



BONDING LEUCITE REINFORCED CERAMICS: LITERATURE REVIEW OF *IN VITRO* STUDIES

INTRODUCTION: Contemporary bonding protocols are crucial to achieve micromechanical interlocking and chemical bonding in ceramics.¹ These steps are taken to ensure bonding durability and clinical longevity.²

OBJECTIVES:

1. To review and report in vitro studies which varied the adhesive protocol in leucite reinforced ceramic samples
2. To identify gaps in the scientific evidence regarding this topic

METHODS: A search strategy was employed in the **PubMed/Medline** database, with the following controlled search terms: “leucite ceramics”, “leucite reinforced”, “leucite porcelain”, “bonding”, “adhesion”, “luting”, “dental composite”, “resin composite”. Bond strength test studies, both tensile and shear bond, which varied the adhesive protocol and which included leucite reinforced ceramics bonded/luted to resin composite were included in this study. Only studies published after **2000 were considered**. Studies that aged samples were excluded. The screening and selection process followed the **PRISMA statement flowchart** and was conducted by two reviewers, working independently.

RESULTS:

STUDY	SAMPLE	EXPERIMENT	CONCLUSION
Sattabanasuk et al. *3 (2017)	IPS Empress Esthetic (Ivoclar Vivadent) bonded to Filtek Z350 (3M ESPE)	Etching with hydrofluoric acid (yes OR no): silane coupling agent (yes OR no) and type of bonding agent (ETCH & RINSE or UNIVERSAL) - Adper Scotchbond Multipurpose ou Scotchbond Universal (3M ESPE)	Group etched with hydrofluoric acid and silanized showed higher bond strengths. Universal bonding agent did not outperform etch & rinse.
Al Rifaiy et al. *2 (2016)	Heracerm Press (Ivoclar Vivadent) bonded to Filtek Z250 (3M ESPE)	with OR without post-etching cleaning (ortophosphoric acid 37,5% 1min followed by rinsing and ultrasonic cleaning) and with OR without silane coupling agent and heating	Heating the silane coupling agent yielded higher bond strengths. Post-etching cleaning was the most significant factor in the bond strength increase.
Taira, Sakai & Sawase*1 (2012)	GN-Ceram bonded to Clearfil DC Core (Kuraray Noritake)	Groups with different silane coupling agents: 5 commercial silanes (GC Ceramic Primer, Clearfil Ceramic Primer, Tokuso Ceramic Primer, Porcelain Liner & Monobond Plus); 4 experimental silanes e 2 control primers	The components of the silane coupling agent influence the bond strength of the ceramic-resin interface
Fabianelli et al.*2 (2009)	IPS Empress 1 (Ivoclar Vivadent) bonded to Tetric EvoCeram (Ivoclar Vivadent)	Experimental groups were wetched with hydrofluoric acid followed by silane coupling agent application with OR without heating (Monobond-S); OR silane application only with OR without heating	The highest bond strength values were registered in the group etched with hydrofluoric acid and were the silane coupling agent was heated
Melo, Valandro & Bottino (2007)*2	Omega 900 (VITA Zahnfabrik) bonded to Filtek Z250 (3M ESPE)	2 experimental groups: 1. 6% Hydrofluoric acid for 1min + silane coupling agent air dried for 30s 2. Sandblasting with silicized particles (CoJet, 3M ESPE) + silane coupling agent dried for 5min	Both surface treatment methods revealed similar results.
Kukiattrakoon & Thammasitboon*1 (2007)	IPS Empress 1 (Ivoclar Vivadent) bonded to Filtek Z250 (3M ESPE)	Experimental groups received surface treatment with acidulated phosphate fluoride gel, each group varying from 1 to 10min (1min increments). A control group (no treatment) and an extra group receiving 9.6% hydrofluoric acid for 4min was included	The highest bond strength results belonged to the group treated with hydrofluoric acid.
Piowarczyk, Lauer & Sorensen*1 (2004)	IPS Empress 1 (Ivoclar Vivadent) bonded to Herculite XRv (Kerr)	Variation of luting agents: zinc phosphate , glass ionomers (Fuji I, Ketac-Cem), resin modified glass ionomers (Fuji Plus, Fuji Cem, RelyX Luting), resin based luting agents (RelyX ARC, Panavia F, Variolink II, Compolute) and a self-adhesive luting agent (RelyX Unicem)	The highest bond strengths were observed in the group featuring Relyx Unicem (self-adhesive luting agent)
Della Bona, Anusavice & Shawl *2 (2000)	IPS Empress 1 (Ivoclar Vivadent) bonded to Filtek Z100 (3M ESPE)	Variation of the etching agent (9.5% hydrofluoric acid OR 4%acidulated fluor phosphate 2min) and adding a silane step OR not	Silane application alone had the best results. Two minutes of hydrofluoric acid etching had detrimental effects over the ceramic surface.

CONCLUSION: The etching step with hydrofluoric acid and application of a silane coupling agent are well established in the literature as mandatory steps in bonding leucite reinforced ceramics. Variables such as the recommended time for silanization and drying methods warrant further research. Furthermore, bonding of this ceramic with new agents, such as flowable resin composites, is also a gap found in this research line.

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