Push-out Bond Strength of Ceramic Inlays Cemented with Contemporary Resin Cements

ASHRAF A. KHALIL [1], KHALID M. ABDELAZIZ [2]
Ali A. Alqahtani [3], Ahmed A. Alahmari [3], Khalid H. Al Faifi [3]

(1) Assistant professor, (2) Associate Professor, (3) Intern
College of Dentistry, King Khalid University, Abha, Saudi Arabia

Introduction

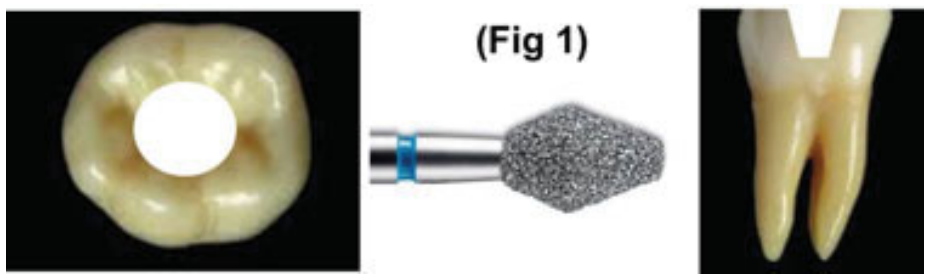
In response to increased aesthetic awareness, dental patients have become more interested in tooth-coloured restorations.[1] However, the obvious weakness and poor fit of the early ceramic inlays together with the problems encountered with their cementation have limited their clinical use.[2,3]

With the recently-developed luting cements and bonding systems, achieving a strong and durable bond between the tooth structure and the ceramic restorations could be feasible.[4-6]

Therefore, the present study aimed to compare the push-out bond strength of ceramic inlay materials bonded to dentin using two different types of contemporary luting cements.

Materials & Methods

Occlusal surfaces of 40 molar teeth were ground flat to expose dentin. Standardised occlusal cavities (5 mm in occlusal diameter, 3.5 mm in cervical diameter and 3.5 mm deep) were then prepared using a truncated cone-shaped diamond rotary cutting instrument (Fig. 1).

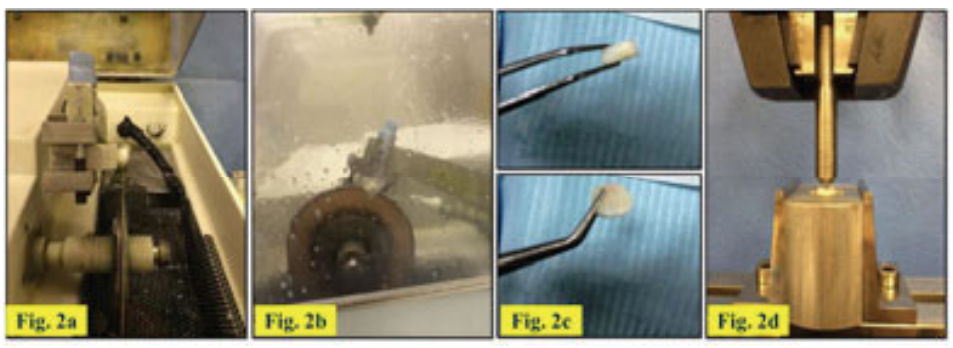


The prepared cavities were restored in 2 groups with IPS e.max CAD (IPS) (G.1) and zirconia-based (Zr) (G.2) ceramic inlays (n=20 each). Specimens of each group were subdivided into 2 subgroups (n=10) according to the type of luting cement used to fix the fabricated inlays into their respective cavities (Table 1). Either self-adhesive (SG:A) or conventional etch-and-bond (SG:B) cement was applied following the manufacturer's instructions. Half the specimens in each subgroup (n=5) were subjected to 5000 thermal cycles at 4, 37 and 55 ° C with 30s dwell time.

Levels of The Study.

Total Specimens	Groups (n=20)	Subgroups (n=10)
40 Molars	G-1: IPS e.Max CAD	SG-A: Luted with self-adhesive resin-based cement
		SG-B: Luted with Etch-and-Bond resin-based cement
	G-2: Zirconia-based	SG-A: Luted with self-adhesive resin-based cement
		SG-B: Luted with Etch-and-Bond resin-based cement

The roots of all teeth were cut off and the crowns were then trimmed to a standardised thickness of 3.5mm (Figs. 2a,b). The cut specimens were finished to show both the occlusal and the pulpal surfaces of the cemented inlays with no cement flashes covering (Fig. 2c). Following 24h storage in water, the push-out bond strength was tested on a universal testing machine (Fig. 2d). 1-way ANOVA was used to statistically analyse the collected bond strength data, while the chi^2 test was used to analyse the non-parametric data of the bond failure frequency.



Results

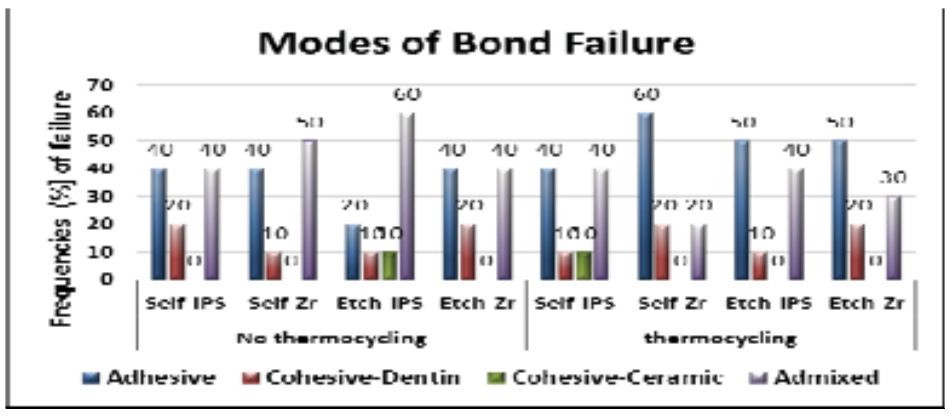
The 1-way ANOVA showed insignificant differences between the push-out bond strength values of all tested subgroups (p= 0.7161) (Table 2). Accordingly, no difference between the bond strength values of both ceramic materials and no preference between the cementing materials can be reported. Moreover, thermocycling had no significant effect on the recorded bond strength values of different ceramic-cement combinations (Table 2).

Table 2. Mean Push-out bond strength (MPa) ±S.D. in different subgroups

Ceramic Type	Self-Adhesive resin cement (SG:A)		Conventional Etch&Bond resin cement (SG:B)	
	No thermocycling	Thermocycling	No thermocycling	Thermocycling
IPS (G.1)	7.00±1.06[a]	6.607±1.24[a]	6.96±1.21[a]	6.91±0.78[a]
Zr (G.2)	7.52±0.71[a]	6.73±1.51[a]	6.95±1.09[a]	6.71±0.95[a]

- Same superscript letters indicate no difference between subgroups

The visual observation of bond failure modes indicated that the admix (50%) and adhesive (50-60%) types were dominant among the thermocycled and the non-thermocycled specimens respectively (Fig. 3). However, the statistical analysis of the recorded frequencies of different modes of bond failure showed no differences between the tested subgroups (chi^2, p = 8.4283) .



Conclusions

- Neither the type of ceramic nor resin cement has an effect on the bonding values to dentin.
- Thermocycling of bonded inlays has no adverse effect on their bonding values, although the mode of failure could be affected.

References

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