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A Comparative Study of Zirconia and Lithium Disilicate (E-Max) Preferences Among Dental Practitioners in Western Libya

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ABSTRACT

Purpose: This study investigated comparative preferences between all-zirconia, layered zirconia, and lithium disilicate materials among dental practitioners in four western Libyan cities.

Materials and Methods: A cross-sectional questionnaire survey was administered to 133 dentists and dental technicians in Misurata, Tripoli, Zawiya, and Sabratha between August and September 2022. The survey assessed material preferences for single-unit crowns on a posterior tooth (#19) and an anterior tooth (#8), alongside demographic and professional characteristics. Data were analyzed using SPSS version 25, with chi-square tests determining statistical significance ($p<0.05$).

Results: Of 133 distributed questionnaires, 113 (85.0%) were completed and included in analysis. For posterior tooth #19, 73.5% preferred all-zirconia, 15.9% layered zirconia, and 10.6% lithium disilicate. For anterior tooth #8, preferences shifted dramatically: lithium disilicate was favored by 66.4%, followed by all-zirconia (18.6%) and layered zirconia (15.0%). Significant inter-city variations were observed ($p<0.001$), with Zawiya practitioners demonstrating higher utilization of lithium disilicate for anterior restorations and layered zirconia for both regions compared to other cities. Most respondents (67.8%) cited mechanical strength as the primary factor for posterior material selection, while 31.4% prioritized aesthetic properties for anterior restorations.

Conclusion: Libyan dental practitioners demonstrate distinct material selection patterns based on tooth location, favoring all-zirconia for posterior regions and lithium disilicate for anterior aesthetics. However, knowledge disparities exist between cities, indicating need for standardized continuing education on material properties and clinical indications. *(Open J Biomed Res 2025;4:2-6)*

Keywords

Zirconia, Lithium Disilicate, E-Max; Material Preference, Dental Ceramics, Libya.

AUDIOABSTRACT

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INTRODUCTION

Restorative dentistry has evolved significantly with the introduction of metal-free ceramic systems that offer superior aesthetics and biocompatibility. For decades, porcelain-fused-to-metal (PFM) restorations represented the gold standard, combining adequate strength with reasonable aesthetics.[1] However, increasing patient demand for highly aesthetic, metal-free alternatives has driven adoption of all-ceramic systems, particularly zirconia and lithium disilicate ceramics. [2,3]

Zirconia-based ceramics are available in two primary configurations: monolithic (all-zirconia) and layered zirconia. Monolithic zirconia offers exceptional flexural strength (exceeding 1,200 MPa) and minimal tooth reduction requirements, making it particularly suitable for posterior applications where occlusal forces are greatest.[4] Layered zirconia combines a high-strength zirconia core with aesthetic veneering porcelain, providing improved translucency for anterior regions while maintaining satisfactory mechanical properties.[5]

Lithium disilicate glass-ceramics (commercially known as E-Max) demonstrate superior optical properties with higher translucency that closely mimics natural dentition, though with lower flexural strength (approximately 440 MPa) compared to zirconia.[6] This material is particularly indicated for anterior restorations where aesthetic demands supersede functional requirements.[7]

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Despite established material properties, clinical selection often depends on practitioner knowledge, experience, and regional availability. In Libya, limited data exists regarding material preferences and awareness levels among dental professionals. Understanding these patterns is crucial for identifying educational needs and improving restorative outcomes. This study aims to delineate preferences between zirconia and lithium disilicate materials among dental practitioners in Western Libya and evaluate factors influencing their clinical decisions.

MATERIALS AND METHODS

Study Design and Population

This cross-sectional survey study targeted dental practitioners (Dentists and Dental Technicians) working in private clinics across four major western Libyan cities: Misurata, Tripoli, Zawiya, and Sabratha. The study was conducted between August and September 2022 and received ethical approval from the University of Zawia Faculty of Medical Technology.

Questionnaire Development

A self-structured questionnaire was developed based on previous studies[8] and expert consensus. The instrument consisted of two sections:

Demographic and professional data:

- Gender, age group, and professional qualification (General Practitioner vs. Specialist).
- Years of professional experience.
- Weekly working hours.
- Clinic location type (Urban, Suburban, Rural).

Clinical material preferences:

Data were statistically analyzed by using IBM Practitioners were presented with a standardized clinical scenario describing a 40-year-old male patient with low caries risk, satisfactory occlusion, minimal wear, and adequate financial resources. They were asked to select their preferred material for:

- Single-unit crown on tooth #19 (lower left second molar).
- Single-unit crown on tooth #8 (upper right central incisor).

Response options included: All-zirconia (e.g., Bruxzir), Layered zirconia (e.g., Lava), and Lithium disilicate (e.g., E-Max). Participants were requested to provide brief justifications for their selections.

Data Collection

Questionnaires were distributed to 133 dental practitioners through direct clinic visits. Researchers provided verbal explanations regarding study objectives and obtained informed consent. Participants completed forms either immediately or within one week. Responses were anonymized to ensure confidentiality.

Statistical Analysis

Data were coded and analyzed using IBM SPSS Statistics version 25. Descriptive statistics (frequencies, percentages) characterized the sample distribution. Chi-square tests assessed associations between demographic variables and material preferences, with statistical significance set at $p<0.05$. Cross-tabulation examined inter-city variations in material selection.

RESULTS

Participant Characteristics

Of 133 distributed questionnaires, 113 were completed and met inclusion criteria, yielding an 85.0% response rate. The sample comprised 64 males (56.6%) and 49 females (43.4%). The majority (64.5%) were aged 25-34 years, with 31.9% in the 25-29 age group and 32.7% in the 30-34 group. Most participants were general practitioners (80.5%), while 19.5% were specialists (Table 1).

Material Preferences for Posterior Restoration (Tooth #19)

For the posterior molar restoration, all-zirconia was the predominant choice (73.5%), followed by layered zirconia (15.9%) and lithium disilicate (10.6%) (Table 2). Primary justification for selecting all-zirconia included superior mechanical strength (67.8%), cost-effectiveness (11.7%), and functional restoration (6.8%).

Material Preferences for Anterior Restoration (Tooth #8)

For the anterior incisor restoration, preferences shifted significantly toward lithium disilicate (66.4%), with all-zirconia and layered zirconia selected by 18.6% and 15.0% respectively (Table 3). Aesthetic properties that mimic natural teeth were the primary rationale (31.4%), followed by translucency (3.7%) and cost considerations (5.1%).

Inter-City Comparisons

Significant regional variations emerged in material selection. For tooth #19, Zawiya practitioners demonstrated significantly higher preference for all-zirconia (47.0% of city's selections, $p<0.001$) compared to other cities (Table 4). For tooth #8,

Zawiya showed significantly greater utilization of both layered zirconia (76.5% of layered zirconia selections, p=0.001) and lithium disilicate (42.7% of city's selections, p=0.005) compared to Sabratha, Tripoli, and Misurata (Table 5).

Table 1: Demographic and professional characteristics of participants (n=113).

Characteristic	Category	Count	Percentage
Gender	Male	64	56.6%
	Female	49	43.4%
Age Group	25-29 years	36	31.9%
	30-34 years	37	32.7%
	35-39 years	23	20.4%
	40-44 years	8	7.1%
	45-49 years	6	5.3%
	≥50 years	3	2.7%
Qualification	General Practitioner	91	80.5%
	Specialist	22	19.5%
Experience	≤5 years	45	39.8%
	>5 years	68	60.2%
Working Hours	≥32 hours/week	63	55.8%
	<32 hours/week	50	44.2%
Location Type	Urban	97	85.8%
	Suburban	13	11.5%
	Rural	3	2.7%

Table 2: Material preference for tooth #19 (Lower left second molar).

Material	Count	Percentage
All-zirconia	83	73.5%
Layered zirconia	18	15.9%
Lithium disilicate	12	10.6%
Total	**113**	**100.0%**

Table 3: Material preference for tooth #8 (Upper right central incisor).

Material	Count	Percentage
Lithium disilicate	75	66.4%
All-zirconia	21	18.6%
Layered zirconia	17	15.0%
Total	**113**	**100.0%**

Table 4: Material preference for tooth #19 by City.

Material	Sabratha n (%)	Zawia n (%)	Tripoli n (%)	Misurata n (%)	p-value
All-zirconia	16 (19.3)	39 (47.0)	14 (16.9)	14 (16.9)	<0.001
Layered zirconia	2 (11.1)	8 (44.4)	5 (27.8)	3 (16.7)	0.198
Lithium disilicate	2 (16.7)	6 (50.0)	1 (8.3)	3 (25.0)	0.198

Table 5: Material preference for tooth #8 by City.

Material	Sabratha n (%)	Zawia n (%)	Tripoli n (%)	Misurata n (%)	p-value
All-zirconia	2 (9.5)	8 (38.1)	6 (28.6)	5 (23.8)	0.312
Layered zirconia	2 (11.8)	13 (76.5)	0 (0.0)	2 (11.8)	0.001
Lithium disilicate	16 (21.3)	32 (42.7)	14 (18.7)	13 (17.3)	0.005

DISCUSSION

This study reveals distinct practitioner preferences aligned with established material properties. For posterior restorations subject to high masticatory forces, all-zirconia dominated selections (73.5%), consistent with its superior flexural strength (>1200 MPa) and fracture toughness.[9] This preference aligns with international trends emphasizing strength in posterior regions [8]. Conversely, for aesthetically critical anterior restorations, lithium disilicate was favored by two-thirds of practitioners, reflecting its superior translucency and ability to replicate natural tooth optical properties.[10]

Despite established evidence supporting lithium disilicate for single-unit posterior crowns,[7,11] only 10.6% selected this material for tooth #19. This reluctance may reflect inadequate awareness of lithium disilicate's adequate flexural strength (440 MPa) for posterior applications or historical biases favoring zirconia's robustness. Similarly, layered zirconia utilization remained low (15.0-15.9%) across both indications, suggesting practitioners may underestimate its aesthetic advantages in anterior regions.[12]

Zawia practitioners exhibited significantly advanced material knowledge, demonstrating higher utilization of all-zirconia for posterior restorations ($p<0.001$) and both layered zirconia and lithium disilicate for anterior restorations ($p=0.001$ and $p=0.005$, respectively). This disparity may reflect differential access to continuing education, supplier presence, or peer influence. Tripoli and Misurata, despite being larger urban centers, showed more conservative material selection patterns, indicating that city size alone does not predict adoption of advanced materials.

Justification analysis revealed that 67.8% prioritized mechanical strength for posterior applications, while 31.4% emphasized aesthetics for anterior restorations. Interestingly, only 11.7% considered cost for posterior selections and 5.1% for anterior, suggesting that clinical performance outweighs economic factors among this cohort. This contrasts with global trends where cost considerations often limit material selection,[8] possibly reflecting the specific demographic of private practice practitioners serving patients with adequate financial means.

Our findings corroborate a Saudi Arabian study where lithium disilicate was preferred for anterior restorations,[8] though that study reported higher lithium disilicate acceptance for posterior teeth (50% vs. our 10.6%). This discrepancy may reflect regional variations in training or material availability. The dominance of all-zirconia for posterior teeth supports European and North American trends favoring monolithic zirconia's durability and minimal wear of opposing dentition.[13]

This study has several limitations. The sample, while representative of private practitioners, may not reflect public sector dentists who face different resource constraints. The 85% response rate, though acceptable, may introduce non-response bias if non-participants held different material preferences. Additionally, the hypothetical scenario, while standardized, cannot capture the nuanced decision-making involved in complex clinical cases. Long-term clinical outcome data was not collected, limiting assessment of whether preferences translate to successful restorations.

Results highlight the need for targeted continuing education programs, particularly in cities with lower adoption of advanced materials. Emphasis should be placed on lithium disilicate's proven performance in posterior applications and layered zirconia's aesthetic versatility. Manufacturers and suppliers should prioritize equitable dissemination of material science updates across all regions. Furthermore, dental curricula should incorporate comprehensive ceramic material science to prepare graduates for evidence-based selection.

CONCLUSION

Libyan dental practitioners demonstrate logical material selection patterns, favoring all-zirconia for posterior restorations and lithium disilicate for anterior aesthetics, though significant knowledge disparities exist between cities with Zawia practitioners showing more sophisticated material utilization, suggesting uneven access to professional development; awareness of lithium disilicate's posterior applicability and layered zirconia's aesthetic potential remains suboptimal, representing targets for continuing education, while mechanical strength and aesthetic properties serve as the primary drivers of material selection with cost being a secondary consideration among private practitioners, underscoring the importance of standardized educational initiatives to ensure all practitioners can make evidence-based material selections that optimize patient outcomes.

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