



The Dental Cement Spectrum: A Comprehensive Literature Review

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INTRODUCTION

Dental cements are versatile substances used in dentistry to bond, seal, or affix dental prostheses and restorations to natural teeth. They are designed to provide both structural support and aesthetic harmony, making them essential in achieving functional and cosmetically pleasing results in dental treatments.

Resin cements are a subclass of dental cements that are composed of a resin matrix and fillers, these cements offer excellent bond strength and versatility.¹ The adhesive properties of resin cement allow for minimal tooth reduction during restoration placement, preserving more of the patient's natural tooth structure.

All-ceramic restorations have gained immense popularity in recent years due to their natural appearance and biocompatibility. These restorations, including crowns, bridges, partial coverage, and veneers are fabricated from various ceramic materials like feldspathic ceramic, lithium disilicate, alumina, and zirconia.² The successful outcome of all ceramic restorations relies heavily on dental cements to securely bond them to the prepared tooth structure. The common complications associated with resin-bonded prosthesis are discoloration (18%), debonding (21%) and recurrent caries (7%).³

The purpose of this poster is to summarize the literature reviews on resin cement compatible with all-ceramic restorations and the type of primary surface bonding required prior to definitive cementation.

OBJECTIVES

The aim of this review is to offer dental practitioners a guidelines on choosing the right resin cement for all-ceramic restorations and to highlight essential surface bonding treatment considerations. Adhering to these recommendations, dental professionals may enhance the longevity and aesthetic outcomes of their restorative dental procedures.

METHODS

A literature search through PubMed using search terms “*resin cement and bonding and all ceramic and zirconia*”, “*resin cement and bonding and all ceramic and lithium disilicate*”, “*resin cement and bonding and all ceramic and feldspathic*” yielded 1229 citations. Limiting these results to randomized controlled trials, clinical trials, meta-analyses, and systematic reviews yielded 251 results. Further limiting these results to articles published within the last 5 years yielded 37articles. Among these 37 articles, some articles were excluded based on title, abstract, and duplicates which resulted in 15 articles for final evaluation.

RESULTS

References	Type of restorations	Types of resin cement	Surface conditioning	Comparison	conclusion
Zahran et al- 2023 ⁴	Lithium disilicate (LDS) (Veneers)	Multilink Automix	1. Etching with HF followed by ceramic primer. 2. Etch with APF followed by ceramic primer Conditioning with etch and prime	Mean Fracture resistance (in Newton): 1. Hydrofluoric acid (HF)-2672 ± 216 N (p<0.0001) 2. Acidulated phosphate fluoride (APF)- 2104 ± 299 N (p=0.435)	Etching with 5% HF followed by ceramic primer (Monobond N) showed higher fracture resistance and resistance to cyclic loading fatigue.
Sahoo et al- 2023 ⁵	3Y-TZP zirconia	Panavia V5	1. Ultra- Short laser pulse. 2. Short laser pulse 3. Long laser pulse	Roughness test: 1. Ultra-short- 9.73µm roughness while others had 4.47µm roughness	Ultra-short, pulsed laser provides strong bonding to produce defect free surface for adhesion.
Rigos et al- 2023 ⁶	zirconia	MDP and non MDP cements	1. Sand blasting 2. Tribochemical silica coating	93 articles were reviewed comparing tensile and shear bond strength	1. Silica coating with sand blasting is preferred for non MDP cement 2. MDP cement with silica coating gives maximum results
Souza et al- 2023 ⁷	Zirconia and lithium disilicate	Panavia V5	1. Laser irradiation 2. Sand blasting 3. Laser irradiation with HF acid etching	Shear bond strength: 1. Zirconia - Laser (33.5 MPa) > sandblasting (28 MPa) 2. LDS- laser + HF (22-24 MPa) > sandblasting (12.2 MPa)	Laser irradiation increases roughness of zirconia and LDS leading to better bond strength with resin cement.
Lobo et al- 2023 ⁸	CAD/CAM ceramics- feldspathic ceramic, zirconia 3Y-TZP	Rely X ultimate	1. Grinding 2. HF- 5% conditioning 3. Sandblasting Al ₂ O ₃ 50um	Surface energy (mJ/m ²) : 1. Grinding- Y-ZT (44.1) > Feldspathic (37.2) 2. HF 5%- Y-ZT (43.2) > Feldspathic (37.2) 3. Sandblasting- Feldspathic (46.9) > Y-ZT (42.4)	LDS- sandblasting is preferred over grinding and HF Zirconia- HF 5% conditioning, grinding and sandblasting all are accepted .
Nova et al- 2022 ⁹	LDS and feldspathic ceramic	ALL CEM- dual cure resin cement	1. 10% HF with silane 2. self etching ceramic primer (MEP)	Fracture failure rate: 1. LDS- MEP > HF – 54% 2. Feldspathic- MEP > HF – 20%	LDS and feldspathic ceramic- 10% HF with silane is preferred over MEP
Hammoudi et al- 2022 ¹⁰	LDS and zirconia	Panavia F 2.0	No surface tx mentioned	Success rate : 1. LDS – 98.6% 2. Zirconia – 99.1%	Panavia (dual cure resin) is good for LDS and zirconia
Chatterjee et al- 2022 ¹¹	zirconia	Cements with 10 MDP- Panavia	1. Mechanical 2. Chemical 3. Mechanochemical	Sandblasting with 50µm Al ₂ O ₃ had less variation in shear stress	Sandblasting with 50µm Al ₂ O ₃ and adhesive cement with 10 MDP is the best procedure to cement zirconia
Alsaeed et al- 2022 ¹²	CAD/CAM ceramics	Dual cure- Panavia F2.0	1. HF with silane 2. Sandblasting with Al ₂ O ₃	Failure under shear stress and tensile bond strength test was more in untreated surfaces.	HF or sandblasting both can be used followed by Monobond primer to enhance chemical bonding
Alammar et al- 2021 ¹³	4Y- TZP, 5Y- TZP zirconia	Cements with 10 MDP- Panavia	1. Sandblasting 2. HF with silane	Failure under shear stress and tensile bond strength test was more in untreated surfaces and resin cements containing phosphates	HF or sandblasting both can be used with resin cement containing 10 MDP.
Garayoa et al- 2021 ¹⁴	3Y-TZP zirconia	BisGMA, MDP, self-adhesive cement	1. Mechanical 2. Chemical 3. Mechanochemical	1. Mean bond strength between zirconia and resin cement: 0- 47.1 MPa 2. Cement containing 10-MDP had more bond strength than other cements.	1. Mechanochemical surface pretreatments offered best adhesive results 2. Cements containing 10-MDP had better outcomes in adhesion to zirconia
Da Silva et al- 2021 ¹⁵	Zirconia	Panavia F2.0	1. laser with pulse- 50 µs 2. laser 100 µs 3. laser 300 us 4. laser 600 µs 5. Tribochemical silica (TSC) coating All were sintered after surface treatment	Failure rate: 1. 50% - Laser 50 µs 2. 52% - Laser 100 µs 3. 62% - Laser 300 µs 4. 50% - Laser 600 µs 5. 21% - TSC	Tribochemical silica coating with silane coupling agent is recommended for bonding
Cuenvas- Suarez et al- 2020 ¹⁶	LDS, feldspathic, zirconia		1. Silane primer 2. Artificial aging with thermocycles	TBS and SBS calculated before and after bonding procedure	LDS- high bond strength with primer Feldspathic and Zirconia- high bond strength with universal adhesive
Russo et al- 2019 ¹⁷	zirconia	10 MDP cement- Panavia	1. Sandblasting 2. Silica coating	Survival rate: 1. Sandblasting- 98% 2. Silica coating- 21%	Sandblasting with cement containing 10 MDP shows promising long-term results
Feltosa et al- 2017 ¹⁸	LDS	Variolink	1. Er:YAG Laser 2. Graphite + Er:YAG laser 3. Nd:YAG Laser 4. Graphite + Nd: YAG Laser	Mean TBS 1. Er:YAG Laser- 27.5 MPa 2. Graphite + Er:YAG laser – 12.1 MPa 3. Nd:YAG Laser – 17.7 MPa 4. Graphite + Nd: YAG Laser – 7.7 MPa	Er: YAG Laser treatment protocol has higher bond strength than other surface treatment protocols.

CONCLUSION

Type of restoration	Resin cement preferred	Surface bonding
Zirconia	Resin cement with 10 MDP- Panavia F 2.0, Panavia V5	Air abrasion/Sandblasting with 30-50µm Al ₂ O ₃ , application of silane or Er: YAG Laser treatment with ultra- short pulsed rhythm. 6,8,10,11,12,13,14,15,17
LDS	Multilink, Variolink	5% HF followed by silane application (no sandblasting- can lead to microcracks) ^{4,9,10,16,17,18}
Feldspathic ceramic	Dual cure resin cement- Rely X Unicem	5-10% HF followed by silane application or Laser treatment ^{8,9,16}

- Physio mechanical conditioning and air-particle abrasion of all ceramic restorations is needed to increase the adhesion and bonding strength of the restoration. ^{1, 2, 4-18}

REFERENCES

