E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.02.494

Research Article

Translucency of High-Translucency Zirconia versus Lithium Disilicate at Varying Thicknesses: A Systematic Review and Exploratory Meta-analysis

Eisha Fatima[1], Shai Mureed[2], Ayesha Rafique[3], Jeetesh kumar[4], Alian Abid[5], Zunaira Qazi[6*]
[1]Dental Surgeon, Akhtar Saeed Medical College, Lahore, Pakistan.
[2]Assistant Professor, Department of Prosthodontics, Dental Section, Bolan Medical College (BMC), Quetta, Pakistan.
[3]Postgraduate Resident, Department of Prosthodontics, Institute of Dentistry, CMH Lahore Medical College, Lahore, Pakistan.
[4]Senior Registrar, Department of Prosthodontics, Ziauddin Dental College, Ziauddin University, Karachi, Pakistan.
[5]3rd Year BDS (student), Shahida Islam Dental College, Lodhran, Pakistan.
[6*]Lecturer, Department of Science of Dental Materials, Watim Medical and Dental College, Rawat, Islamabad, Pakistan.
Email: [1]eishafatima@icloud.com, [2]shahmureed862@gmail.com, [3]ayesharafique142@gmail.com, [4]jeeteshmkella@gmail.com, [5]alian.abid7950@gmail.com, [6*]xunairaqazi.208@gmail.com
Corresponding Author: Zunaira Qazi
Lecturer, Department of Science of Dental Materials, Watim Medical and Dental College, Rawat, Islamabad, Pakistan.
Email: xunairaqazi.208@gmail.com
Received: 01.07.26, Revised: 06.08.26, Accepted: 08.09.26

ABSTRACT

Background: High-translucency zirconia has been developed to improve the esthetic limitations of conventional zirconia while retaining favorable mechanical properties. Lithium disilicate remains an established esthetic ceramic, but the relative translucency of the two material families is strongly influenced by thickness and zirconia composition.

Objective: To systematically synthesize comparative evidence on the translucency of true polycrystalline zirconia and lithium disilicate and to examine the influence of material thickness.

Methods: Comparative primary studies evaluating at least one true polycrystalline zirconia and one lithium disilicate group were eligible when a quantitative optical translucency outcome was reported at a defined thickness. We treated the translucency parameter (TP), CIEDE2000-based translucency parameter (TP00), contrast ratio (CR), and direct/total transmittance as distinct outcome constructs. Studies using only zirconia-reinforced lithium silicate without a true zirconia arm were excluded. We included 17 traceable comparative primary studies in the qualitative synthesis. Quantitative pooling was restricted to directly comparable thickness-specific TP datasets with extractable sample size, mean, and standard deviation.

Results: Across the included evidence, lithium disilicate generally demonstrated greater translucency than conventional 3Y zirconia and most high-translucency zirconias at equal thickness. Increasing yttria content improved zirconia translucency, with 5Y/5.5Y materials approaching lithium disilicate in several studies. Thickness consistently reduced translucency. In an exploratory random-effects meta-analysis of directly comparable 5Y/5.5Y zirconia versus lithium disilicate datasets, the pooled mean difference in TP at 0.8 mm was -3.26 (95% CI -4.35 to -2.16; I^2=95.5%), favoring lithium disilicate. At 1.5 mm, the pooled mean difference was -0.81 (95% CI -2.27 to 0.65; I^2=98.6%), showing no clear pooled difference. The very high heterogeneity and small number of studies require cautious interpretation.

Conclusion: Lithium disilicate remains more translucent than most zirconia formulations at equal thickness, although newer high-yttria zirconias substantially narrow this difference. Thickness, yttria content, shade, specimen geometry, and optical measurement method are major determinants of apparent translucency. Material selection should therefore be based on both composition and clinically intended restoration thickness rather than material name alone.

Keywords: Zirconia, Lithium Disilicate, Translucency, Translucency Parameter, Contrast Ratio, Transmittance, Thickness, Dental Ceramics, Meta-Analysis.

INTRODUCTION

Esthetic ceramic restorations require a balance between optical integration and mechanical reliability. Lithium disilicate glass-ceramics are widely used because of their favorable translucency and tooth-like optical behavior, whereas yttria-stabilized zirconia is valued for high strength and fracture resistance. Conventional 3 mol% yttria-stabilized tetragonal zirconia polycrystal (3Y-TZP), however, is relatively opaque. The development of 4Y and 5Y partially stabilized zirconias, together with modifications in grain structure and sintering, has increased the cubic-phase fraction and improved light transmission.

Translucency is not an intrinsic material label alone. It changes with ceramic thickness, crystalline composition, shade, surface treatment, aging, background, measurement geometry, and the optical index used. Translucency parameter (TP), TP00, contrast ratio (CR), and direct or total transmittance quantify related but non-identical optical phenomena. Higher TP or transmittance indicates greater translucency, whereas a higher CR indicates greater opacity. These differences are important when synthesizing evidence and preclude indiscriminate pooling of all optical outcomes.

Comparative studies have increasingly evaluated newer translucent zirconias against lithium disilicate at clinically relevant thicknesses. A thickness-specific synthesis is therefore needed to clarify whether high-translucency zirconia approaches lithium disilicate and under which conditions. This review aimed to synthesize comparative evidence on true polycrystalline zirconia versus lithium disilicate and to explore thickness-specific quantitative differences where sufficiently comparable data were available.

MATERIALS AND METHODS

Review question and eligibility

The review question was: Among dental ceramic specimens or monolithic restorations, how does the translucency of true polycrystalline zirconia compare with lithium disilicate, and how is this relationship influenced by material thickness?

Element	Definition
Population	Dental ceramic specimens or monolithic restorations.
Index material	True polycrystalline yttria-stabilized zirconia, including conventional and high-translucency 3Y, 4Y and 5Y/5.5Y formulations.
Comparator	Lithium disilicate glass-ceramic tested within the same primary study.
Outcomes	TP, TP00, CR, direct/total transmittance, or another clearly defined quantitative translucency measure.
Effect modifier	Ceramic/restoration thickness.
Design	Comparative primary in-vitro studies and directly relevant comparative experimental studies.

Inclusion and exclusion criteria

Studies were included when they were original comparative investigations, contained at least one true polycrystalline zirconia arm and one lithium disilicate arm, reported a quantitative translucency outcome, and specified the specimen or restoration thickness. Studies were excluded when they evaluated zirconia-reinforced lithium silicate alone without a true zirconia arm, lacked a lithium disilicate comparator, did not quantify translucency, were reviews or non-primary publications, or did not provide sufficient thickness information. A study was not required to test more than one thickness to be eligible. Instead, thickness was treated as an effect modifier and analyses were stratified by thickness whenever comparable data permitted.

Information sources and search approach

A structured electronic search was undertaken using combinations of terms for zirconia, translucent or monolithic zirconia, yttria-stabilized zirconia, lithium disilicate, e.max CAD/e.max Press, translucency, translucency parameter, contrast ratio, transmittance, and optical properties. MEDLINE/PubMed was used as the principal bibliographic verification source, supplemented by publisher records and citation searching. Studies were retained only when their bibliographic identity and direct zirconia-versus-lithium-disilicate comparison could be independently traced.

Core PubMed syntax: ("zirconia"[Title/Abstract] OR "translucent zirconia"[Title/Abstract] OR "monolithic zirconia"[Title/Abstract] OR "yttria stabilized zirconia"[Title/Abstract] OR 3Y-TZP[Title/Abstract] OR 4Y-PSZ[Title/Abstract] OR 5Y-PSZ[Title/Abstract]) AND ("lithium disilicate"[Title/Abstract] OR "e.max CAD"[Title/Abstract] OR "e.max Press"[Title/Abstract]) AND (translucen*[Title/Abstract] OR "contrast ratio"[Title/Abstract] OR transmittance[Title/Abstract] OR "optical properties"[Title/Abstract]).

Data extraction and outcome harmonization

Study design, sample size, zirconia system, lithium disilicate comparator, thickness, optical outcome, measurement method, and principal findings were extracted. For quantitative synthesis, sample size, mean, and standard deviation were extracted only when directly recoverable. Classical CIELAB TP, CIEDE2000-based TP00, CR, and transmittance were not assumed to be interchangeable. CR was interpreted in the opposite direction to TP and transmittance. Baseline measurements were preferred for cross-material comparisons in aging studies.

Statistical analysis

For identical outcome scales, mean difference (zirconia minus lithium disilicate) with 95% confidence intervals was used. Random-effects models were selected because clinically important heterogeneity was expected from differences in zirconia generation, brand, shade, sintering, specimen preparation, measurement equipment, and background. Heterogeneity was summarized using I^2. Multi-arm studies were not treated as multiple independent studies when they shared the same lithium-disilicate control. Quantitative pooling was limited to comparisons with sufficiently compatible thickness, outcome definition, and extractable numerical data.

RESULTS

Study selection and characteristics

Seventeen traceable comparative primary studies published between 2014 and 2024 met the review criteria and were included in the qualitative synthesis. The evidence was predominantly in vitro. Tested thicknesses ranged from approximately 0.5 to 2.0 mm in the principal comparative datasets, with some studies evaluating a single thickness and others testing multiple thicknesses. Zirconia systems included conventional 3Y materials and newer 4Y, 5Y, and 5.5Y high-translucency formulations. Lithium disilicate comparators included low- and high-translucency CAD/CAM or pressed systems.

Study	Year	Design	Comparison	Thickness (mm)	Outcome	Main finding
Harianawala et al.	2014	In vitro	Conventional/high-translucency zirconia vs conventional/HT LDS	1.0	Direct transmittance	HT LDS highest; HT zirconia remained below conventional LDS.
Harada et al.	2016	In vitro	5 zirconias vs e.max CAD LT	0.5, 1.0	Total transmittance	LDS more translucent at matched thicknesses.
Church et al.	2017	In vitro	4 translucent zirconias vs e.max CAD HT	0.5-2.0	TP	LDS higher at equal thickness; thin zirconia could exceed thicker LDS.
Baldissara et al.	2018	In vitro crowns	Cubic zirconias vs LDS	1.0, 1.5	Transmission, CR	Thin ultra-translucent zirconia could

						equal/exceed thicker LDS in crown geometry.
Kwon et al.	2018	In vitro	3Y/5Y zirconia vs e.max CAD LT/HT	1.0	TP00	5Y intermediate between 3Y and LDS.
Yilmaz et al.	2018	In vitro aging	Monolithic zirconia vs LDS (+ZLS)	0.5, 0.7, 1.0	RTP/TP00	LDS ranked above monolithic zirconia at each thickness.
Zhang et al.	2019	In vitro	3Y/4Y/5Y zirconia vs LDS	0.5	CR / optical mapping	Higher-yttria zirconia approached LDS translucency.
Sen & Isler	2020	In vitro	YZ HT/ST/XT vs e.max CAD LT	0.5, 1.0, 1.5	TP, CR	LDS most translucent at 0.5 mm; 5Y zirconia closest.
Lawson & Maharishi	2020	In vitro	High-translucency zirconias vs e.max CAD	1.0	TP00	Material and sintering affected zirconia translucency.
Aljanobi & Al-Sowygh	2020	In vitro aging	Multilayer zirconias vs e.max CAD HT	1.0	TP	Material-specific translucency and aging effects.
Kim	2020	In vitro	5 zirconias vs e.max CAD HT/LT	1.0	TP00, transmittance	e.max HT highest; 5Y zirconia more translucent than 3Y.
Cho et al.	2020	In vitro	3Y/4Y/5Y vs LDS	0.8, 1.5	TP	LDS highest at both thicknesses; 5Y closest.
Ziyad et al.	2021	In vitro	3 multilayer zirconias vs e.max CAD LT	1.0	TP, CR	LDS highest TP and lowest CR.
Park et al.	2022	In vitro	3Y/4Y/5.5Y vs LDS	0.8, 1.5	TP	Higher yttria increased TP; 5.5Y approached LDS at 1.5 mm.
Kanpalta et al.	2022	In vitro aging	UT zirconias vs e.max CAD LT	1.0	TP	LDS reference showed higher TP

						than tested zirconias.
Wang et al.	2023	In vitro	2 zirconias vs 2 LDS systems	0.5, 1.0, 2.0	TP	TP decreased with thickness; material type strongly affected TP.
Aydoğdu et al.	2024	In vitro veneers	Monolithic zirconia vs LDS	0.5, 0.7, 1.0	TP	Zirconia significantly less translucent; thickness significant.

Quantitative optical findings

Study	Thickness	Zirconia	n	Mean±SD	LDS	n	Mean±SD	Metric
Harada 2016	0.5	Katana UT	5	33.73±0.13	e.max CAD LT	5	40.32±0.25	Total transmittance %
Harada 2016	1.0	Katana UT	5	23.37±0.27	e.max CAD LT	5	27.05±0.56	Total transmittance %
Kwon 2018	1.0	Katana UTML 5Y	10	8.30±0.24	e.max CAD LT	10	9.28±0.36	TP00
Lawson 2020	1.0	Katana STML	10	7.88±0.25	IPS e.max CAD	10	9.33±0.56	TP00
Cho 2020	0.8	Katana UTML 5Y	10	15.36±0.50	Rosetta SM LDS	10	19.18±0.29	TP
Cho 2020	1.5	Katana UTML 5Y	10	12.64±0.19	Rosetta SM LDS	10	14.20±0.39	TP
Ziyad 2021	1.0	Katana STML	18	14.280±0.345	e.max CAD LT	18	20.439±0.860	TP
Ziyad 2021	1.0	Katana STML	18	0.696±0.039	e.max CAD LT	18	0.592±0.016	CR
Park 2022	0.8	5.5Y zirconia	10	16.47±0.39	Rosetta SM LDS	10	19.17±0.29	TP
Park 2022	1.5	5.5Y zirconia	10	14.13±0.12	Rosetta SM LDS	10	14.20±0.32	TP
Kanpalta 2022	1.0	Katana UTML	5	12.11±0.41	e.max CAD LT	5	18.93±0.52	TP

Thickness-dependent pattern

All multi-thickness comparative studies showed a reduction in translucency as ceramic thickness increased. At equal thickness, lithium disilicate generally retained an optical advantage. The magnitude of this advantage narrowed with newer high-yttria zirconias. Importantly, clinically recommended minimum thicknesses are not necessarily equal between materials. Church et al. reported that 0.5-mm zirconia specimens could be more translucent than 1.0-mm lithium disilicate despite lithium disilicate being more translucent at every equal-thickness comparison. Baldissara et al. similarly demonstrated that restoration geometry and clinically selected thickness can alter the practical ranking observed in flat-specimen experiments.

Exploratory meta-analysis

Thickness	Studies	Comparison	Random-effects MD	95% CI	I²	Interpretation
0.8 mm	Cho 2020; Park 2022	5Y/5.5Y zirconia vs LDS	-3.26	-4.35 to -2.16	95.5%	Favors LDS
1.5 mm	Cho 2020; Park 2022	5Y/5.5Y zirconia vs LDS	-0.81	-2.27 to 0.65	98.6%	No clear pooled difference

The 0.8-mm pooled estimate favored lithium disilicate. At 1.5 mm, the pooled confidence interval crossed zero. Both analyses showed extreme heterogeneity and contained only two studies, so they should be interpreted as exploratory. The heterogeneity likely reflects differences in zirconia composition, specific brands, optical measurement conditions, and specimen characteristics.

Methodological quality considerations

The evidence base was dominated by laboratory studies. Most studies clearly described the ceramic systems, specimen dimensions, optical measurement method, and statistical comparisons. Recurrent methodological limitations across the literature included small group sizes, inconsistent reporting of sample-size calculations and randomization, variable reporting of operator or assessor blinding, heterogeneous spectrophotometric methods, and differences in surface treatment, shade, background, sintering, and aging protocols. These limitations reduce the certainty of a single pooled material effect and support outcome- and thickness-specific interpretation.

DISCUSSION

This systematic review demonstrates a consistent overall pattern: lithium disilicate is generally more translucent than conventional and many high-translucency zirconias when the materials are compared at the same thickness. The difference is largest for conventional 3Y zirconia and becomes progressively smaller as zirconia formulations contain more yttria and a larger cubic-phase fraction. Several studies found 5Y or 5.5Y zirconia to approach lithium disilicate, particularly at greater thicknesses or when compared with lower-translucency lithium disilicate formulations.

Thickness was one of the most consistent determinants of translucency. Increasing thickness reduced TP and transmittance and increased optical masking. This observation has direct clinical importance because zirconia and lithium disilicate do not always require the same minimum restorative thickness. Consequently, an equal-thickness laboratory comparison answers a material-science question, whereas a comparison at clinically recommended thicknesses may better reflect restorative decision-making. A thin high-translucency zirconia restoration may therefore exhibit clinically acceptable or even greater light transmission than a thicker lithium disilicate restoration despite the intrinsic optical superiority of lithium disilicate at equal thickness.

The quantitative synthesis also illustrates why a single overall meta-analysis would be misleading. TP, TP00, CR, and transmittance are related but not identical measures. In addition, multi-arm studies often compare several zirconia generations with a shared lithium-disilicate control. Treating every arm as an independent study would artificially increase precision. The present analysis therefore used only directly comparable thickness-specific TP datasets for exploratory pooling.

The 0.8-mm meta-analysis favored lithium disilicate, whereas the 1.5-mm analysis did not demonstrate a clear pooled difference. However, I^2 exceeded 95% in both analyses. This heterogeneity is clinically plausible rather than merely statistical: zirconia composition, cubic-phase content, grain size, sintering schedule, shade, surface finish, background, and measurement device can all alter the observed translucency. The pooled estimates should therefore be viewed as summaries of a narrow subset of the evidence rather than universal material constants.

Clinical implications

For highly esthetic situations in which maximal translucency is required, lithium disilicate remains the more predictable optical choice. High-yttria zirconia may be advantageous when greater strength, reduced restorative thickness, or masking is required, while still providing substantially improved translucency compared with conventional zirconia. The selection of zirconia should specify its generation and yttria content; the broad term 'zirconia' is insufficient for optical decision-making.

Limitations

The principal limitation is the heterogeneity of the available laboratory evidence. Studies used different zirconia generations, lithium-disilicate translucency grades, shades, thicknesses, specimen geometries, backgrounds, aging protocols, surface treatments, spectrophotometers, and optical indices. Numerical mean/SD data were not uniformly recoverable for every eligible study, restricting quantitative pooling. The exploratory meta-analyses contained only two directly comparable studies at each thickness and therefore cannot support robust publication-bias assessment or extensive sensitivity analysis. In addition, the review is based predominantly on in-vitro evidence, and optical measurements obtained from flat specimens do not completely reproduce the complex geometry, substrate, cement, and lighting conditions of clinical restorations.

CONCLUSION

Within the limitations of the available evidence, lithium disilicate generally exhibits greater translucency than zirconia at equal ceramic thickness. The optical gap is most evident for conventional 3Y zirconia and narrows substantially with newer 5Y/5.5Y high-translucency zirconias. Increasing thickness reduces translucency in both material families. Exploratory pooling favored lithium disilicate at 0.8 mm but showed no clear pooled difference at 1.5 mm; the high heterogeneity prevents definitive quantitative generalization. Clinical material selection should therefore consider zirconia generation, lithium-disilicate translucency grade, restoration thickness, substrate, and required balance between esthetics and mechanical performance.

REFERENCES

1. Harianawala HH, Kheur MG, Apte SK, Kale BB, Sethi TS, Kheur SM. Comparative analysis of transmittance for different types of commercially available zirconia and lithium disilicate materials. J Adv Prosthodont. 2014;6(6):456-461. doi:10.4047/jap.2014.6.6.456.
2. Harada K, Raigrodski AJ, Chung KH, Flinn BD, Dogan S, Mancl LA. A comparative evaluation of the translucency of zirconias and lithium disilicate for monolithic restorations. J Prosthet Dent. 2016;116(2):257-263. doi:10.1016/j.prosdent.2015.11.019.
3. Church TD, Jessup JP, Guillory VL, Vandewalle KS. Translucency and strength of high-translucency monolithic zirconium oxide materials. Gen Dent. 2017;65(1):48-52. PMID:28068266.
4. Baldissara P, Wandscher VF, Marchionatti AME, Parisi C, Monaco C, Ciocca L. Translucency of IPS e.max and cubic zirconia monolithic crowns. J Prosthet Dent. 2018;120(2):269-275. doi:10.1016/j.prosdent.2017.09.007.
5. Kwon SJ, Lawson NC, McLaren EE, Nejat AH, Burgess JO. Comparison of the mechanical properties of translucent zirconia and lithium disilicate. J Prosthet Dent. 2018;120(1):132-137. doi:10.1016/j.prosdent.2017.08.004.
6. Yilmaz B, Ozcelik TB, Wee AG. Effect of thickness on optical properties of monolithic CAD-CAM ceramics. J Dent. 2018;72:25-32. doi:10.1016/j.jdent.2018.01.010.
7. Zhang F, Reveron H, Spies BC, Van Meerbeek B, Chevalier J. Trade-off between fracture resistance and translucency of zirconia and lithium-disilicate glass ceramics for monolithic restorations. Acta Biomater. 2019;91:24-34. doi:10.1016/j.actbio.2019.04.043.
8. Sen N, Isler S. Microstructural, physical, and optical characterization of high-translucency zirconia ceramics. J Prosthet Dent. 2020;123(5):761-768. doi:10.1016/j.prosdent.2019.05.004.
9. Lawson NC, Maharishi A. Strength and translucency of zirconia after high-speed sintering. J Esthet Restor Dent.

2020;32:219-225. doi:10.1111/jerd.12524.
10. Aljanobi G, Al-Sowygh ZH. The effect of thermocycling on the translucency and color stability of modified glass ceramic and multilayer zirconia materials. Cureus. 2020;12(2):e6968. doi:10.7759/cureus.6968.
11. Kim HK. Optical and mechanical properties of highly translucent dental zirconia. Materials (Basel). 2020;13(15):3395. doi:10.3390/ma13153395.
12. Cho YE, Lim YJ, Han JS, Yeo ISL, Yoon HI. Effect of yttria content on the translucency and masking ability of yttria-stabilized tetragonal zirconia polycrystal. Materials (Basel). 2020;13(21):4726. doi:10.3390/ma13214726.
13. Ziyad TA, Abu-Naba'a LA, Almohammed SN. Optical properties of CAD-CAM monolithic systems compared: three multi-layered zirconia and one lithium disilicate system. Heliyon. 2021;7(10):e08151. doi:10.1016/j.heliyon.2021.e08151.
14. Park JH, Bang HJ, Choi NH, Park EJ. Translucency and masking ability of translucent zirconia; comparison with conventional zirconia and lithium disilicate. J Adv Prosthodont. 2022;14(5):324-333. doi:10.4047/jap.2022.14.5.324.
15. Kanpalta B, Burduroğlu D, Kara Ö. Effect of artificial aging on the translucency of monolithic zirconia materials sintered at different temperatures. J Prosthet Dent. 2022;128(1):91.e1-91.e6. doi:10.1016/j.prosdent.2022.05.002.
16. Wang J, Yang J, Lv K, Zhang H, Huang H, Jiang X. Can we use the translucency parameter to predict the CAD/CAM ceramic restoration aesthetic? Dent Mater. 2023;39(3):e1-e10. doi:10.1016/j.dental.2023.01.002.
17. Aydoğdu HM, Yıldız P, Ünlü DG. A comparative study of translucency and color perception in monolithic zirconia and lithium disilicate veneers. Heliyon. 2024;10(1):e23789. doi:10.1016/j.heliyon.2023.e23789.
18. Hetzler S, Schmitt C, Rammelsberg P, Rues S, Zenthöfer A. Translucency of 3D-printed 3Y- and 5Y-doped zirconia. J Esthet Restor Dent. 2025:1-9. doi:10.1111/jerd.70072.
19. Zhang F, Lawn BR. Novel zirconia materials in dentistry. J Dent Res. 2018;97(2):140-147. (background reference underlying several ultra-translucent-zirconia mechanistic papers)
20. Jansen JU, Lümkemann N, Letz I, Pfefferle R, Sener B, Stawarczyk B. Impact of high-speed sintering on translucency, phase content, grain sizes, and flexural strength of 3Y-TZP and 4Y-TZP zirconia materials. J Prosthet Dent. 2019;122(4):396-403.
21. Zhang F, et al. Making yttria-stabilized tetragonal zirconia translucent. Dent Mater. 2015;31(1):veh. (ScienceDirect S0109564114005831 — Y2O3/La2O3 doping effects on 3Y-TZP translucency and aging resistance).
22. Ban S. Zirconia: more and more translucent. Curr Oral Health Rep. 2023. doi:10.1007/s40496-023-00344-1.
23. Farah R. Dental zirconia generations: a comparative study of translucency parameters and light transmittance across varying thicknesses. Braz Dent Sci. 2024;27(3). doi:10.4322/bds.2024.e4021.
24. Salama AA, Shehab KA, Bushra SS, Hamza FS. The effect of aging on the translucency of contemporary zirconia generations: in-vitro study. BMC Oral Health. 2024;24(1):744. doi:10.1186/s12903-024-04465-6.