greater clinical experience. Therefore, caution is warranted when generalizing these results.

Gender was correlated with differences in impression material type, impression technique and routine soft tissue management practices. Regression analysis indicate an association between gender and selection of digital impression techniques. These findings differ with the several international researches that reported minimum or no gender related influence on impression decisions.<sup>9,11,17</sup> However, some regional researches have outlined that there are gender-related variations: in certain aspects of impression procedures, including laboratory-based observations from Yemen and survey-based findings from Saudi Arabia.<sup>13,14</sup> However, previous evidence suggests that gender-related variations may appear in specific procedural aspects rather than representing generalized practice behaviors.<sup>11</sup>

In this survey, small proportion of dentists reported not routinely checking final impressions, which indicating a potential gap in quality control. Importantly, bivariate analysis showed that dentists who reported not routinely checking final impressions were mostly within the less experienced dentist. This finding is clinically relevant, as previous studies have observed that early-career dentists may be more susceptible to impression-related errors, particularly when using elastomeric materials.<sup>11,12,14</sup>

When practice-related factors (frequency of impression taking, use of digital impressions, and impression material type) were entered into the multivariable analysis, impression material type emerge as the strongest predictors of soft tissue management decisions. This finding suggests that clinicians primarily adapt soft tissue management procedure according to the technical requirements of the selected impression material. This interpretation is consistent with previous evidence indicating that elastomeric materials generally require strict moisture control, whereas digital impression necessitate a clean, dry, and blood-free field to minimize optical interference.<sup>21,22</sup>

Digital impression adoption was comparatively high in our sample, this reflecting a notable step toward digital workflows in Iraqi dental practice. However, in spite of this growing adoption, the use of digital impressions did not independently associate with impression task delegation in the multivariable model.<sup>23</sup> This suggests that while digital technologies are increasingly integrated into clinical practice, delegation behaviors are likely shaped by other organizational and contextual factors not captured in the present study.<sup>17</sup>

Generally, the findings of our research highlight the importance of targeted continuing education, especially for general practitioners and dentists in the early stages of their careers, to improve impression practices and reduce procedural errors. The observed variation pattern across specialties and experience suggests that specific training programs may help standardize impression techniques and enhance overall quality within the profession. Considering the importance of impression accuracy in prosthodontic procedures, continued training in material selection, technique refinement, and quality control may be beneficial.<sup>14,18,22</sup>

## Limitations of this Study

In this research has several limitations. First, the use of convenience sampling may have introduced selection bias, as participation was limited to dentists who were accessible and willing to respond during the data collection period. Although the response rate (62.7%) is comparable to similar questionnaire-based dental studies, non-responders may differ systematically from responders in terms of workload, practice setting, or adoption of advanced technologies, which could have influenced the observed association. Consequently, the sample of our study may not be fully representative of the whole population of Iraqi dentists, and the findings should be interpreted with caution considering their generalizability.

Second, early-career dentists were overrepresented in the sample, with 65.5% having fewer than five years of clinical experience. This imbalance may have influenced the observed prevalence of certain clinical practices and further limits the generalizability of the results to more experienced practitioners.

Third, the absence of an a priori sample size or power calculation may have reduced the ability to detect smaller effect sizes.

Finally, this study did not account for differences related to practice setting (public versus private sector) or geographic location (urban versus rural), factors that may influence clinical decision-making and practice pattern.

## Conclusion

Dental-related factors, including specialty, experience, and gender, were influence impression-related practices and soft tissue management among Iraqi dentists. Specialty showed consistent associations with impression material selection, and soft tissue management procedures, whereas the effect of clinical experience varied across outcomes. Notably, clinical experience was not an independent predictor of digital impression adoption after multivariable adjustment. Gender reported limited and inconsistency effect.

With respect to practice-related factors, impression material type was emerged as strongest predictor associated with soft tissue management decisions. Although the use of digital impressions was relatively high among participants, digital impression user showed unrelated association to impression task delegation.

In addition, a quality control gap was identified, as small proportion of practitioners reported not routinely examining final impressions, this pattern predominantly among less experienced dentists.

## Competing Interests

Authors declare that they have no competing interests.

## Data Availability

The data that support the results of this study are available from the corresponding author upon reasonable request.

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