RADIOGRAPHIC ASSESSMENT PRACTICES AND KNOWLEDGE OF RETROGRADE PERI-IMPLANTITIS AMONG PAKISTANI DENTISTS: A CROSS-SECTIONAL STUDY

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ABSTRACT
Background: Radiographic assessment is vital in implant dentistry to evaluate osseointegration, detect peri-implant bone loss, and identify pathology such as retrograde peri-implantitis (RPI) (1,2). Radiographs play a critical role in determining implant prognosis and in postoperative follow-up (3).
Objective: To evaluate radiographic assessment practices and the level of knowledge among Pakistani dentists regarding the recognition of retrograde peri-implantitis.
Methods: A cross-sectional study was conducted among 100 dental practitioners using a structured questionnaire. Data were analyzed using SPSS version 25. Descriptive statistics and chi-square tests were applied, with $p < 0.05$ considered significant (4).
Results: Half of the respondents were aged 45–64 years, and 60% were male. Panoramic radiographs were the most commonly used imaging modality after implant placement (55%), followed by periapical radiographs (30%) and CBCT (15%). Significant associations were found between radiograph preference and clinician experience, age, and implant load ($p < 0.05$). Only 26% took radiographs at prosthesis delivery. Forty-seven percent correctly identified apical radiolucency as a sign of retrograde peri-implantitis (5).
Conclusion: The study highlights variable radiographic practices and limited awareness regarding retrograde peri-implantitis among dental practitioners. Training in evidence-based imaging protocols and early detection of peri-implant pathology is essential to improve outcomes (6).

Key Words: Implant dentistry, Osseointegration, Peri-implant bone loss, Pakistani dentists

INTRODUCTION

Dental implants are a widely accepted treatment for missing teeth, offering high long-term success rates when biological and mechanical factors are properly maintained (7). Radiographic evaluation is a key component for implant placement, postoperative assessment, and maintenance (8,9). Periapical and panoramic radiographs are routinely used to monitor osseointegration, marginal bone loss, and implant–bone contact, while CBCT provides three-dimensional visualization for more detailed diagnosis (10,11).

Retrograde peri-implantitis (RPI) is a pathologic condition characterized by apical bone loss while maintaining coronal osseointegration (12). It is usually identified radiographically as an apical radiolucency and may be associated with overheating during drilling, pre-existing infection, or contamination of implant surfaces (13,14). Early radiographic detection of such lesions prevents implant failure (15).

Several studies have shown that the radiographic practices of dental clinicians vary widely between regions and experience levels (16,17). While advanced imaging such as CBCT provides superior detail, its use is limited by cost and radiation exposure (18,19). In Pakistan, there is limited literature regarding radiographic assessment trends and awareness of RPI among general dental practitioners (20). The **rationale** of this study was to identify current radiographic practices, preferred imaging modalities, and diagnostic understanding of RPI among Pakistani dentists.

The **objective** was to evaluate radiographic assessment practices and to correlate knowledge of RPI recognition with demographic factors such as age, gender, clinical experience, and annual implant workload.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted among 100 practicing dentists. A structured and validated questionnaire adapted from previous studies (21,22) was distributed both electronically and in person. The questionnaire consisted of demographic details and 3 main questions related to radiographic assessment after implant placement and RPI identification.

Data Analysis

Data were entered and analyzed using SPSS version 25. Chi-square tests were applied to evaluate associations between demographic variables and responses. Statistical significance was set at $p < 0.05$ (23).

RESULTS

Table 1. Demographic characteristics of respondents (n = 100)

Variable	Category	n	%
Gender	Male	60	60.0
	Female	40	40.0
Age (years)	< 30	18	18.0
	30–44	26	26.0
	45–64	50	50.0
	> 65	6	6.0
Experience (years)	< 5	27	27.0
	5–9	8	8.0
	10–19	30	30.0
	> 19	15	15.0
Implants per year	0	16	16.0
	< 20	19	19.0

Variable	Category	n	%
	20–80	43	43.0
	> 80	22	22.0

Half the respondents were aged 45–64 years, and 43% placed 20–80 implants annually. These demographic trends resemble those seen in similar studies among Middle Eastern and Asian dentists (24,25).

Table 2. Preferred radiograph after implant placement (Question 1) compared with demographic variables

Variable	Category	Pan	Peri	CBCT	p value
Gender	Male	30	20	10	0.469 (NS)
Female		25	10	5	
Age	< 30	8	0	10	0.000 *
30–44		11	15	0	
45–64		31	15	4	
> 65		5	0	1	
Experience	< 5	10	3	14	0.000 *
5–9		0	7	1	
10–19		7	10	0	
> 19		28	10	0	
Implants / year	0	0	3	13	0.000 *
< 20		9	8	2	
20–80		43	0	0	
> 80		3	19	0	

Panoramic radiographs dominated overall (55%), consistent with previous findings in regional studies (26). Significant differences were noted for age, experience, and implant workload, whereas gender showed no statistical difference.

Table 3. Timing of postoperative X-ray (Question 2) compared with demographic variables

Variable	Category	Other	Correct (at prosthesis delivery)	p value
Gender	Male	46	14	0.457 (NS)
Female		28	12	
Age	< 30	1	17	0.000 *
30–44		17	9	
45–64		50	0	
> 65		6	0	

Only 26% of respondents took postoperative radiographs at prosthesis delivery — below the recommended standards (27,28). This highlights the gap between knowledge and routine clinical practice, also observed in similar cross-sectional studies (29).

Table 4. Radiographic recognition of retrograde peri-implantitis (Question 3)

Variable	Category	No	Radio-opaque	Radiolucent apical (Correct)	Radiolucent lateral	p value
Gender	Male	8	6	32	14	0.350 (NS)
	Female	8	3	15	14	
Age	< 30	0	8	10	0	0.000 *

Overall, 47% correctly identified apical radiolucency as indicative of RPI, comparable to findings by Reiser et al. (30) and Kato et al. (31). Knowledge of RPI correlated significantly with age, experience, and implant load, but not with gender.

DISCUSSION

In the present study, panoramic radiographs were most preferred, similar to the trends reported by Al-Dosari et al. (32) and Awooda et al. (33). This reflects that panoramic imaging remains a first-line modality for implant evaluation due to accessibility and cost-effectiveness (34).

However, evidence suggests that periapical and CBCT imaging provide superior accuracy for assessing marginal bone levels and detecting early peri-implant pathology (35,36). The limited use of CBCT (15%) in this study mirrors findings from studies in India and Saudi Arabia, where financial constraints and radiation concerns reduced its routine use (37,38).

Only 26% of respondents took radiographs at prosthesis delivery, which is significantly lower than the standards recommended by the European Association for Osseointegration (39). Similar deficits in radiographic follow-up were reported by Al-Harthi et al. (40) and Prithviraj et al. (41).

Nearly half (47%) correctly identified apical radiolucency as a feature of RPI. This indicates moderate awareness, consistent with Reiser et al. (30) and Sarmast et al. (42), who also found that diagnostic understanding of RPI among general practitioners remains limited.

Compared with studies in developed regions, such as Meijer et al. (43) and Bornstein et al. (44), our participants showed lower diagnostic confidence — possibly due to differences in continuing education opportunities and access to CBCT imaging.

The variation between this study and international findings may also reflect differences in dental curricula and the availability of advanced imaging modalities in Pakistan (45).

Limitations

This study was conducted among a limited sample of 100 dentists within a single country, which may not represent the entire dental community. Only self-reported practices were recorded, which might not reflect actual clinical behavior.

Implications

The study highlights the need for enhanced training and continuing education programs focusing on evidence-based radiographic protocols and peri-implant disease recognition. Greater accessibility to CBCT and inclusion of radiographic interpretation modules in dental curricula are recommended (46,47).

CONCLUSION

This study revealed that panoramic radiographs remain the most common imaging modality after implant placement, with limited adherence to follow-up imaging guidelines. Knowledge of retrograde peri-implantitis was moderate, and diagnostic accuracy increased with experience and implant workload. Continued professional education and standardization of radiographic practices are essential to improve early detection and management of peri-implant pathology.

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