DOI: http://dx.doi.org/10.17921/2447-8938.2019v21n5p464-469

Conservative Substitution of Fractured Ceramic Onlays Using Self-Adhesive Cement: Case Report

Substituição Conservadora de Onlays Cerâmicas Fraturadas Utilizando Cimento Autoadesivo: Relato de Caso

Mariana Dias Flor-Ribeiro*[a]; Josué Júnior Araújo Pierote[a]; Giselle Maria Marchi[a]; Luis Alexandre Maffei Sartini Paulillo[a]

[a]State University of Campinas, Stricto Sensu Graduate Programa in Ontological Clinic, SP, Brazil.
*E-mail: marianadiasflor@gmail.com
Recebido em: 18/03/2019; Aprovado em: 07/05/2019

Abstract

The advances in bonding of ceramics and self-adhesive resin cements to tooth structure make this treatment a feasible alternative to restore posterior teeth. This case report described the removal of two fractured onlays and the fabrication of new lithium disilicate onlays cemented with self-adhesive resin cement. The rationale for various choices in this treatment protocol is detailed with reference to the pertinent literature. It is concluded that the clinical success of the technique depends on the correct identification of the case for which this treatment is appropriate and on the successful execution of the clinical steps involved.

Keywords: Dental Cements. Resin Cements. Dental Bonding.

Resumo

Os avanços na adesão de cerâmicas e cimentos resinosos autoadesivos à estrutura dentária tornam este tratamento uma alternativa viável para restaurar os dentes posteriores. Ester relato de caso descreveu a remoção de duas onlays fraturadas e confecção de novas onlays de dissilicato de lítio cimentadas com cimento resinoso auto-adesivo. A justificativa para várias escolhas neste protocolo de tratamento é detalhada com referência à literatura pertinente. O sucesso clínico da técnica depende da correta identificação do caso para o qual este tratamento é adequado e da execução bem-sucedida das etapas clínicas envolvidas.

Palavras-chave: *Cimentos Dentários. Cimentos de Resina. Colagem Dentária.*

1 Introduction

Since the invention of the indirect dental restoration, there has always been a need to cement them into the tooth. Just as the restorative materials have continually evolved, so have the cements[1]. The resin cements have long been valued for their high retentive strengths, resistance to wear, and insolubility[2,3]. This makes them ideal for short clinical preparations with limited retention. One factor that has discouraged greater use of resin cements has been the need to etch the preparation and apply a separate adhesive or bonding agent. This requirement helps achieve desirable bond strengths, but can occasionally lead to postoperative sensitivity[3,4].

The concern with resin cementation is its general intolerance to moisture. When a dry field is not present, conventional resin cements are usually contraindicated. The latest advancement in luting cements has been referred to as a self-adhesive resin cement[3,5].

These materials have been developed to take advantage of some of the best properties of modern resin cements with the added advantages of improved tolerance to moisture and not requiring a separate adhesive application[6, 7]. Even though bond strengths appear to be less than conventional resin cements (the ones that require a separate adhesive), 18% of dentists now report using self-adhesive resin cements on a regular basis[2,8].

They can be used for metal-containing crowns and bridges including porcelain-fused-to-metal (PFM) and full-cast metal, as well as ceramic and metal inlays and onlays. In fact, they can be used in virtually any clinical cementation situation except possibly bonding porcelain laminates or resin-bonded bridges[3,9,10].

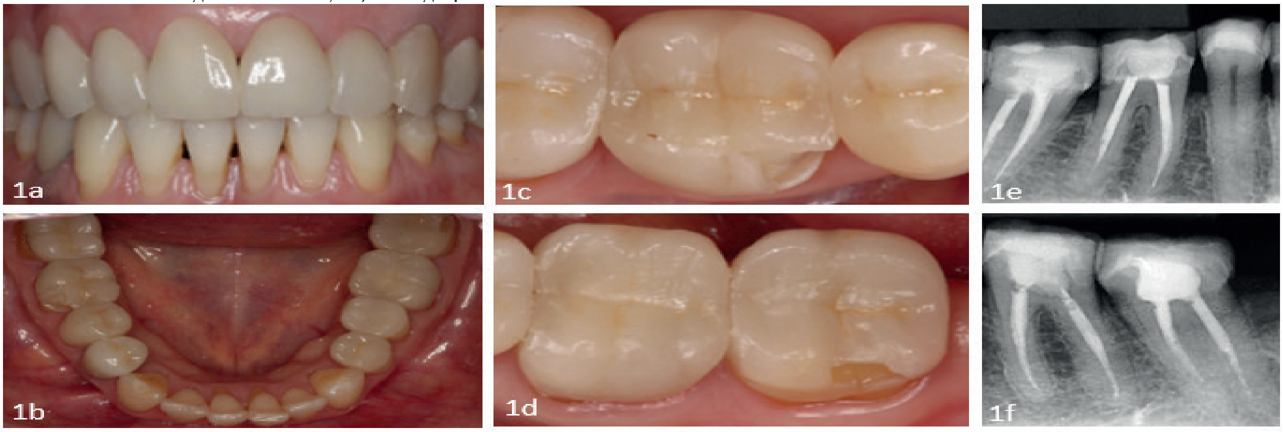
Therefore, this report aims to present an esthetic approach to reestablishing the esthetics and balancing the smile with self-adhesive resin cements for onlays ceramics as the restorative strategy.

2 Case Report

A 46-year-old woman, housewife, sought for treatment to recover an indirect restoration and a pigmentation in some teeth to improve their appearance (Figure 1a, 1b).

After the clinical and radiographic evaluations, the presence of fractured ceramic restorations in the lower right first molar (Figure 1c, 1e) and the lower left second molar was identified (Figure 1d, 1f). After treatment, modalities were discussed with the patient. The decision was to prepare the lower left first molar and the lower left second molar with lithium disilicate ceramic to reestablish the teeth size and shape.

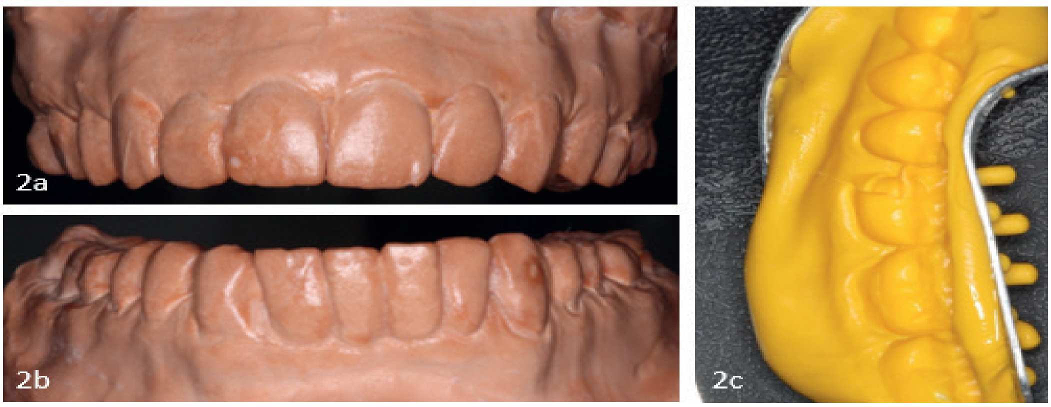
Figure 1 - 1a) frontal view, 1b) lower arch, 1c) fractured lower right first molar, 1d) fractured lower left second molar, 1e) radiograph of fractured lower right first molar, 1f) radiograph of fractured lower left second molar



Fonte: Os autores.

To begin the treatment, the adequacy of the oral environment was performed by supra-gingival scaling of calculus with periodontal curettes and root planing with rubber cups at low rotation and water-pumice paste. Dental arches were molded with alginate (Hydrogum, Zhermack Clinical, Italy) to obtain the dental cast (Herodent type III, Coltene, Rio de Janeiro, Brazil) (Figure 2a, 2b). The impressions with silicone (Zetaplus, Zhermack, Labordental, São Paulo, Brazil) (Figure 2c) were obtained and used for the provisional restorations.

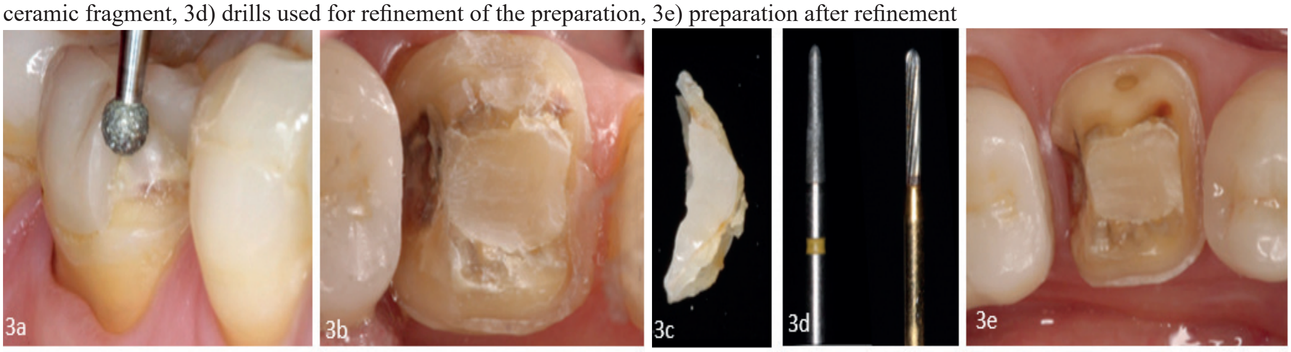
Figure 2 - 2a) upper arch model, 2b) lower arch model, 2c) temporary molding of the models



Fonte: Os autores.

Fractured ceramic removals for onlay must be performed with calibrated spherical diamond burs (KG Sorensen, São Paulo, Brazil) (Figure 3a, 3b). For the proximal area, metal sandpaper (KG Sorensen) was used to create a separation between the teeth to facilitate the definition of the proximal margin. Finally, all angles were rounded, and an extrafine, tapered-cylinder, as well as a round-end diamond burr (KG Sorensen) (Figure 3c, 3d) were used to smoothen the prepared surface (Figure 3e).

Figure 3 - 3a) removal of fractured ceramic with spherical drill, 3b) preparation after removal of fractured restoration, 3c) removed ceramic fragment, 3d) drills used for refinement of the preparation, 3e) preparation after refinement



Source: The authors.

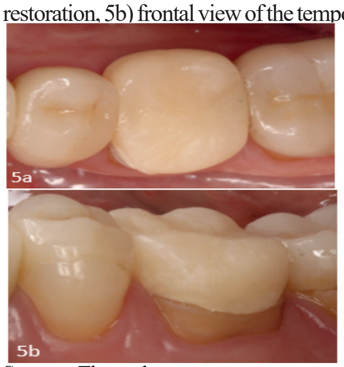
For the impression technique, two retraction cords (Ultrapack, Ultradent Products, São Paulo, Brazil) of different diameters were placed in the gingival sulcus, and a complete impression with a doubleviscosity polyvinyl siloxane material was made after the removal of the second cord (Figure 4a,4b). The first retraction cord was also removed, and the evaluation of the tooth color was performed by using a spectrophotometer (Easyshade, Vident, Brea, CA, USA) (Figure 4c), in the same position by a silicon guide (Express XT, 3M ESPE, Sumaré, SP, Brazil) with an opening to the buccal surface (Figure 4d). This is an important step in determining the results, requiring effective communication between the practitioner and the technician.

Figure 4 - 4a) Retractor wire positioned for molding the preparation, 4b) Silicone addition in low viscosity used for molding, 4c) Spectrophotometer (Easyshade, Vident, Brea, CA, USA), 4d) Spectrophotometer positioned with silicone guide

Source: The authors.

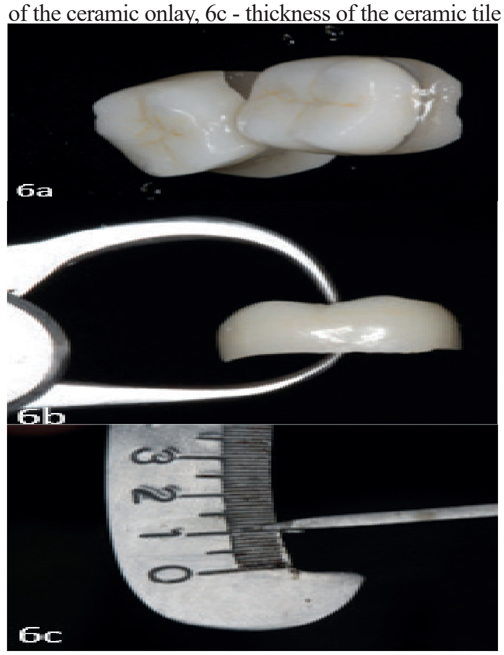
Finally, provisional restorations were made with an acrylic resin (Vipi, Dental Vipi, Pirassununga, Brazil) (Figure 5a, 5b). The maxillary and mandibular casts were sent to the dental technician for pouring, creation of dies, and fabrication of lithium disilicate (Emax Esthetic, Ivoclar Vivadent, São Paulo, Brazil) (Figures 6a, 6b, 6c).

Figure 5 – 5a) occlusal vision of the temporary restoration, 5b) frontal view of the temporary restoration



Source: The authors

Figure 6 - 6a) ceramic onlays, 6b) evaluation of the thickness of the ceramic onlay, 6c - thickness of the ceramic tile



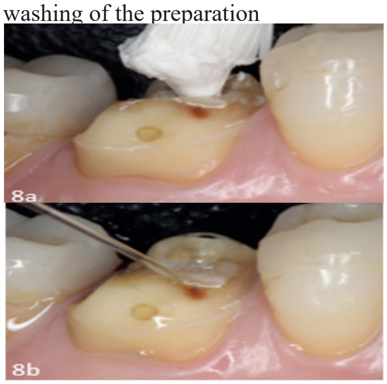
Source: The authors

Once the onlays were received from the technician, they were carefully positioned to verify marginal adaptation, alignment, shape, and color, with completely satisfactory results (7a, 7b). The teeth were subjected to a prophylaxis with pumice and rubber cup, a rinsing, and a careful drying (Figure 8a, 8b). The conditioning of internal surfaces of the restorations was performed through the application of 10% hydrofluoric acid for 1 minute (Condac Porcelana, FGM Products) (Figure 9a), washing under running water and (Figure 9b) air-drying (Figure 9c); afterward, a one-bottle bonding system (Single Bond, 3M ESPE) was applied, and the surface was gently air-dried (Figure 9d). The luting of the onlays was performed for each tooth individually, following the same sequence.

Figure 7 - 7a) evaluation of the ceramic onlay in plaster model, 7b) clinical evaluation of the ceramic onlay

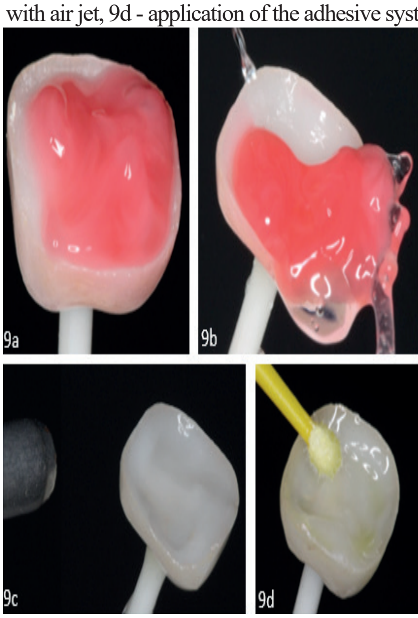
Source: The authors.

Figure 8 - 8a) prophylaxis of the preparation, 8b) washing of the preparation



Source: The authors.

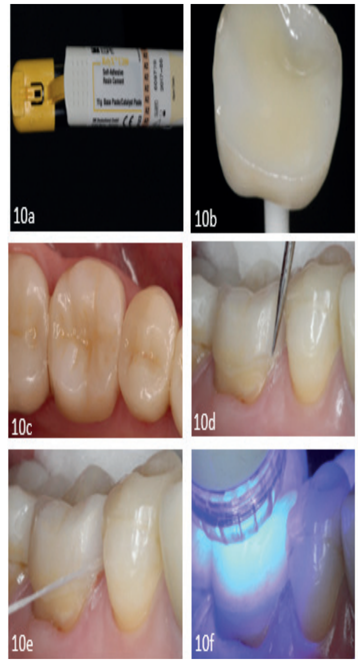
Figure 9 - 9a) conditioning of the onlay with floridric acid, 9b) washing of the onlay with water, 9c) drying of the onlay with air jet, 9d - application of the adhesive system



Source: The authors.

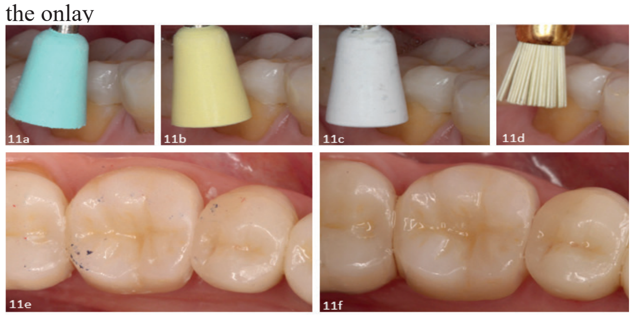
The luting agent used in this case was self-adhesive resin cement RelyX U200 A2 (3M ESPE, São Paulo, Brazil) (Figure 10a), which was applied in the internal surface of the onlay (Figure 10b), and then the onlay was positioned (Figure 10c). After light curing for five seconds, excess cement was removed using manual instruments (Figure 10d, 10e), and the onlay was once more light-cured at the facial and lingual sides for 40 seconds (Figure 10f). After the placement of all the onlay, finishing and polishing of the cement line were performed with silicone rubber (Resin Finish, Microdont) (Figure 11a, 11b, 11c) and silicon carbide brush (Jiffy Brush, Ultradent) (Figure 11d). A final adjustment of the ceramic was performed with FF diamond burs (KG Sorensen) in the areas marked with graphite (Figure 11e). At adjusted surfaces, polishing was performed to avoid additional wear (Figure 11f). The cervical margins were verified, and the excess cement was removed with sandpaper strips. The result can be seen immediately in a clinical follow-up at 1 month with intraoral aspects of the patient (Figure 12a, 12b, 12c, 12d).

Figure 10 - 10a) self-adhesive resin cement (RelyX U200, 3M ESPE), 10b) resin cement inserted into the onlay, 10c) onlay positioned, 10d) removal of excess cement with probe, 10e) removal of excess cement with floss, 10f) photopolymerization of the onlay



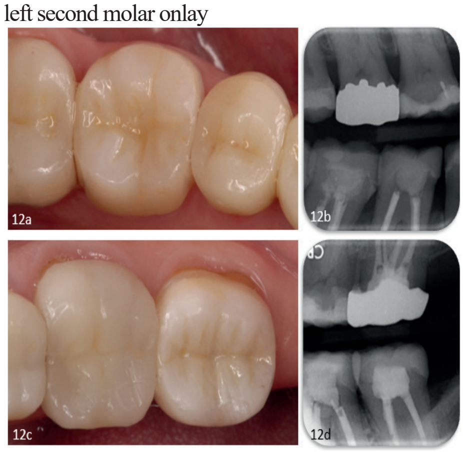
Source: The authors.

Figure 11 - 11a), 11b), 11c) silicone rubber (Resin Finish, Microdont), 11d) silicon carbide brush (Jiffy Brush, Ultradent), 11e) occlusion adjustment with carbon, 11f) final appearance of the onlay



Source: The authors.

Figure 12 - 12a) clinical aspect of the onlay of the lower right first molar, 12b) radiographic appearance of the lower right first molar onlay, 12c) clinical appearance of the lower left second molar onlay, 12d) radiographic appearance of the lower left second molar onlay



Source: The authors.

2.1 Discussion

Choosing the correct cementation system is extremely important to the success and longevity of indirect restorative treatment. Thus, the luting cement selection criteria should be based on esthetics, adequate marginal sealing, compressive and flexural strength, adhesive strength and ease of handling [11,12].

In addition, a durable bonding between dental tissues and ceramic pieces is crucial for the success of restorations that do not have retentive properties [13], such as those with inlays and onlays.

Therefore, the self-adhesive cements arose, fact which represents an alternative to traditional cements. These cements do not require acid conditioning or prior washing, nor do they use primers of hydrophobic adhesives before cementation. It reduces the technique sensitivity and facilitates its clinical use [1,13-16].

Although some studies have shown that self-adhesive cements have a lower adhesion capacity due to poor interaction with the substrate and non-formation of the hybrid layer[9, 17,18], these studies do not demonstrate differences in the adhesive strength of the self-adhesive resin cement compared with the conventional dual resin cement[15,19].

In this case report, the failure was the fracture of the old ceramic pieces due to a probable adhesive failure, since clinical failures can occur when there is no adequate adhesion of the restoration to the tooth, inducing the fracture of the ceramic restorations[20].

The main causes of adhesive failure refer to loss of retention of the part with the dental substrate and marginal degradation[21].

Thus, for substitution of the fractured onlay, lithium disilicate ceramics was chosen because it exhibits higher bond strength to the resin cement than other types of ceramic[22]. In addition, its structure prevents the propagation of fractures, due to the addition of lithium disilicate crystals (approximately 60% by volume). This composition promotes greater flexural strength and fracture resistance due to the spatial configuration of its crystalline phase[15].

Moreover, RelyX U200 self-adhesive cement was selected as a strategy for cementing lithium disilicate onlay. The use of self-adhesive cements has been intensely studied and explored in the clinical sense[23]. The adhesive properties of the cements can increase the resistance to fracture of the ceramic pieces, because a correct adhesion between the dental substrate and the ceramic allows the distribution of tension in the dental restoration, which improves the resistance and prevents the propagation of cracks, besides increasing the clinical longevity of the piece[24].

The action mechanism of self-adhesive resin cements is based on the chelation of calcium ions by the acidic groups, producing chemical adhesion with the hydroxyapatite of the dental structure[25]. The resin cement used in this case presents adhesion to the dental substrate by the micromechanical retention mechanism and chemical interaction among the acidic monomers (methacrylate phosphoric ester) of the cement and the hydroxyapatite of the substrate[16,26,27]. In addition, the content of 10% fluoride leads to speculation that the cement has less nanoinfiltration [28], and this may be related to the repulsion effect of water fluoride ions, which can reduce the residual water of the bonding interface and, thus, improve the cement resistance to the hydrolytic degradation[29].

In the case described, both onlays were cemented predominantly on the dentin substrate. Studies have indicated that adhesion to dentin using contemporary adhesive resin cements, such as RelyX U200, is shown to be more stable than with previous cements and is directly related to the durability of indirect restorations, which are more reliable and predictable[30].

Since the clinical evidence on the use of self-adhesive cements luting in the lithium disilicate onlays is limited, especially regarding clinical studies[31], we intend to provide evidence and clinical follow-up in the sector with this case report.

4 Conclusion

It is concluded that self-adhesive resin cement is satisfactory and suitable for cementation of ceramic onlays based on lithium disilicate. Self-adhesive resin cement is a practical and feasible alternative to cementing ceramic tiles.

References

1. Manso AP, Carvalho RM. Dental Cements for Luting and Bonding Restorations: Self-Adhesive Resin Cements. Dent Clin North Am 2017;61(4):821-34. doi: 10.1016/j.cden.2017.06.006
2. Christensen GJ. Why use resin cements? J Indiana Dent Assoc 2010;89(3):6-8. doi: 10.14219/jada.archive.2010.0140
3. Goracci C, Cury AH, Cantoro A, et al. Microtensile bond strength and interfacial properties of self-etching and self-adhesive resin cements used to lute composite onlays under different seating forces. J Adhes Dent 2006;8(5):327-35.
4. Belli R, Pelka M, Petschelt A, Lohbauer U. In vitro wear gap formation of self-adhesive resin cements: a CLSM evaluation. J Dent 2009;37(12):984-93. doi: 10.1016/j.jdent.2009.08.006
5. Rodrigues RF, Ramos CM, Francisconi PA, Borges AF. The shear bond strength of self-adhesive resin cements to dentin and enamel: an in vitro study. J Prosthet Dent 2015;113(3):220-7. doi: 10.1016/j.prosdent.2014.08.008
6. Malmstron H, Cacciato R, Yunker M. A 24-month clinical evaluation of a self-adhesive resin cement. J Dent Res 2010;89.
7. Radovic I, Monticelli F, Goracci C, Vulicevic ZR, Ferrari M. Self-adhesive resin cements: a literature review. J Adhes Dent 2008;10(4):251-8.
8. Silva RA, Coutinho M, Cardozo PI, Silva LA, Zorzatto JR. Conventional dual-cure versus self-adhesive resin cements in dentin bond integrity. J Appl Oral Sci 2011;19(4):355-62. doi: 10.1590/S1678-77572011005000010

9. Aguiar TR, Di Francescantonio M, Ambrosano GM, Giannini M. Effect of curing mode on bond strength of self-adhesive resin luting cements to dentin. J Biomed Mater Res B Appl Biomater 2010;93(1):122-7. doi: 10.1002/jbm.b.31566

10. Guarda GB, Gonçalves LS, Correr AB, Moraes RR, Sinhoreti MAC, Correr-Sobrinho L. Luting glass ceramic restorations using a self-adhesive resin cement under different dentin conditions. J Appl Oral Sci 2010;18(3):244-8. doi: 10.1590/S1678-77572010000300008

11. Soares CJ, Faria-E-Silva AL, Rodrigues MP, Vilela ABF, Pfeifer CS, Tantbirojn D, Versluis A. Polymerization shrinkage stress of composite resins and resin cements - What do we need to know? Braz Oral Res. 2017 Aug 28;31(suppl 1):e62. doi: 10.1590/1807-3107bor-2017.vol31.0062

12. Pereira SG, Fulgêncio R, Nunes TG, Toledano M, Osorio R, Carvalho RM. Effect of curing protocol on the polymerization of dual-cured resin cements. Dent Mater 2010;26(7):710-8. doi: 10.1016/j.dental.2010.03.016

13. Saker S, Alnazzawi A, Özcan M. Adhesive strength of self-adhesive resins to lithium disilicate ceramic and dentin: effect of dentin chelating agents. Odontology 2016;104(1):53-9. doi: 10.1007/s10266-014-0180-3

14. Prieto LT, Araújo CT, Humel MM, et al. Influence of selective acid etching on microtensile bond strength of a self-adhesive resin cement to enamel and dentin. Braz J Oral Sci 2010;9(4):455-8.

15. Rigolin FJ, Miranda ME, Flório FM, Basting RT. Evaluation of bond strength between leucite-based and lithium disilicate-based ceramics to dentin after cementation with conventional and self-adhesive resin agents. Acta Odontol Latinoam 2014;27(1):16-24.

16. Ebrahimi-Chaharom ME, Abed-Kahnamoui M, Bahari M, Hamishehkar H, Gharouni M. Effect of different concentrations of specific inhibitor of matrix metalloproteinases on the shear bond strength of self-adhesive resin cements to dentin. J Clin Exp Dent 2017;9(3):e431-e436. doi: 10.4317/jced.53486

17. Temel UB, Van Ende A, Van Meerbeek B, Ermis RB. Bond strength and cement-tooth interfacial characterization of self-adhesive composite cements. Am J Dent. 2017 Aug;30(4):205-211.

18. Roy AK, Mohan D, Sunith M, Mandokar RB, Suprasidh S, Rajan S. Comparison of Shear Bond Strengths of Conventional Resin Cement and Self-adhesive Resin Cement bonded to Lithium Disilicate: An in vitro Study. J Contemp Dent Pract 2017;18(10):881-6. doi: 10.5005/jp-journals-10024-2143

19. Taschner M, Krämer N, Lohbauer U, Pelka M, Breschi L, Petschelt A, et al. Leucite-reinforced glass ceramic inlays luted with self-adhesiveresin cement: a 2-year in vivo study. Dent Mater 2012;28(5):535-40. doi: 10.1016/j.dental.2011.12.002

20. Heintze SD, Albrecht T, Cavalleri A, Steiner M. A new method to test the fracture probability of all-ceramic crowns with a dual-axis chewing simulator. Dent Mater 2011;27(2):e10-9. doi: 10.1016/j.dental.2010.09.004

21. Manuja N, Nagpal R, Pandit IK. Dental adhesion: mechanism, techniques and durability. J Clin Pediatr Dent 2012;36(1):223-34. doi: 10.17796/jcpd.36.3.68805rl1r037m063

22. Della Bona A, Anusavice KJ, Shen C. Microtensile strength of composite bonded to hot-pressed ceramics. J Adhes Dent 2000;2(4):305-13.

23. Pilo R, Folkman M, Arieli A, Levartovsky S. Marginal fit and retention strength of zirconia crowns cemented by self-adhesive resin cements. Oper Dent 2018;43(2):151-61. doi: 10.2341/16-367-L

24. Burke FJ, Wilson NH, Watts DC. Fracture resistance of teeth restored with indirect composite resins: the effect of alternative luting procedures. Quintessence Int 1994;25(4):269-75.

25. Roedel L, Bednarzig V, Belli R, Petschelt A, Lohbauer U, Zorzin J. Self-adhesive resin cements: pH-neutralization, hydrophilicity, and hygroscopic expansion stress. Clin Oral Investig. 2017;21(5):1735-1741. doi: 10.1007/s00784-016-1947-4

26. Giannini M, Takagaki T, Bacelar-Sá R, Vermelho PM, Ambrosano GM, Sadr A, et al. Influence of resin coating on bond strength of self-adhesive resin cements to dentin. Dent Mater J 2015;34(6):822-7. doi: 10.4012/dmj.2015-099

27. Lima JF, Lima AF, Humel MM, Paulillo LA, Marchi GM, Ferraz CC. Influence of irrigation protocols on the bond strength of fiber posts cemented with a self-adhesive luting agent 24 hours after endodontic treatment. Gen Dent 2015;63(4):22-6.

28. Pontes DG, Araujo CT, Prieto LT, Oliveira DC, Coppini EK, Dias CT, et al. Nanoleakage of fiber posts luted with different adhesive strategies and the effect of chlorhexidine on the interface of dentin and self-adhesive cements. Gen Dent 2015;63(3):31-7.

29. Gerth HU, Dammaschke T, Züchner H, Schäfer E. Chemical analysis and bonding reaction of RelyX Unicem and Bifix composites: a comparative study. Dent Mater 2006;22(10):934-41. doi: 10.1016/j.dental.2005.10.004

30. Christensen GJ. Should resin cements be used for every cementation? J Am Dent Assoc 2007;138(1):817-9. doi: 10.14219/jada.archive.2007.0271

31. Brondani LP, Pereira-Cenci T, Wandsher VF, Pereira GK, Valandro LF, Bergoli CD. Longevity of metal-ceramic crowns cemented with self-adhesive resin cement: a prospective clinical study. Braz Oral Res 2017;31:e22. doi: 10.1590/1807-3107bor-2017.vol31.0022