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Knowledge and Perception of Occlusion among Dentists in Aden, Yemen: A Cross-Sectional Study

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ABSTRACT

Background: Occlusion is vital in dental diagnosis and treatment, yet little is known about dentists' knowledge and practices in resource-limited settings such as Aden, Yemen.
Objective: To assess the knowledge and perception of occlusion among dentists in Aden and identify gaps related to training, tools, and clinical practice.
Methods: A cross-sectional study was conducted in 2025 involving 188 licensed dentists selected through stratified random sampling. Data were collected using a validated questionnaire assessing knowledge (15 MCQs), clinical practices, and perceived barriers. Analysis included descriptive statistics, chi-square tests, and logistic regression ($p < 0.05$).
Results: Only 41.5% accurately defined the centric relation. Dentists with postgraduate training were 3.2× more likely to understand functional occlusion ($p < 0.001$) and had 22% higher knowledge scores ($t(186) = 4.1$, $*p* < 0.001$). A hierarchical regression model confirmed that receiving training ($\beta = 0.38$, $*p* < 0.001$) and having tools available ($\beta = 0.29$, $*p* = 0.002$) were significant predictors of higher self-reported confidence in occlusal management, explaining 37% of the variance (Adjusted $R^2 = 0.37$, $F(5,179) = 18.6$, $*p* < 0.001$). . Public-sector dentists reported significant resource limitations, including a lack of articulators (68% vs. 29% in private clinics). Only 9.8% use digital tools.
Conclusion: Knowledge and practice gaps were associated with limited training and resources. Dentists with postgraduate training were 3.2× more knowledgeable, and public-sector clinicians faced major resource shortages. Curricular improvement and wider access to digital tools are recommended.

Keywords: Occlusion; Dental Education; Clinical Practice; Digital Tools; Yemen.

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INTRODUCTION

Occlusion, defined as the static and dynamic contact between the maxillary and mandibular teeth, is central to functional and restorative dentistry [1]. Its role spans mastication, speech, and prevention of temporomandibular disorders (TMDs) [2–4]. Bilateral temporomandibular joint (TMJ) subluxation, defined by excessive anterior displacement of the condyle beyond the articular eminence, compromises essential functions such as mastication, speech, and occlusion [5]. Malocclusion and poor occlusal management can lead to tooth wear, pain, and prosthetic failure [6,7]. Despite advancements in occlusal diagnostics, particularly digital technologies like T-Scan and intraoral scanners [8–11], adoption remains low in resource-limited areas due to training and financial constraints [12,13].

Globally, several studies have reported persistent gaps in dentists' understanding and application of occlusal principles, even in high-income settings where advanced training and digital tools are available [14–18]. These competency gaps often translate into diagnostic inconsistencies, treatment failures, and limited integration of evidence-based occlusal concepts into daily practice [19–21]. In low- and middle-income countries, such as Yemen, these challenges are further compounded by constrained educational infrastructure, limited continuing professional development opportunities, and uneven access to digital diagnostic technology. The result is a pronounced disparity in clinical confidence and resource utilization between well-equipped urban practices and under-resourced public clinics.

In Yemen, no previous study has evaluated dentists' understanding of occlusion. This study aimed to assess knowledge and perception of occlusion among dentists in Aden, Yemen, and explore the influencing factors, including postgraduate training, practice sector, and access to digital diagnostic tools.

METHODS

Study Design and Setting

A descriptive cross-sectional study was conducted among licensed dentists in Aden, Yemen, from January to April 2025.

Participants and Sampling

The sample size was calculated to be 188 dentists using a formula for cross-sectional studies, with a 95% confidence level, 5% margin of error, and an assumed population proportion of 50% to ensure maximum variability. Participants were selected via stratified random sampling from private clinics, public hospitals, and academic institutions to ensure representative distribution.

Inclusion criteria required dentists to have at least one year of active practice and to provide informed consent. Dentists who submitted incomplete questionnaires (<80% completion) or were not in active practice were excluded. An 80% completion threshold was selected to ensure data reliability and minimize missingness bias.

Data Collection Tool

A structured, pre-validated questionnaire was used, comprising four sections:

1. Demographic and professional details.
2. Knowledge: Assessed by 15 multiple-choice questions.
3. Perceptions: Measured on a 5-point Likert scale (5 items).
4. Clinical Practices: Questions on assessment frequency and tools.

The questionnaire was adapted from previously published studies on occlusal knowledge and perception, then reviewed by a panel of five prosthodontic experts from the University of Science and Technology (Yemen) and National Ribat University (Sudan) to ensure content and face validity. Following expert feedback, minor wording and sequencing adjustments were made.

A pilot test was conducted on 20 licensed dentists who were not part of the main study to assess clarity, relevance, and completion time. Based on their feedback, ambiguous items were refined. The final questionnaire's reliability was confirmed with good internal consistency (Cronbach's $\alpha = 0.82$ for the knowledge scale and 0.76 for the perception scale).

Data Analysis

Data were analyzed using SPSS version 28. Descriptive statistics, Chi-square tests, independent t-tests, and logistic regression were employed, with a statistical significance level set at $p < 0.05$.

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Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of the University of Science and Technology (Ref: UST/DENT/2025-03). Participant anonymity and confidentiality were maintained throughout the study.

RESULTS

This cross-sectional study evaluated the knowledge, perceptions, and clinical practices related to occlusion among 188 dentists in Aden, Yemen (response rate: 89.5%). Key findings revealed significant associations between advanced training, access to technology, and superior occlusion-related outcomes. Detailed demographic characteristics are presented in Table 1.

Table 1: Demographic Characteristics of Participating Dentists, (n = 188).

Variable	Category	n (%)
Age	25–34 years	118 (62.8%)
	35–44 years	52 (27.7%)
	≥45 years	18 (9.5%)
Education	BDS	140 (74.5%)
	Master's/PhD	48 (25.5%)
Practice Setting	Private	126 (67.0%)
	Public	62 (33.0%)

Knowledge of Occlusion and Associated Factors

Overall, knowledge of fundamental occlusion concepts was limited. Only 41.5% (n=78) of participants correctly defined centric relation. A binary logistic regression identified postgraduate training as the strongest significant predictor of high knowledge scores (adjusted OR = 3.2, 95% CI: 1.7–5.9, *p* < 0.001) (Table 2). Specialists (e.g., prosthodontists, orthodontists) demonstrated significantly higher knowledge than general dentists (68.2% vs. 32.1%, *p* = 0.003). Access to digital tools was also a significant positive predictor (*p* = 0.028).

Table 2: Logistic Regression Analysis of Predictors for High Occlusion Knowledge Score.

Predictor	Adjusted Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Postgraduate training	3.2	1.7–5.9	<0.001*
Digital tool access	2.1	1.1–4.0	0.028*
Practice in the private sector	1.8	0.9–3.5	0.089

Note: * statistically significant.

Clinical Practices and Access to Technology

A substantial disparity in access to essential equipment was observed. Dentists in public clinics were significantly more likely to lack articulators (68%) compared to those in private clinics (29%) ($\chi^2(1) = 24.7$, *p* < 0.001) (Figure 1). The use of digital occlusal tools (e.g., T-Scan, intraoral scanners) was very low overall (9.8%, n=18). (Figure 2).

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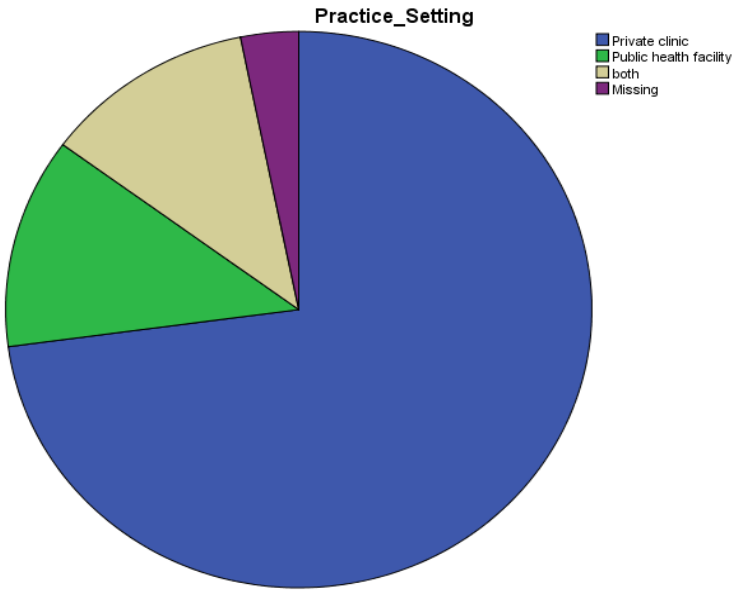

Figure 1: Percentage of Dentists Lacking Access to an Articulator, by Practice Setting (n=188). A significantly higher proportion of dentists in public hospitals reported a lack of access compared to those in private clinics ($\chi^2(1) = 24.7$, ***p* < 0.001).

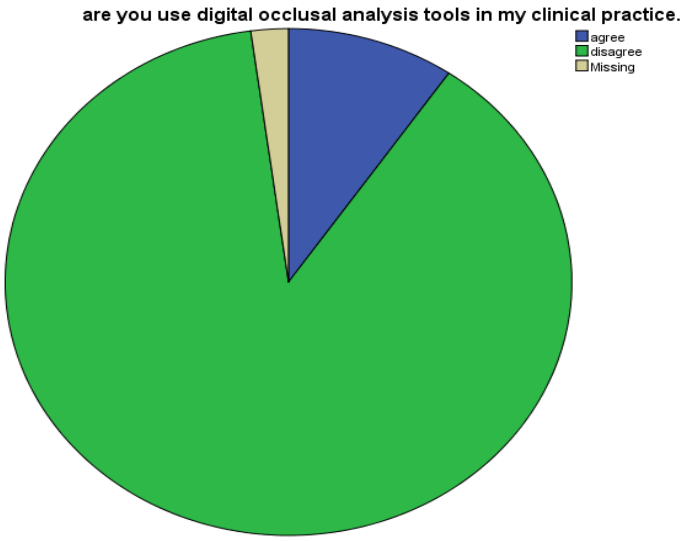

Figure 2: The use of digital occlusal analysis tools in participants' clinical practice. Only 9.8% (n=18) use digital tools.

Perceptions, Confidence, and the Role of Training

Formal training was a critical factor influencing practice and confidence. Dentists with training were 3.2 times more likely to routinely assess occlusion (*p* < 0.001) and had 22% higher knowledge scores (t (186) = 4.1, *p* < 0.001). A hierarchical regression model confirmed that receiving training (β = 0.38, *p* < 0.001) and having tools available (β = 0.29, *p* = 0.002) were significant predictors of higher self-reported confidence in occlusal management, explaining 37% of the variance (Adjusted R^2 = 0.37, F(5,179) = 18.6, *p* < 0.001) (Table 3). Furthermore, perception of occlusion's importance was significantly higher among dentists with doctoral-level qualifications (F (2,176) = 5.6, *p* = 0.004).

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Table 3: Hierarchical Regression Analysis Predicting Confidence in Occlusal Management.

Step	Predictor	β	p-value	ΔR^2
1	Demographics	0.12	0.15	0.04
2	Training Received	0.38	<0.001*	0.22
3	Tool Availability	0.29	0.002*	0.11

Final Model: Adjusted $R^2 = 0.37$, $F(5,179) = 18.6$, $p < 0.001$.
Note: β = standardized beta coefficient; ΔR^2 = change in explained variance. * statistically significant.

DISCUSSION

This study provides the first systematic analysis of occlusal knowledge, perceptions, and practices among dentists in Aden, Yemen. The findings reveal significant gaps between theoretical understanding and clinical application, primarily influenced by educational background, access to technology, and practice setting. The discussion is organized around the core themes of education, clinical practice, technology, resources, and research to logically frame the implications.

A primary finding is the critical role of formal education in shaping occlusal competency. Recent graduates showed better theoretical knowledge, reflecting modern curricula that incorporate evidence-based occlusal concepts [1, 14]. However, this knowledge often does not translate into consistent practice, highlighting the need for supervised, hands-on experience [4, 14]. Structured training is essential for diagnostic precision [18, 22].

Clinical use of occlusal principles remains limited by a pronounced technology divide. Adoption of digital occlusal analysis tools is low, despite strong evidence that they improve diagnostic accuracy [13–18]. Barriers such as cost and inadequate training are significant [7]. Public dentists lack articulators more often than private dentists, compromising outcomes [11, 19, 22].

Formal training and access to diagnostic tools predict proficient practice. Continuous professional development programs focusing on occlusion and TMDs are needed [21, 23]. Policies must also address resource inequities between public and private sectors to ensure equitable access to articulators and digital diagnostic systems [24].

Clinically, imbalanced or excessive occlusal load remains a key contributor to structural changes in the tooth-supporting apparatus. For instance, hypercementosis —the abnormal thickening of cementum at the tooth root apex—has been linked to chronic occlusal stress and traumatic bite forces. Its occurrence, although uncommon, serves as a biological indicator of the consequences of unmonitored occlusal load, underscoring the necessity for accurate occlusal assessment and force calibration [26]. Future studies should evaluate the effectiveness of educational interventions and low-cost digital tools that can enhance diagnostic precision and reduce occlusal overload, particularly in low-resource clinical environments [7, 19].

Limitations

This study has several limitations that should be acknowledged. First, as a descriptive cross-sectional design, it identifies associations between training, access to digital tools, and knowledge levels but cannot establish causal relationships. Longitudinal or interventional studies would be necessary to confirm the direction of these effects.

Second, although the response rate was high (89.5%), the possibility of non-response bias cannot be fully excluded. Dentists who were more interested or confident in occlusal concepts may have been more likely to participate, potentially overestimating knowledge and perception levels. Future research employing randomized or multi-phase designs could minimize these biases and strengthen generalizability.

CONCLUSION

This study identifies a substantial disparity in occlusal knowledge and practice among dentists in Aden, driven predominantly by gaps in education and unequal access to diagnostic technology. Dentists with postgraduate training were 3.2 times more likely to demonstrate adequate occlusal knowledge, while those in public-sector clinics reported a 68% higher rate of resource shortages compared to their private-sector counterparts.

These findings imply that improving patient care requires a dual strategy: mandating enhanced, practical occlusion training and strategically

allocating resources to mitigate technological inequities. We therefore call upon dental educators, professional associations, and health policymakers to collaborate on standardizing occlusal education and increasing the availability of essential diagnostic tools to ensure higher standards of restorative and prosthetic care across all sectors.

Conflict of Interest

The authors declare that there is no conflict of interest.

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