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Bonding of indirect esthetic restorations: Case reports

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Abstract
Indirect restorations are the mainstay and future of dentistry. It depends solely on the bonding mechanisms. This article has tried its maximum to show the clinical aspects and mechanisms involved with bonding of Indirect Esthetic restorations.

Keywords: Esthetic restorations, mechanisms, clinical aspects

Introduction
In the 1980s, the adhesive technology needed to fuse indirect restorations to the tooth structure was initially developed [1, 2]. Since then, indirect adhesive restorations have emerged as a key component of restorative dental care. Secondly, they give the bonded repair more strength. They permit a preparatory design that is simpler and frequently more conservative.
The luting agent plays a critical role in the success of non-metallic restorations by ensuring marginal integrity and an efficient, long-lasting connection between the restoration and the tooth structure. Luting agents ought to be biocompatible, produce good aesthetic effects, and have minimal solubility and radiopacity [3].
For a number of reasons, including the existence of decay, fractures, dental wear, loss of structure, functionality, and aesthetics, as well as the need to repair anterior restorations that have failed, dental restorations are recommended to restore lost tissues [4, 5].
For Indirect restorations ceramic, hybrid, or polymeric materials might be utilised. Because of its excellent ability to fit in with the oral environment and meet both practical and aesthetic requirements, ceramic is a material that is commonly employed. Comparable to resin restorations, or marginally superior, is its clinical behaviour [6].

Case Reports
Case 1
A 48-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, KVG Dental College and Hospital Sullia, Dakshina Kannada with a chief complaint of fractured restoration in lower left back tooth region since one month. Patient was asymptomatic. Clinical Examination revealed fractured composite restoration in relation to 36.Electric Pulp Testing showed a positive Response with the said tooth. Radiographic examination revealed a fractured restoration with sufficient amount of remaining dentin. No obvious abnormalities detected periapically. After discussing with patient, it was decided that an All-ceramic Indirect Overlay restoration with Lithium Di silicate might be the better treatment choice. Patient consent was taken. Patient was not willing for a fixed prosthodontic therapy in relation to missing 35.

Fig 1: Pre-operative clinical photograph

Fig 2: Pre-operative radiograph

Same Appointment under rubber dam isolation remaining restoration and caries where removed followed by pulp protecting agent applied. A class II Distoproximal Overlay cavity was prepared (Figure 3). Followed by putty impression taken (Figure 4). Reason for overlay planning was due to the thin lingual wall and existing cracks in the buccal wall.

Fig 3: Photograph of overlay Preparation

Fig 4: Photograph of Putty impression made with light body in relation to tooth of interest

After Cavity Preparation Provisional restoration was given. In the second appointment Provisional restoration has been removed followed by selective etching of Enamel with 37% phosphoric acid done (Fig 5). Followed by newer generation Bonding agent applied (Single Bond Universal).

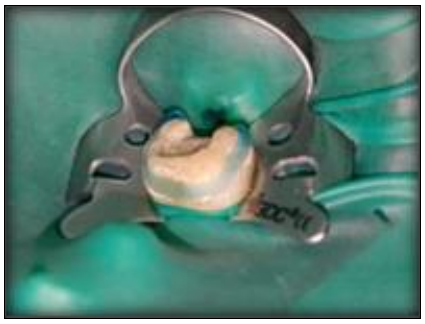

Fig 5: Selective etching of Enamel

Fig 6: Bonding Agent Applied

Fig 7: Etching with Hydrofluoric acid Intaligo surface

Fig 8: Silane coupling Agent

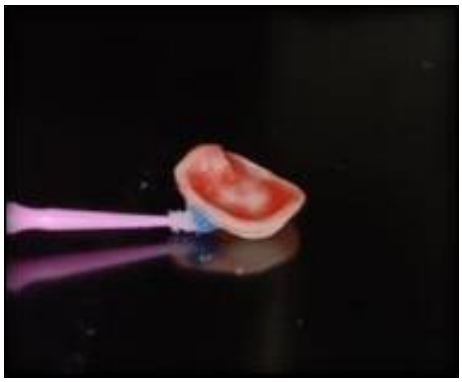

Fig 9: Resin Cement

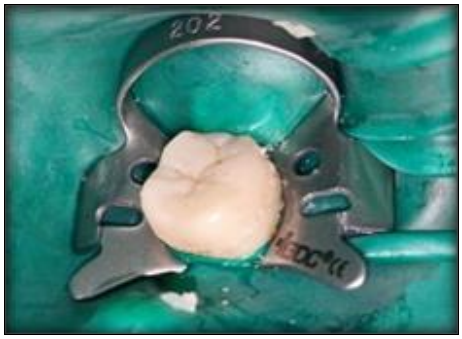

Fig 10: Cementation of overlay

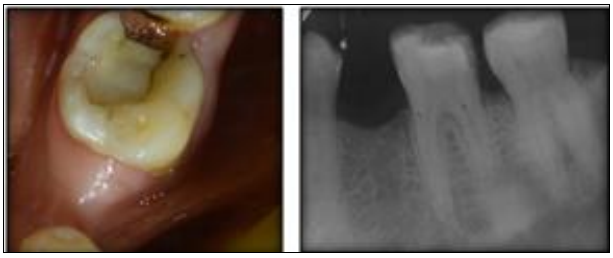

Fig 11: Pre-operative photograph/radiograph

Fig 12: Post-operative photograph/radiograph

Case 2

A 23 year old male patient reported to the Department of Conservative Dentistry and Endodontics, KVG Dental College and Hospital Sullia, Dakshina Kannada with a chief complaint of pain in relation to lower right back tooth region since 3 months which aggrevated while having hot water relieved after taking medications. Clinical Examination revealed a badly mutilated tooth in relation to 46 which was tender on percussion (Fig 13). Radiographically caries involving pulp with widening of periodontal ligament space seen (Fig 14). Diagnosis of the present case was made as chronic irreversible pulpitis with apical periodontitis in relation to 46.

Fig 13: Badly mutilated tooth-46

Fig 14: Radiograph -46

Treatment plan was decided as root canal therapy in relation to 46, Followed by Endocrown fabrication in relation to 46.

Fig 15: Access opening -46

Fig 16: Working length determination

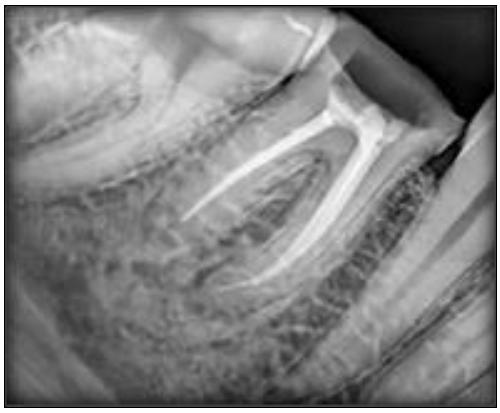

Fig 17: Obtuartion -46

Fig 18: Endocrown preparation -46, 2 mm occlusal reduction, 1.5 mm cervical walk with butt joint preparation

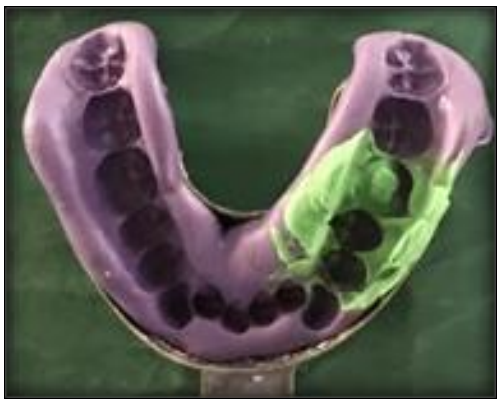

Fig 19: Putty Impression

Fig 20: Endocrown Fabricated

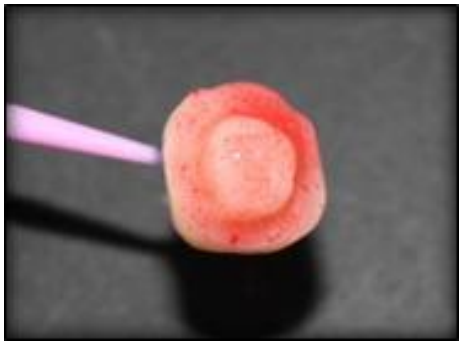

Fig 21: Etched with Hydrofluoric acid

Fig 22: Silane coupling agent applied to endo crown

Fig 23: Etching with phosphoric acid

Fig 24: Resin cement application

Root Canal therapy done (Fig 15, 16, 17) Followed by Endocrown fabrication done in the same visit. 2 mm occlusal reduction done with 1.5 mm of cervical walk on all surface

(Figure 18), Followed by putty impression made) (Figure 19). Lithium disilicate Endocrown was fabricated (Figure 20), followed by etching with Hydrofluoric acid etching done on intaligo surface (Figure 21) and silane coipling agent applied (Figure 22). Simultaneously tooth was etched with 37% Phosphoric acid (Figure 23), bonding agent applied and resin cement applied and light cured (Figure 24).

Fig 25: Pre-operative Photograph /Radiograph

Fig 26: Post-operative Photograph/Radiograph

Discussion

The ultimate goal of dental adhesive development is to achieve strong, long-lasting adherence to dental hard tissues. In 1955. Buonocore demonstrated how applying phosphoric acid to enamel enhances its exposed surface area by creating micro-irregularities that increase adhesion potential.

In 1965, Bowen formulated the first generation of dentinal adhesive. The increasing interest in adhesion in dentistry led to the development of four generations of adhesive systems, with the 4th generation achieving good results for dentin bonding in the 1990s [7].

Etch and rinse adhesives involves using 35–37% orthophosphoric acid to etch the enamel and dentin. Followed by removal with a thorough rinse [8]. Next, the adhesive is polymerized in situ via capillarity, flowing into the porosities in the enamel to form macro tags of entangled resin around the enamel prisms and, in turn, micro tags that pierce the enamel prism cores and effectively aid in material retention. In dentinal surface where hydroxyapatite is nearly non-existent, the acid's impact in the dentinal tissue creates a network of micropores in the collagen. As a result, the adhesion is dependent upon the adhesive hybridising or infiltrating the exposed collagen mesh [9].

Work by penetrating the smear layer and partially dissolving hydroxyapatite to create a hybrid layer that incorporates minerals. Since water is constantly available in their composition to ionise the monomers and enable the adhesive to interact chemically with enamel and dentin, these adhesives do not require a moist dentin substrate.

Self-etching, non-rinsing adhesives cure and prime both enamel and dentin at the same time, eliminating the need for a separate acid-etch procedure. Instead, they compared to etch-and-rinse adhesives, self-etch adhesives have lower enamel bond strengths. When self-etch adhesives are used instead of phosphoric acid, the enamel demineralizes less deeply. Self-etch adhesives attach enamel better when the enamel is roughened to remove prismless areas. An additional phase of phosphoric acid enamel etching can additionally improve the efficiency of adhesives which is called as selective etching which was applied in the case 1. The operating field should be absolutely controlled from saliva, blood contamination [10].

Single Bond Universal adhesive has a very unique set of properties which was used in both cases that include Unwavering and reliable bond strengths, Capable of combining total-etch and self-etch bonding, with almost no post-op sensitivity in the total-etch and self-etch modes. It has high moisture tolerance to enable consistent bonding to both moist- and dry-etched dentin. Combined primer/adhesive capability to bond to indirect substrates (metals, zirconia, alumina, and glass ceramics) without the need for a separate primer [15].

The functional monomer 10-MDP (10-methacryloyloxydecyl dihydrogen phosphate) adheres to calcium without causing strong enamel and dentin decalcification. Calcium release and subsequent formation of stable self-assembled MDP-Ca salts in the form of nanolayering, providing simultaneously chemical and micro mechanical adhesion [16].

In case 1 overlay was fabricated. An overlay is defined as a prosthesis restoring that restores the integrity of the occlusal cusps of a tooth. An overlay can extend cervically beyond the occlusal table and is also referred to as a partial crown in the international literature [14].

Resin cements have superior mechanical properties and enhanced retentive capability when compared to other luting materials such as zinc phosphate and glass-ionomer cements.

In fact, they improve the retention of crowns inserted in teeth with short clinical crowns or less-than-ideal taper, when compared to zinc phosphate cement. Additionally, most aesthetic restorations (e.g., metal-free porcelain veneers, inlays / onlays, resin-bonded fixed partial dentures, some porcelain crowns) can be cemented only with resin cements [11, 12].

The bonding of fired and pressed ceramics requires the sequential preparation of the two substrates - porcelain and tooth. The intaglio surface of the porcelain is etched with hydrofluoric acid for one to two minutes in order to create micro-porosities, rinsed, dried, and covered with a silane coupling solution and a bonding agent. The functional groups in the silane generate covalent bonds to the ceramic structure and to the adhesive/resin cement, which increases bond strengths. The tooth substrate is then etched with a 30% to 40% phosphoric acid gel for 15 seconds, rinsed, and gently dried to leave a moist substrate. This is followed by the application of the dentin/enamel adhesive and insertion of the resin cement into the restoration to be seated [13].

Here Rely X U 200 launched in 2011 has used as resin cement in the dual cure mode. Self-adhesive resin cements was moisture tolerant with long term stability, high bond strength, minimal post operative sensitivity. For RelyX U200 had an additional monomer and a new rheology modifier were added to the mixture and the processing of filler particles was optimized. All that leads to a formulation with increased mechanical properties and excellent overall adhesion performance. Newer generation resin cement had low pH which increased after setting to neutral pH [17].

In order to strengthen the closeness of the connection, it is recommended to improve bonding through modification of the internal porcelain surface. This can be done by exposing the porcelain surface to acid or by air abrasion with alumina particles. It is effective to remove surface imperfections and round off the remaining flaw tips with 10% hydrofluoric acid etching for one minute. This reduces stress concentration and increases overall strength. A chemical connection is created between the luting resin composite and porcelain through

silanization of etched porcelain using a bifunctional coupling agent. After 60 seconds, apply silane to the etched porcelain surface and let it air dry. For the best connection, repeat this step twice [16]. In order to initiate the chemical reaction, single-component systems that contain silane in alcohol or acetone must first acidify the ceramic surface using hydrofluoric acid. Universal adhesives are one-step SE adhesives that, when applied with phosphoric acid to etch enamel and dentin, are also advised by the individual manufacturers to be used as two-step E&R adhesives. Physicians can also employ these adhesives in conjunction with the selective enamel etching method, which involves phosphoric acid etching only the enamel. The presence of functional phosphate and/or carboxylate monomers in universal adhesives is a key distinction between them and conventional one-step SE adhesives. In hydroxyapatite, functional monomers have the ability to initiate chemical interaction with calcium [16].

Conclusion

Indirect esthetic restoration are the newest option and future of dentistry. Bonding of these esthetic indirect restoration is the key step and prime factor in survival of restoartion. Resin cements have been introduced way back and we have dealt with latest and conventional bonding procedures their mechanism of action in various restorations

Conflict of Interest

Not available.

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