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Immediate dentin sealing: Review of literature

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Introduction

Direct resin composite restorations are most preferred by patients for anterior as well as for posterior teeth. The use of this restoration has increased as there is lot of improvements in resin materials in recent years. However performing large proximal restorations have challenges for direct resin composite restorations, such as maintaining adequate proximal contacts, anatomical form, wear resistance, and marginal adaptation[(1,2)] .Polymeric or ceramic-based indirect restorations are effective treatment options for such cases. In fact, partial adhesive indirect restorations have multiple advantages such as improved anatomic shape, contour, esthetics, and fracture resistance.

Conventional indirect restoration involves multiple complicated procedural steps. The restorations are laboratory fabricated and require at least two appointments:

In the first appointment, an impression is made after tooth preparation, followed by luting a temporary restoration. In the second appointment, the temporary restoration is removed, then a bonding agent is applied to the dental substrate; next, for the adhesive luting procedure, a resin luting agent is applied. [(3)] This technique, known as delayed dentin sealing (DDS), dentin hybridization is performed following the provisional restorations and just previously to the indirect restoration luting process. The drawbacks of this technique include, residual temporary cement might

persist on the dental surface, and some cement constituents perhaps infiltrate the dental surface [4].Here the restoration is not bonded to freshly prepared dentin but to a contaminated dentin, which could result in hybridization failure and lessened bond strength [5].

In order to prevent this, the immediate dentin sealing (IDS) method was introduced in the early-1990s by Pashley et al. This method, also referred to as "pre hybridization", "dual bonding technique", and "resin coating technique. In this procedure, an adhesive is applied directly to the fresh cut dentin before the placement of the provisional restoration. IDS demands hybridization of the freshly cut dentinal surface soon after preparing the tooth and before the luting processes[6,7]. This technique provides adhesion to a freshly cut and uncontaminated dentin, which is ideal for bonding[8,9] also presents benefits with regard to bacterial micro leakage, dentin hypersensitivity, gap formation, and bond strength.

Immediate dentin sealing (IDS) has been suggested to reduce postoperative sensitivity and bacterial infiltration while contributing to improved bond strength of indirect restorative procedures [10].

According to previous reports, patients treated with the IDS technique experienced improved comfort during the provisional restoration stage [11,12]. In this technique, the dentin is hybridized using either a two-step self-etching or a three-step etch and- rinse adhesive system (hydrophobic resin covering the primer layer) immediately after preparation and before impression taking, contributing to a reduction of dentin permeability. Simplified etch-and-rinse and self-etching adhesive systems are widely available for clinicians; however, their efficacy in the IDS technique has not been reported so far [13,14,15].

Immediate Dentin Sealing Protocol

According to Magne[16,17] steps in IDS are;

1. Distinguish enamel from dentin by etching for 2-3 sec
2. Expose a fresh layer of dentin using diamond or carbide bur
3. Application of dba and polymerisiation (a supplementary layer of flowable resin in case of unfilled adhesive)
4. Application of glycerine gel and polymerisation
5. Rinse with air/water spray
6. Pumice the preparation with rubber cup to reduce the oxygen inhibition layer.
7. Make the impression.
8. Isolate with separating medium.
9. Place interim restoration
10. Sealed surface must be air abraded and etched before placing final restoration.
11. Lute the final restoration with resin cement

Type of Adhesive System

A conventional three-step total-etch DBA considered to be the most reliable long-term option as recommended by Magne(16) for IDS.It was reported(18,19) that older three-step etch- and-rinse systems and two-step self-etch systems are superior to single-step systems with regard to durability, aging, and bond strength. Disadvantage of single-step self-etching adhesives is that it is susceptible to degradation in the presence of moisture because of the increased hydrophilicity of their interface. (21)

It has also been suggested that, for vital teeth with positive pulpal pressure, the penetration of dentinal fluid through polymerized adhesive layers may destruct the hermetic dentin sealing when single-step self-etching adhesives was used(22) Duarte et al (23) revealed that both total-etch adhesives and self-etch adhesives favored

IDS achieving a significantly higher bond strength than that using the conventional approach (without IDS).

Interaction with Impression Materials

After light curing DBAs present a superficial OIL(oxygen inhibiting layer) of thickness ~40 μm and can inhibit the polymerization of elastomeric impression materials.(24,25)

Ghiggi et al,(26) observed the interaction of resin materials and impression materials. He found that silicone showed incomplete polymerization and polyether attempted to adhere to the resin present on the surface.

Sinjari et al,(27) evaluated the application of prophy paste treatment (surface carefully cleaned with a handpiece, coping brush, and prophy paste at 500 rpm under a water spray for 15 s) and of a surfactant agent (Marseille soap) on the IDS surface before impression-taking with silicone and polyether. They found a reduction of residues in prophy groups and their total disappearance in prophy + Marseille-soap groups for the two impression materials tested.

OIL elimination is the key factor for a defect-free impression. Double polymerization of the DBA with glycerine gel and the several cleaning protocols have shown to give a defect free impression.

Bruzi et al(28) suggested that covering the IDS layer with a liner (flowable/composite) resolves the issue of interaction with impression materials. Coating the DBA with flowable resin enhances subsequent polymerization of the OIL in uncured adhesives thanks to the diffusion of free radicals from the flowable resin.(29)

Interaction with Provisional Materials

With regard to the choice of interim material and cement, resin-based ones should be avoided.(30) Direct acrylic- based provisional materials cannot seal preparations hermetically, which results in contamination of the IDS surface and loss of retention. Conversely, regardless of OIL removal, direct bis-acryl-based provisional materials and resin-based interim cements bond strongly to the IDS substrate. Hence, removal of the provisional material becomes difficult. (31)

The presence of interim-material residue on dentin has been identified in studies using scanning electron microscopy(32) .To avoid this Magne(33) recommends isolation of the tooth preparation with a thick layer of a separating medium (petroleum jelly) during fabrication of the provisional material.

Some authors have reported a reduction in the bond strength of resin materials only after use of eugenol-containing cements(34) .To counteract the drawbacks of eugenol (interaction with initiators, loss of retention, microleakage, it can be replaced by carboxylic acids. However, a reduction in bond strength after adhesive cementation has also been observed with non-eugenol formulations. It has been demonstrated that if IDS is applied, regardless of the use of eugenol-containing or eugenol-free provisional luting agents, interim materials do not influence the adhesion quality of resin cements. (35)

Film Thickness

There is a risk of re-exposure of dentin after conditioning is and is dependent on the conditioning method and on the thickness of the IDS film.(36)

Stavridakis et al (37) suggested the use of a filled DBA to prevent dentin re-exposure after conditioning.

Hashimoto et al (38) observed an increase in the bond strength after application of multiple layers of adhesive (≤4 layers), whereas Ito et al(39) concluded that the separate polymerization of each layer improved the quality of dentin adhesion.

The IDS layer has been found to affect cement thickness. A thicker IDS film contributes to better distribution of stress, yields a superior bond strength, and provides more stable bonding, (40)whereas elimination of undercuts becomes easier.

Interaction with Luting Cements

IDS provides efficient retention with glass ionomer cements, but not advised to be used with zinc phosphate.

In a study (41) that tested several self-adhesive resin cements, IDS was found to influence the bond strength of the resin cement (bond-strength values of Panavia F2.0, RelyX Unicem and RelyX Unicem2 were improved, but no effects were reported for Clearfil SA Cement and G-Cem).

It has been also demonstrated that IDS increases the bond strength of self-adhesive and conventional resin cements. (42)

IDS also interacts well if luted with conventional light-cured composites. IDS has been demonstrated to improve the bond strength of resin cements (conventional or self-adhesive). (43)

Time of Restoration Placement

Magne advocates that IDS favors delayed restoration placement for ≤12 weeks. Leesungbok et al(44) investigated the influence of IDS on the dentin bond strength of a lithium-disilicate ceramic under various thermocycling periods (1, 2, 7 and 14 days). They identified a reduction in bond strength after 1 week and a greater reduction after 2 weeks. Thus, the authors strongly recommend the final bonding to be within 1 week after IDS application.

Even if it is claimed that a delayed restoration placement is attainable when IDS is applied, the final restoration should be delivered as soon as possible.

Hypersensitivity

Hu and Zhuunder [45]took a sensitivity assessment 1 week as well as 1, 6, 12 and 24 months after cementation of a three-unit full-coverage restoration on vital abutment teeth. They identified a significant improvement in patients to whom IDS was applied at 1 week and 1 month after cementation, whereas no differences between IDS and DDS groups were found at the end of 6, 12 and 24 months.

Conversely, van der Breemer (46) detected no difference among IDS and DDS, an anticipated result given the minimally invasive design used for partial ceramic restorations in their study. Hence, the amount of tooth tissue removed plays an important part in the degree of postoperative sensitivity. A distance of 0.5 mm from the pulp can cause a pulpal reaction in 60% of cases, whereas a similar situation occurs in 5% of teeth in which >1 mm of dentin has been preserved. (47)

Early sealing of dentin tubules provided by the IDS technique seems to reduce sensitivity during the provisional phase and after cementation. This is a promising strategy for enhancing comfort and treatment satisfaction.

Conclusion

The IDS technique seems to be advantageous with regard to bond strength, gap formation, bacterial microleakage, and dentin hypersensitivity. However, issues arising from interaction with impression materials, the provisional phase, and conditioning methods before cementation require further investigation. There are no documented reasons preventing clinicians applying IDS in their everyday practice.

References

1. Summit, J.B.; Robbins, J.W.; Hilton, T.J.; Schwartz, R.S. Fundamentals of Operative Dentistry. A Contemporary Approach, 3rd ed.; Quintessence Publishing: Chicago, IL, USA, 2006; pp. 293–294. [Google Scholar]
2. Roberson, T.M.; Heymann, H.O.; Swift, E.J., Jr. Sturdevant's Art and Science of Operative Dentistry, 5th ed.; Mosby: St. Louis, MI, USA, 2006; pp. 504–505. [Google Scholar]
3. Swift, E.J., Jr. Critical appraisal; immediate dentin sealing for indirect bonded restorations. J. Esthet. Restor. Dent. 2009, 21, 62–67. [Google Scholar] [CrossRef]
4. Tetsuka, N. Influence of temporary cement on dentin permeability. Jpn. J. Conserv. Dent. 1993, 36, 822–828. [Google Scholar]
5. Paul, S.J.; Schärer, P. Effect of provisional cements on bond strength of various adhesive bonding systems on dentin. J. Oral Rehabil. 1997, 24, 8–14. [Google Scholar] [CrossRef]
6. Magne, P.; So, W.S.; Cascione, D. Immediate dentin sealing supports delayed restoration placement. J. Prosthet. Dent. 2007, 98, 166–174. [Google Scholar] [CrossRef]
7. Magne, P. Immediate dentin sealing: A fundamental procedure for indirect bonded restorations. J. Esthet. Restor. Dent. 2005, 17, 144–155. [Google Scholar] [CrossRef]
8. Samartzi, T.K.; Papalexopoulos, D.; Sarafianou, A.; Kourtis, S. Immediate Dentin Sealing: A Literature Review. Clin. Cosmet. Investig. Dent. 2021, 13, 233–256. [Google Scholar] [CrossRef] [PubMed]
9. Elbishari, H.; Elsubeihi, E.S.; Alkhoujah, T.; Elsubeihi, H.E. Substantial in-vitro and emerging clinical evidence supporting immediate dentin sealing. Jpn. Dent. Sci. Rev. 2021, 57, 101–110. [Google Scholar] [CrossRef] [PubMed]
10. Hu J, & Zhu Q (2010) Effect of immediate dentin sealing on preventive treatment for postcementation hypersensitivity International Journal of Prosthodontics 23(1) 49-52.
11. Magne P, Kim TH, Cascione D, & Donovan TE (2005) Immediate dentin sealing improves bond strength of indirect restorations Journal of Prosthetic Dentistry 94(6) 511-519
12. Pashley EL, Comer RW, Simpson MD, Horner JA, Pashley DH, & Caughman WF (1992) Dentin permeability: Sealing the dentin in crown preparations Operative
13. Albuquerque M, Pegoraro M, Mattei G, Reis A, & Loguercio AD (2008) Effect of double-application or the application of a hydrophobic layer for improved efficacy of one-step self-etch systems in enamel and dentin Operative Dentistry 33(5) 564-570.
14. King NM, Tay FR, Pashley DH, Hashimoto M, Ito S, Brackett WW, Garcı´a-Godoy F, & Sunico M (2005) Conversion of one-step to two-step self-etch adhesives for improved efficacy and extended application. American Journal of Dentistry 18(2) 126-134.
15. Santana VB, de Alexandre RS, Rodrigues JA, Ely C, & Reis AF (2016) Effects of immediate dentin sealing and pulpal pressure on resin cement bond strength and nanoleakage Operative Dentistry 41(2) 189-199.
16. Magne P, Kim TH, Cascione D, Donovan TE. Immediate dentin sealing improves bond strength of indirect restorations. J Prosthet Dent. 2005;94(6):511–519. doi:10.1016/j.prosdent.2005.10.010

17. Magne P. IDS: Immediate Dentin Sealing (IDS) for tooth preparations. J Adhes Dent. 2014;16(6):594. doi:10.3290/j.jad. a33324
18. Magne P, So WS, Cascione D. Immediate dentin sealing supports delayed restoration placement. J Prosthet Dent. 2007;98(3):166– 174. doi:10.1016/S0022-3913(07)60052-3
19. Nawareg MM, Zidan AZ, Zhou J, Chiba A, Tagami J, Pashley DH. Adhesive sealing of dentin surfaces in vitro: a review. Am J Dent. 2015;28(6):321–332
20. Ferreira-Filho RC, Ely C, Amaral RC, et al. Effect of different adhesive systems used for immediate dentin sealing on bond strength of a self-adhesive resin cement to dentin. Oper Dent. 2018;43(4):391–397. doi:10.2341/17-023-L22
21. Sahin C, Cehreli ZC, Yenigul M, Dayangac B. In vitro permeability of etch-and-rinse and self-etch adhesives used for immediate dentin sealing. Dent Mater J. 2012;31(3):401–408. doi:10.4012/dmj.2011-217
22. Duarte S Jr., de Freitas CR, Saad JR, Sadan A. The effect of immediate dentin sealing on the marginal adaptation and bond strengths of total- etch and self-etch adhesives. J Prosthet Dent. 2009;102(1):1–9. doi:10.1016/S0022-3913(09)00073-0
23. Rueggeberg FA, Margeson DH. The effect of oxygen inhibition on an unfilled/filled composite system. J Dent Res. 1990;69 (10):1652–1658. doi:10.1177/00220345900690100 50
24. Erickson RL. Mechanism and clinical implications of bond formation for two dentin bonding agents. Am J Dent. 1989;2:117–123.
25. Ghiggi PC, Steiger AK, Marcondes ML, Mota EG, Burnett LHJ, Spohr AM. Does immediate dentin sealing influence the polymerization of impression materials? Eur J Dent. 2014;8(3):366– 372. doi:10.4103/1305-7456.137650
26. Sinjari B, D'Addazio G, Murmura G, et al. Avoidance of interaction between impression materials and tooth surface treated for immediate dentin sealing: an in vitro study. Materials (Basel). 2019;12(20):3454. doi:10.3390/ma1220345434
27. Bruzi G, Carvalho MA, Maia HP, Giannini M, Magne P. Are there combinations of resin liners and impression materials not compatible with IDS technique? Am J Esthet Dent. 2013;3 (3):200–208.
28. Jayasooriya PR, Pereira P, Nikaido T, Tagami J. Efficacy of a resin coating on bond strengths of resin cement to dentin. J Esthet Restor Dent. 2003;15(2):105–113; discussion 113. doi:10.1111/ j.1708-8240. 2003.tb00325.x32
29. da Silva CJR, Gonçalves ICS, Botelho MPJ, Guiraldo RD, Lopes MB, Ja G. Interactions between resin-based temporary materials and immediate dentin sealing. Appl Adhes Sci. 2016;4(3).
30. Schoenbaum TR, Ercus S, Snowden J. Reverse spot bonding: a novel technique for provisionalization with immediate dentin sealing. Compend Contin Educ Dent. 2012;33(5):374–377.36
31. Watanabe EK, Yatani H, Ishikawa K, Suzuki K, Yamashita A. Pilot study of conditioner/primer effects on resin-dentin bonding after provisional cement contamination using SEM, energy dispersive x-ray spectroscopy, and bond strength evaluation measures. J Prosthet Dent. 2000;83(3):349–355. doi:10.1016/s0022- 3913(00)70139-938
32. Magne P, Kim TH, Cascione D, Donovan TE. Immediate dentin sealing improves bond strength of indirect restorations. J Prosthet Dent. 2005;94(6):511–519. doi:10.1016/j.prosdent.2005.10.01010

33. Yap AU, Shah KC, Loh ET, Sim SS, Tan CC. Influence of eugenol-containing temporary restorations on bond strength of composite to dentin. Oper Dent. 2001;26(6):556–561.41
34. Hironaka NGL, Ubaldini ALM, Sato F, Giannini M, Terada RSS, Pascotto RC. Influence of immediate dentin sealing and interim cementation on the adhesion of indirect restorations with dual-polymerizing resin cement. J Prosthet Dent. 2018;119(4):678e1– 678 e8. doi: 10.1016/j.prosdent.2018.02.00140
35. Stavridakis MM, Krejci I, Magne P. Immediate dentin sealing of onlay preparations: thickness of pre-cured dentin bonding agent and effect of surface cleaning. Oper Dent. 2005;30(6):747–757.57
36. Stavridakis MM, Krejci I, Magne P. Immediate dentin sealing of onlay preparations: thickness of pre-cured dentin bonding agent and effect of surface cleaning. Oper Dent. 2005;30(6):747–757.57
37. Hashimoto M, Sano H, Yoshida E, et al. Effects of multiple adhesive coatings on dentin bonding. Oper Dent. 2004;29 (4):416–423.59
38. Ito S, Tay FR, Hashimoto M, et al. Effects of multiple coatings of two all-in-one adhesives on dentin bonding. J Adhes Dent. 2005;7 (2):133–141.60
39. Murata T, Maseki T, Nara Y. Effect of immediate dentin sealing applications on bonding of CAD/CAM ceramic onlay restoration. Dent Mater J. 2018;37(6):928–939. doi:10.4012/dmj.2017-377
40. Giannini M, Takagaki T, Bacelar-Sa R, et al. Influence of resin coating on bond strength of self-adhesive resin cements to dentin. Dent Mater J. 2015;34(6):822–827. doi:10.4012/dmj.2015-099
41. Santana VB, de Alexandre RS, Rodrigues JA, Ely C, Reis AF. Effects of immediate dentin sealing and pulpal pressure on resin cement bond strength and nanoleakage. Oper Dent. 2016;41 (2):189–199. doi:10.2341/15-150-L
42. Van den Breemer CRG, Buijs GJ, Cune MS, et al. Prospective clinical evaluation of 765 partial glass-ceramic posterior restorations luted using photo-polymerized resin composite in conjunction with immediate dentin sealing. Clin Oral Investig. 2021;25 (3):1463–1473. doi:10.1007/s00784-020-03454-777
43. Leesungbok R, Lee SM, Park SJ, et al. The effect of IDS (immediate dentin sealing) on dentin bond strength under various thermocycling periods. J Adv Prosthodont. 2015;7(3):224–232. doi:10.4047/jap.2015.7.3.22490
44. Hu J, Zhu Q. Effect of immediate dentin sealing on preventive treatment for postcementation hypersensitivity. Int J Prosthodont. 2010;23(1):49–52.104
45. van den Breemer C, Gresnigt M, Ozcan M, Kerdijk W, Cune MS. Prospective randomized clinical trial on the survival of lithium disilicate posterior partial crowns bonded using immediate or delayed dentin sealing: short-term results on tooth sensitivity and patient satisfaction. Oper Dent. 2019;44(5):E212–E222. doi:10.2341/18-047-C103
46. Camps J, Dejou J, Remusat M, About I. Factors influencing pulpal response to cavity restorations. Dent Mater. 2000;16 (6):432–440. doi:10.1016/s0109-5641(00)00041-5106.