



Immediate Dentin Sealing for Indirect Bonded Restoration: Literature Review

Sarah Omar ^{a#*}, Waad Albelady ^{a#}, Yamam Alharbi ^{a#},
Tamadher Alzubaidi ^{a#} and Latifah Shuailah ^{a#}

^a Vision Medical College, Jeddah, Saudi Arabia.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Objectives: The purpose of this review was to elaborate on the role of the immediate dentinal sealing technique in reducing hypersensitivity after indirect bonded restoration placement.

Materials and Methods: A PubMed literature search was conducted using the search terms "immediate dentin sealing" AND "dual bonding technique" AND "resin coating technique" AND "prehybridization". The search was restricted to studies published between 1 January 2010 and 1 November 2022. A total of 31 papers were found as a result of the PubMed search. After the exclusion of irrelevant or duplicated articles, 15 articles were included in this review.

Results: The results strongly indicate that the immediate dentine sealing technique (IDS) improves the bonding strength between indirect restoration and tooth as compared to conventional delayed dentinal seal.

Conclusions: IDS is a sealing adhesive technique that reduces post-cementation hypersensitivity and improves adhesion for indirect restoration, especially in those indirect restorations in which hypersensitivity is more common after cementation and retention are difficult to achieve such as porcelain laminated veneer.

Interns Students;

*Corresponding author: E-mail: Sara.monawar12@gmail.com;

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1. INTRODUCTION

Direct restoration such as composite restoration does not provide better results in large cavities with proximal surface involvement. It affects proximal contact, tooth anatomy, improper marginal adaptation, and can wear [1]. Indirect restoration such as ceramic veneers, full-coverage crowns, inlay, and onlay provides a better result as compared to direct restoration because they can provide better aesthetics, and tooth anatomy, and give better resistance against fracture [2].

Proper adhesion of indirect restoration with the tooth structure plays an important role in the success of the treatment. The IDS technique provides a better outcome in inlay, onlay, and veneer adhesion with the tooth [3, 4]. IDS technique forms a dentine bond before the impression that seals the dentinal tubules. After the provisional restoration is removed, this dentine bond is reactivated by air-particle or abrasion, before the luting of the final restoration [5].

IDS technique had various advantages including improving the dentine bonding with freshly cut dentine, in indirect restoration stress-free dentine bond development with IDS due to delayed occlusal forces and IDS forms a seal that prevents sensitivity and bacterial invasion until final restorative placement [6].

Furthermore, applying a direct bonding agent on the freshly cut dentin increases strength and blockage of the dentinal tubule, provides better marginal adhesion, decreases microleakage, and hypersensitivity, reducing infection or RCT, or failure of the restoration as compared to DDS [7]. IDS technique required careful management of the oxygen inhibition layer (OIL) before impression and complete cleaning of the dentinal surface is required before cementation of final restoration because any remnant particles of luting cement on the dentinal surface can reduce the bonding strength and adhesion failure with indirect restoration [8].

Post-cementation sensitivity is common after indirect restoration placement [9]. Some factors can increase tooth hypersensitivity such as excessive tooth preparation, which affects the dentine through heat and mechanoreceptors [10]. The immediate dentinal seal technique,

reduce hypersensitivity by obturating the dentinal tubules before impression, reduce irritation of freshly cut tooth at the time of impression, and control sensitivity during the period of provisional and final restoration placement [11].

IDS technique more effectively controls hypersensitivity as compared to the conventional adhesive system. IDS provide better result in controlling post-cementation hypersensitivity in the full-coverage crown as compared to posterior inlay and onlay; that is due to more dentinal tubules being exposed in a full-coverage crown. IDS obturates the dentinal tubules and reduces dentinal permeability by applying adhesive resin before the impression. More clinical trials and data analyzing literature are required for evaluating the result that IDS is better than conventional DDS in controlling post-cementation hypersensitivity after indirect restoration placement. Consequently, the aim of this literature review was to elaborate on the role of the IDS technique in reducing hypersensitivity after indirect bonded restoration placement.

2. METHODS

A PubMed literature search was conducted using the search terms “immediate dentin sealing” AND “dual bonding technique” AND “resin coating technique” AND “prehybridization”. The search was restricted to studies published between 1 January 2010 and 1 November 2022. A total of 31 papers were found as a result of the PubMed search. After the exclusion of irrelevant or duplicated articles, 15 articles were included in this review according to the selected criteria (Fig. 1). These studies are summarized in Table 1.

3. RESULTS

3.1 Steps of IDS Technique

IDS is known as a dual bonding technique because it is a modified method to improve the luting of indirect restoration [12]. IDS with indirect restorative material overcomes all the disadvantages of direct restorative material such as marginal adaptation, better proximal contact, and wear resistance which compromises the aesthetic and function, especially in the anterior teeth. In IDS seal is applied on dentine before the impression then placed the provisional restoration with the help of temporary luting

cement. After the final restoration comes the provisional restoration is replaced with the final restoration with the help of luting cement [6].

In the IDS technique, the dentine is prepared before applying adhesive bond resin with the help of initial etching of the dentinal surface for 2 to 3 sec. This etching exposed the dentinal surface so dentine bonding agent (DBA) can bind with dentine easily. The thickness of DBA and polymerization affected by the prepared depth of the dentine for seating the restoration, especially in porcelain veneer [6]. After DBA polymerization, either self-cure or light cure, additional polymerization is required for DBA with glycerine

gel. It forms an oxygen inhibition layer (OIL) for oxygen blockage [13].

Before the impression, OIL is removed otherwise it interacts with the impression material and delayed its polymerization. With the help of a rubber cup, softly rubbing the resin surface, especially with the elastomer material. Take impression and lute the interim restoration with help of temporary luting cement after applying a separating medium so it can remove easily. Before the final restoration placement, removes all particles of luting cement otherwise it affects the adhesion. Then etch the enamel and lute the restoration with the luting cement.

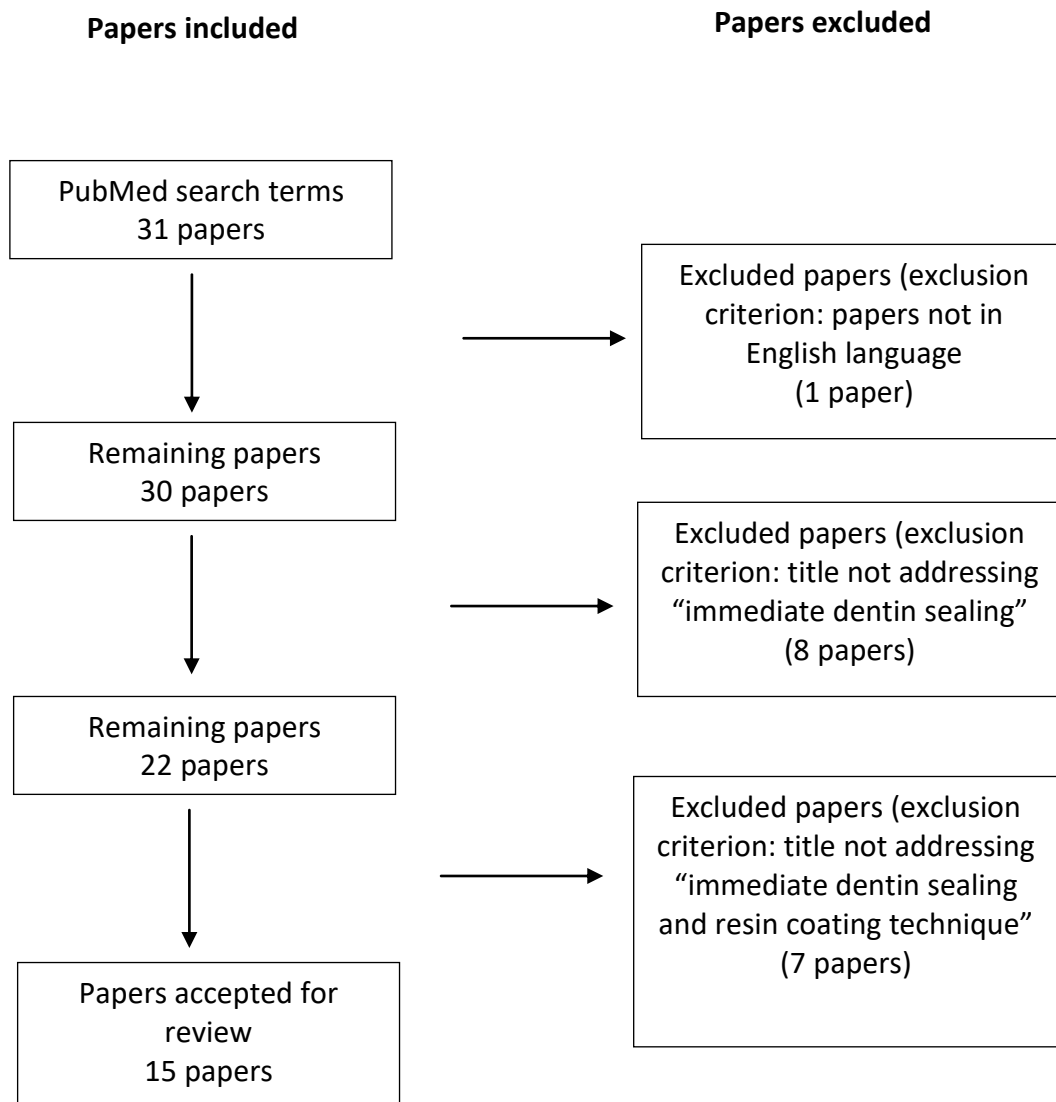


Fig. 1. PubMed search process

Table 1. Previous studies and clinical trials on IDS that published from 2010 to 2022

Title of paper	Author name	Page no	Result	Conclusion
The development of immediate dentin sealing/selective etching bonding technique.	Helvey GA, 2011	24–32	Evaluate different bonding material and technique.	Combing different bonding technique led to IDS creation.
Effect of Immediate Dentin Sealing on Preventive Treatment for Post-cementation Hypersensitivity.	Hu, Jun, and Qing dang Zhu, 2011	49-52	Teeth in Group A were treated with Prime and Bond using the IDS technique while teeth in Group B were used as a control and left untreated. Scores for teeth in Group A were statistically significantly lower than those in Group B at 1 week and 1-month post-cementation ($P < .05$), whereas there was no significant difference between Groups A and B at the end of 6, 12, and 24 months ($P > .05$).	Preventive treatment with Prime and Bond using the IDS technique can significantly reduce post-cementation hypersensitivity
Are some combinations of resin liners and impression materials not compatible with IDS technique?	G Bruzi, et al. 2013	200-208	This study aimed to explore the interactions between adhesive resins/liners and impression materials when using immediate dentin sealing (IDS). Four different adhesive systems were used: Optibond FL, Scotchbond Universal, Optibond XTR, and Filtek LS. Two impression materials were used: Express STD or Impregum F. For each adhesive and impression material, six surface treatments were evaluated. Additional groups were tested by adding a liner on top of the IDS layer.	No interaction was found in control group. The combination of vinyl polysiloxane (VPS) and simplified adhesives showed 100% unpolymerized impression material. Optibond FL demonstrated VPS inhibition (66.6%) only when untreated. The combination of polyether and IDS showed unpredictable results with varying amounts of negative interactions (0% to 100%). No interactions were observed when a liner was applied. Only the combination of VPS and Optibond FL yielded 100% perfect impressions when used in conjunction with any of the surface treatments. All other adhesives resulted in significant unpolymerized VPS even after surface treatment.

Title of paper	Author name	Page no	Result	Conclusion
Performance of ceramic laminated veneers with immediate dentine sealing: an 11-year prospective clinical trail	MMM Gresnigt, et al. 2013	1042-1052	In teeth with more than 50% of dentin exposure, a significant increase in survival rate was observed when IDS was used (96.4% versus 81.8%). No significant difference was found between teeth with and without pre-existing composite resin restorations (84.6% versus 95.5%) or between vital and non-vital teeth (95.6% versus 88.1%).	Teeth with more than 50% of dentin exposure significantly benefit from IDS. Pre-existing restorations or endodontic treatments do not have an effect on the survival rate of ceramic laminate veneers. However, smoking habits and previous endodontic treatments negatively affect the success rate due to colour changes.
Influencing of different conditioning method on the immediate or delayed dentine sealing	Falkensammer F, et al. 2014	204-210	The immediate group had significantly lower bond strengths than the delayed group. Fracture analysis found more failures in the adhesive layers in the immediate groups and a prevalence of mixed failures in the delayed groups. The surface analysis found significant abrasion and roughness when airborne-particle abrasion with silicate dialuminium oxide was used for immediate and delayed dentin sealing surfaces.	Polishing and airborne-particle abrasion with silicate dialuminium oxide or glycine are efficient methods in conditioning immediate and delayed dentin sealing surfaces. Airborne-particle abrasion with silicate dialuminium oxide leaves significant surface alterations on both types of surfaces
Does immediate dentine seal influence the polymerization of impression material?	PC Giggi et al. 2014	366-372	The objective of the following study is to evaluate the interaction between the resin materials used in immediate dentin sealing (IDS) techniques and impression materials with two different techniques to eliminate the oxygen-inhibition layer. Small quantity of unpolymerized impression material remained attached to the CSE or to the PLF in Groups 1b and 1e. Groups 1c and 1d prevented the interaction. Small quantity of polymerized impression material remained attached to the CSE or to the PLF for Groups 2b and 2e. The same interaction was observed	Resin materials interacted with impression materials. The application of glycerine jelly and alcohol prevented the interaction of CSE with Express XT and PLF with Impregum; however, these treatments were not completely effective in preventing the interaction of CSE with Impregum and PLF with Express XT

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Immediate dentin sealing for indirect bonded restoration	Anchal Qanungo et al., 2016	240-249	for Groups 2c and 2d. For Groups 2c and 2f, no interactions were observed. Immediate dentine sealing (IDS), appears to achieve improved bond strength, fewer gap formations, decreased bacterial leakage, and reduces post-cementation sensitivity. This rational approach to adhesion is also reported to have a positive influence on tooth structure preservation, patient comfort, and long -term survival of indirect bonded restorations.	In the extensive literature regarding advantages of using IDS technique significant differences have been shown when compared to Delayed Dentine Sealing. Although more research is required in this field, presently there are NO scientific reasons not to recommend IDS in routine practice.
Effect of immediate dentine sealing on the lithium disilicate and multiphase resin composite inlay restoration	Van den breemer, et al. 2017	102-109	No significant differences were observed between the materials with respect to cement remnants or IDS after fracture ($p=0.880$). The incidence of repairable failure types (83%) was more common with L than with MR (75%) material ($p>0.05$)	Immediate dentin sealing improves adhesion, and thereby the fracture strength of inlays made of lithium disilicate but not that multiphase resin composite
Effect of different adhesive systems used for immediate dentin sealing on bond strength of a self-adhesive resin cement to dentin.	Ferreira-Filho RC, Ely C, Amaral RC, et al. 2018	391–397.	The purpose of this study was to investigate the immediate and three-month water storage behaviour of adhesives when used for immediate dentin sealing (IDS).After seven days, the control group presented the lowest μ TBS but did not differ from XP Bond and Clearfil SE Bond. After three months, there was no μ TBS difference between the IDS groups and the control.	After seven days of water storage, the groups with IDS presented higher μ TBS values than the control group, although XP Bond and Clearfil SE Bond did not present significant differences. However, after three months of storage in water, IDS groups did not differ significantly from control group, which did not receive IDS.
Prospective randomize clinical trial on the survival of lithium disilicate posterior partial crown bonded using immediate or delayed dentine	Van den breemerc, et al. 2019	212-222	Data were analyzed and shoe that there was no significant difference in patient-reported tooth sensitivity between the preoperative phase and all other time points ($p>0.01$). There was also no	No tooth sensitivity change was noticed with the application of partial ceramic indirect restorations. This clinical study could not confirm that IDS is more advantageous than DDS in terms of tooth

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seal			significant difference between IDS and DDS ($p>0.01$) for all items on the questionnaire. VAS scores did not differ significantly between the IDS and DDS groups for all items in the questionnaire at all time points ($p>0.01$).	sensitivity and patient satisfaction at 1 year of clinical service of partial ceramic restorations
Effect of immediate dentine sealing and surface conditioning of microtensile bond strength of resin-based composite to dentine	Van den Breemer, et al. 2019	289-298	the interaction of IDS strategy and SC methods appeared statistically significant ($p=0.016$). The six-month specimen evaluation showed no significant difference in μ TBS for SC ($p=0.297$) and SC/IDS interaction ($p=0.055$), but the μ TBS of the IDS strategies differed significantly among them ($p=0.003$). For tribochemical silica-coated IDS, no significant effect of aging on μ TBS was recorded ($p=0.465$), but there was a highly significant difference in μ TBS depending on the IDS strategy ($p<0.001$). In addition, the interaction of IDS and aging was borderline statistically significant ($p=0.045$).	The specimens failed mainly at the adhesive-dentin interface for all experimental groups. Dentin exposure during clinical procedures for indirect restorations benefits from the application of IDS, which was shown to result in higher bond strength. No significant differences were found between cleaning with solely pumice or pumice followed by tribochemical silica coating.
Adhesion of resin cement to dentine: effect of adhesion promoters, immediate dentine sealing strategies and surface conditioning	Van den breemer CR, et al. 2019	52-63	This study evaluated the shear bond strength (SBS) of resin cement to dentin after applying two adhesive (A) systems with a combination of four different immediate dentin sealing (IDS) strategies, and two surface conditioning (SC) methods. No significant differences in SBS results were found between the IDS groups ($P = 0.43$) and between the SC methods ($P = 0.76$). Dentin-cement interface failures diminished with the application of IDS.	IDS improves the SBS compared with DDS. No significant differences were found between the tested conditioning methods

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Substantial in-vitro and emerging clinical evidence supporting immediate dentin sealing	Haitham Elbishari et al. 2021	101-110	The results of this review revealed substantial in-vitro evidence supporting the IDS benefits including improved bond strength, reduced dentin permeability, improved restorations' adaptation, and increased fracture strength of the restorations	Clinical studies have shown that IDS improves survival of ceramic laminate veneers bonded to prepared teeth with increased exposure of dentin. Moreover, it has been shown that IDS reduces post-cementation hypersensitivity in full coverage restorations, which is characterized by exposure of a large number of dentinal tubules
Immediate dentinal seal: A systemic review	Theodora-kalliopi Samartzi et al. 2021	233-256	After exclusion of irrelevant or duplicate articles, 88 articles focusing on aspects of the IDS technique were assessed. IDS 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. On the contrary, the presented technique seems to be beneficial in certain aspects regarding indirect restorations
Immediate Dentin Sealing for Adhesive Cementation of Indirect Restorations: A Systematic Review and Meta-Analysis	Louis Hardan, Walter Devoto, Rim Bourgi, et al. 2022	175	The included studies tested several types of adhesives for IDS, including two-step etch and-rinse, three-step etch-and-rinse, one-step self-etch, two-step self-etch, and universal-adhesives. The bond strength was evaluated using the micro-tensile or the shear bond strength tests	The in vitro evidence suggest that the use of the IDS technique improves the bond strength of dentin to resin-based restorations regardless of the adhesive strategy used. The use of a three-step etch-and-rinse adhesive system or the combination of an adhesive system plus a layer of flowable resin seems to considerably enhance the bond strength in the long term.

“IDS has advantages over DDS in adhesion bonding strength, marginal adaptation, and durability of indirect restoration but IDS has some disadvantages also such as an excessive residual thickness of the adhesive layer, interaction with impression material, and interaction of cement at the poisoning of final restoration” [13].

3.2 Adhesive Bond of Immediate Dentinal Seal

IDS provides better adhesion as compared to conventional delayed dentine seal (DDS) [14]. “Magne et al in their study state that the tensile strength of the three-step etch and rinse DBA is five times more effective than the DDS technique” [15].

The main function of the IDS adhesive system is to provide adhesion to direct and indirect restoration, marginal adaptation, and easily handle for reducing chair time. There are three types of adhesion systems three steps-etch and rinse, two-step or self-etch, and universal etch [7]. Single step etch adhesive system is better in handling but its hydrophilic property can retain water which decreases its durability and bonding strength [16] as compared to three steps etch -rinse and two steps self-etch. Conventional three and two-step etch hydrophobic resin coating make a desirable adhesive system for IDS [5].

In bond strength comparison of resin adhesive system, according to Magne and colleagues [17] studied Optibond FL (Kerr, Orange, Calif, USA), which is a 3-step etch and rinse adhesive resin and Clearfil SE Bond (Kuraray, Tokyo, Japan), a 2-step self-etching adhesive resin, produced significantly higher bond strength when used with IDS as compared to DDS technique there are no significant changes in the bond strength of these two over the period but higher in strength as compare to DDS [5].

For tensile strength comparison between four adhesive resin Opti bond FL bond, Clear fil SE Bond, one-step self-etch Xeno V (Dentsply De Trey), and the 2-step etch and rinse XP Bond (Dentsply De Trey) a study was done by Ferreira-Filho et al. [16]. It was reported that after the adhesive resin keeps in water storage for 30 days, the tensile bond strength was higher in Opti bond FL and Clear fil SE Bond as compared to one-step self-etch Xeno V (Dentsply De Trey) and the 2-step etch and rinse XP Bond (Dentsply De Trey) and negligible difference in tensile

strength was found between Opti bond FL and Clear fil SE Bond.

The smear layer or adhesive layer thickness has an impact on the adhesion property of IDS. There are two types of resin according to resin filling, micro-filled and unfilled resin. Micro-filled resins are better in strength as compared to underfilled due to low viscosity, form a uniform thick polymerized layer, and they can better absorb functional stress or polymerization shrinkage of overlying luting cement due to enriching fiber [18,19]. A thick resin layer also prevents exposure of dentine after removal of provisional restoration. The thickness of filled resin varies by tooth morphology such as shallow and deep undercut between 60 to 80 μm on smooth convex surfaces and up to 200–300 μm on concave structures such as chamfer finish lines [20, 21]. The aggressive drying air to remove luting cement of provisional luting cement affect the thickness of the adhesive layer and adhesion of the resin. Gentle air thinning over adhesive resin has been shown not to affect bond strength [22]. Unfilled resin and a thin layer of adhesive resin provide a weak adhesive bond [8]. Flowable resin after the adhesive layer compensates for this problem. Flowable resin composite improves the strength of the hybrid layer and marginal seal so decreases sensitivity and improves the bond between luting cement and dentine [23, 24]. Flowable resin composite also converse tooth structure by blockage of undercut in inlay and onlay [25].

Magne et al. recommended “the use of a three-step etch and rinse or two-step self-etching filled adhesive resin. It was suggested that if unfilled resin adhesive is used for IDS, it should be protected with a layer of flowable composite resin” [17,26].

3.3 Interaction with Impression

Impression taken after IDS shows that the resin surface interacts with impression material, and it produces residues of different impression materials such as poly ether and silicon due to the oil. It also found that cleaning the surface of the resin to remove oil, overcomes the interaction of impression with IDS treatment [13]. “Different techniques used to eliminate the OIL have been proposed and investigated such as air blocking, pumicing, alcohol, detergent, or cleaning with an Opticlean bur at 500 rpm, prophy paste, and Marseille soap” [13].

3.4 Hypersensitivity

Post-operative sensitivity is the major problem after cementation of in-directed restoration. It is common just after the indirect restoration placement of around 10% of cases [9]. Many factors cause hypersensitivities such as excessive tooth preparation during the removal of deep caries 0.5mm in the pulp tissue and 1mm in remaining dentine that causes can damage the pulp with heat and mechanoreceptors cause hypersensitivity [10].

IDS help to obstructed dentinal tubule just after the preparation, it also decreases microleakage and penetration of bacteria, reduce pain and irritation of freshly cut dentinal tissue during the impression, and controls sensitivity during the provisional period of restoration [11]. IDS can reduce prolong hypersensitivity after cementation of indirect restoration [27]. Biomaterial properties and sealing technique of IDS produce an effective result on the post hypersensitivity.

Other causes include chemical and thermal stimuli during provision and final restoration placement [28]. Post-cementation hypersensitivity is commonly more in the initial 24 hr of the restoration placement but may be prolong to 12-months can be resolved by itself in most cases [29]. "IDS significantly reduced post-cementation hypersensitivity as compared to those with the DDS technique up to 1-month post-cementation. But no difference in post-cementation hypersensitivity after 6- and 24-month follow-ups" [29,30].

Hypersensitivity after cementation also depend upon size of restoration such as inlay, onlay, or full coverage restoration, Hypersensitivity is more common due to more exposure of the dentinal tubules. A study was performed [29] to evaluate the hypersensitivity and the size of restoration after IDS. Post-cementation hypersensitivity decreased on full coverage restoration after applying IDS as compared to DDS after a 1month follow-up [31]. It had been reported that the application of adhesive resin immediately after tooth preparation reduced dentine permeability and controlled hypersensitivity [11,31]. On posterior inlay and onlay restoration, post-cementation hypersensitivity remains with IDS as same with DDS after 1 week, 3 months, and 12 months follow up [32].

"It had been reported that there was low certainty of evidence obtained from clinical trials

demonstrating that IDS does not reduce postoperative sensitivity (POS) in teeth restored with indirect restorations" [8]. "According to previous study there was low statistically significant difference in the occurrence of POS when comparing IDS and DDS techniques. Due to the small number of articles available in literature regarding the subject of dentin sealing techniques in decreasing POS, the need to conduct further randomized clinical trials with larger sample sizes and longer follow-up periods to investigate the effect of IDS on POS" [33, 34].

4. DISCUSSION

IDS is a new technique that formed a dual bond adhesive technique used for indirect restoration. With the help of this technique, a better dentinal seal obtained before impression that preserves the tooth preparation by obturate dentinal tubules, and blocking the pathway that connects microorganism and pulp so help in maintaining the tooth vitality [34]. "IDS provides higher bond strength as compared to DDS.IDS had same bond strength as compared to direct restoration bonding strength. IDS Enhances bonding capacity of indirect restoration with a two-step etch-and-rinse or a one-step self-etch adhesive system, but the complete elimination of marginal microleakage could not be possible" [35].

IDS have advantages over conventional bonding system However, the resin adhesive layer produces chemical interaction with the clinical step of indirect restoration such as increased DBA thickness, delayed polymerization of zinc-oxide eugenol impression material, a residual particle of provisional luting cement can interact with the adhesive bond formation between adhesive cement and final restoration [13].

DBA thickness depends upon the morphology of the tooth and the space available under the tooth [8]. The composition of DBA is also impacted resin application as resin composite have some properties like dental tissue [36] and having same modulus of elasticity so it sharing uniform force under restoration [37] especially with filled DBA can make a uniform film thickness as compare to unfilled [21]. The film thickness can't affects the siting and marginal adaptation of final restoration because impression for final restoration fabrication taken after applying the thick resin film, and also record detail and thickness of DBA [17]. It has been recommended that 3 steps etch -rinse bond and 2-steps filled

adhesive to be used with a flowable resin over unfilled resin to protect it [5,22].

Delayed polymerization of DBA produces oil and it is the main cause of impression surface alteration. Superficial surface of resin adhesive layer is covered with un-polymerized monomer, that interacts with impression materials which results in inhibition of polymerization elastomeric impression material such as polyvinyl siloxane (PVS) [26,38]. It has also been shown to cause adherence and inhibition of polymerization of polyether impression materials [26,39]. Various methods introduced the control of OIL and remain the impression material unaffected such as air blocking, pumicing, alcohol, detergent, surfactant, and propyl past [13]. Combination of OIL eliminating method produce better result as compared to individual especially with poly-ether impression [13]. Flowable composite also produce better result to eliminate oil before impression [39,40].

Post-cementation hypersensitivity is reduced with IDS especially when used for full coverage crown adhesion [41]. Film thickness and dentine bonding agent type also influence the post-cementation hypersensitivity. Feilzer et al. [42] showed that thick film resin provide better result with improved marginal seal and stable adhesion that control hypersensitivity. Similarity, bonding agent type such as prime and bond 5 generation dentine bonding agent can control hypersensitivity better as compare to other type [43]. Self-etch resin bonding system used in IDS is easy in handling, can etch better the dentinal tubules, make improved quality of adhesion bond than other type, decrease microleakage and improve post cementation hypersensitivity [44]. "There is inadequate literature available at present on a consolidated protocol and clinical effectiveness of IDS procedure to minimize hypersensitivity" [45].

IDS adhesion restoration having more survival rate as compared to DDS. Even IDS provide better bond strength if the 50 % of tooth is loss because IDS showed better adhesion with dentine as compared to enamel adhesive system [46]. Gurel et al. [47] showed that porcelain laminated veneer had more survival rate that was 99.1 %in IDS as compared to DDS that have 86.6% survival rate. As compared to porcelain laminated veneer, inlay and onlay, IDS provided better outcomes in posterior inlay and onlay because in posterior teeth there is only axil force the affected the IDS adhesion and while in

porcelain laminated veneer both tensile and shear forces are difficult to encounter by IDS [48].

5. CONCLUSION

IDS is a sealing adhesive technique that reduces post-cementation hypersensitivity and improves adhesion for indirect restoration especially in those indirect restoration in which hypersensitivity is more common after cementation and retention is difficult to achieve such as porcelain laminated veneer. IDS provides successful results with filled resin, flowable composite with unfilled resin and thick layer of dentine bonding agent. IDS having advantages property of decreasing post-cementation hypersensitivity with strengthen adhesive bond, so it improves the survival rate of indirect bonded restoration.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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