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RESEARCH ARTICLE

CLINICAL PROCEDURE OF IMMEDIATE DENTIN SEALING FOR INDIRECT BONDED RESTORATION

Pawan P. Gurjar¹, Kiran Vachhani², Kailash Attur³, Switibahen D. Soni¹, Vishwesh P. Joshi¹ and Akshita Panchal¹

1. PG Student, Department of Conservative Dentistry and Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat, India.
2. Professor, Department of Conservative Dentistry and Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat, India.
3. Head of Department & Professor, Department of Conservative Dentistry and Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat, India.

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Abstract

Immediate Dentin Sealing or pre-hybridization implies the application of resin adhesive to freshly cut dentin after teeth preparation, before impression. Immediate Dentin Sealing has been suggested as an alternative to the delayed dentin sealing (DDS), a technique in which resin adhesive is applied just before final bonding of indirect restorations. Immediate Dentin Sealing technique is universal i.e used in inlays, onlays, veneers, crowns and well documented clinically and experimentally. Various types of Dentin Bonding Agents are available on the market. Difference lies in the thickness of hybrid layer formed and the adhesive used.

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Introduction:-

The most reported clinical problem of Indirect restoration is post-operative sensitivity in patients.^[1] As in tooth preparation, dentinal exposure occurs which leads to post-operative discomforts, such as dentinal hypersensitivity. Due to dentinal exposure, there is fluid movement in the dentinal tubules which have direct connection to pulp tissue which in turn cause sensitivity after indirect restorative cavity preparation.^{[2][3][4]}

The most commonly accepted dentinal hypersensitivity theory proposed by Brannstrom which is hydrodynamic theory which claiming that the sensitivity is justified by minimal movements within the dentinal tubules.^[5] These movements push the odontoblasts by mechanically, thermally, or chemically stimulating the adjacent nerve fibers.^[6]

The tooth preparations would remove more than 2 to 3 mm of tooth structure which would generally expose the undermining dentine structure.^[7] Patients have reported post-operative sensitivity in the ending of the preparation may be either exacerbated or initiated by several factors: use of old burs and points^[3], inadequate use of points and burs, lack of irrigation, application of irritating dental materials, and presence of unsatisfactory margins of the provisional crowns.^[8]

Ambiguity still exist on which technique would be the most adequate approach either to eliminate or to decrease the post-operative sensitivity after tooth preparation and final cementation of indirect restoration.^{[9][10]}

Corresponding Author:- Pawan P. Gurjar

Address:- PG Student, Department of Conservative Dentistry and Endodontics, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat, India.

Till now, none of the predictable management of post-operative pain has been found which would eliminate the long-term pain perception that has been defined as the therapeutic “gold standard”.^[11]

Conceptually there are Among the various methods that have been employed, the pre-hybridization is one of them. Prehybridization is characterized by the application of either an adhesive system or a flowable resin immediately after the preparation aiming to seal and protect the tooth structure. The rationale behind this technique is that the tooth freshly prepared is more permeable therefore becoming more susceptible to irritating agents.^[11]

The dentinal sealing technique has different definitions and their classifications. The first researchers in 1990 develop this technique, named it “resin coating”. During that time, a low viscosity resin with low modulus of elasticity was used after the application and light-curing of the adhesive system. A modification in the technique was described in 1996, so-called “dual bonding technique”, comprised two stages. At the first stage, the adhesive system is applied over the tooth preparation and then light-cured immediately after the ending of the tooth preparation and previously to the impression procedure. In second stage of dual bonding technique, prior to the final cementation of the indirect restoration, a new layer of the bonding agent is applied without its light-curing. This is obtained after the cementation. It is believed that the bonding agent layer together with the luting agent may interfere on the adaptation of the indirect restoration.^[11]

Pashley et al (1992) first proposed sealing the exposed dentinal tubules prior to impressing a prepared tooth to receive an indirect restoration due to the microleakage of the provisional restoration, which resulted in bacterial contamination. This technique, which has been referred to as prehybridization.^[11]

Various studies advised the use of a layer of water-soluble glycerin gel prior to the last photoactivation of adhesive. Its main function is to inhibit the oxygen-inhibiting layer therefore making viable the photoactivation. Another function is that it prevents the interaction between the dentinal adhesive and the impression material which frequently occurs between polyether- and polyvinyl-based materials.^[12]

Application of the water-soluble gel plays a vital role to achieve the complete curing of the impression material. A study in which the gel was not applied, obtained 100% of impression failures because of the interaction of the adhesive system with the impression material.^{[12][13]}

The photoactivation must be executed for 5s before the gel application and for 30s after it.^[13]

However, studies have advocated either 20s prior to and 10s of photoactivation after the gel application or 10s before and after it. Then, the set must be washed aiming to remove the glycerin layer.^[15] After that, the bonding agent excess is removed from the preparation margin with the aid of either instruments or low-speed burs to avoid the misadaptation of the indirect restoration.^[14]

Immediate Dentin Sealing decreases the chances of bacterial contamination stemming from the poor sealing provided by provisional restorations. Studies have showed that there is an increase in the bond strength due to an additional layer of adhesive that was applied during the insertion phase of an indirect restoration and a cushioning of the occlusal load which results from an increase in the adhesive thickness.

The technique which is used is the “total-etch-wet-bonding” approach with either use of a two- or three-bottle adhesive system. Using 37% phosphoric acid, Enamel and Dentin were etched and was rinsed with water, and was dried, leaving a moist surface of the tooth preparation. Then primer was applied over the tooth preparation, followed by the adhesive placement, or a combined primer/adhesive was used and then it was light-polymerized. By application of water-soluble gel over adhesive layer, oxygen-inhibited layer was removed from the surface, then further light-polymerization was done. This step was crucial prior to taking an impression for an indirect restoration. Elimination of the oxygen-inhibited layer on the adhesive prevents the interference with the setting of the impression material and adherence of the provisional restorative.

Immediate Dentin Sealing technique depends upon four major fundamental principles.

1. Freshly cut, uncontaminated dentin which provide superior bonding as compared to other cases.

2. Pre-polymerization of Dentin Bonding Agent, the hybrid layer may collapse due to the pressure from the composite or restoration placement. Thus, precuring the Dentin Bonding Agent would result in a better bond strength.
3. Immediate Dentin Sealing and delayed restoration placement permit maturation of the dentin bond in an environment free of occlusal forces and overlaying composite shrinkage.
4. Immediate Dentin Sealing reduces fluid and bacterial penetration.

Clinical Advantage of Immediate Dentin Sealing are as follows: -

1. Reduced post-cementation sensitivity.
2. Increased bond strength and retention, especially for tapered teeth with short clinical crowns and minimum removal of tooth tissue.

Case Report.

A 27-year-old female patient present to Department of Conservative Dentistry and Endodontics with dislodged composite restoration on tooth 12 and was advised minimally invasive laminate veneer. Tooth preparation was done on the tooth using diamond cutting burs and window preparation of veneer was preferred. Following the tooth preparation of tooth 12, IDS protocols were followed to reduce the post-operative sensitivity and increase the bond strength for cementation of Indirect Restoration after IDS, Impression was carried out. Following protocols were used for Immediate Dentin Sealing.

Immediate Dentin Sealing Technique.

Dentin Identification.

After tooth preparation, uncontaminated dentin surfaces are initially etched for short time 2-3 seconds and was thoroughly dried to easily recognized the dentin which appear glossy while enamel appear frosty. Then thoroughly washed with water and excess water is suctioned off without any direct contact of suction tip and dentin.

Adhesive Technique

As recommended by Magne, use of total-etched technique which may include either three-step (Primer and Adhesive Resin) or two-step (self-priming resin) Dentin Bonding Agent. two-step DBA i.e. Tetric N Bond, Ivoclar.

Firstly, uncontaminated dentin surfaces is etched for 15 seconds using 37% Phosphoric Acid. Then it is thoroughly washed with water and excess water is suctioned off without any direct contact of suction tip and dentin.

Following etching, application of self-priming resin over the prepared tooth surfaces using disposable brush for at least 20 seconds and then first 20 seconds is light cured with a thick layer of glycerin jelly is applied to the sealed surface, and another 10 seconds of light curing is applied to polymerize the air-inhibited layer of the resin. Glycerin is then easily removed by rinsing. After self-priming resin is applied, impression is carried out, preferably with a one-step, double-mix technique: low viscosity material is injected on to the prepared tooth and heavy body material is applied on the tray.



Fig. 1:- Tooth Preparation for minimally invasive porcelain veneer.



Fig.2:- Etching of the tooth with 37% Phosphoric Acid.



Fig.3:- Self-priming adhesive resin is applied using disposable brush.



Fig.4:- Self-priming adhesive resin is then applied gently in brushing motion for at least 20 seconds. Several applications of BA are advised to be applied to the dentin surface. The dentin surface is suctioned again or air dried to remove solvent from the BA.



Fig.5:- Adhesive/BA is then first 20 seconds is light cured with a thick layer of glycerin jelly is applied to the sealed surface, and another 10 seconds of light curing is applied to polymerize the air-inhibited layer of the resin. Glycerin is then easily removed by rinsing. After BA is applied, impression is carried out, preferably with a one-step, double-mix technique: low viscosity material is injected on to the prepared tooth and heavy body material is applied on the tray,

Discussion:-

Indirect restorations provide better esthetic, physical, and mechanical properties reduced polymerization shrinkage, by post-curing the restoration with light/heat. Indirect restorations can also be used in the restoration of deep preparations with gingival margins located in dentin.^[11]

Various studies in the past years the immediate dentin sealing protocol has been proposed as an effective technique of sealing the dentinal tubules in order to reduce post-operative tooth sensitivity and prevent or reduce bacterial contamination during the provisionalization phase while also enhancing the bond strength of the final restoration.^[11]

Restorative procedure is opposed to the excessive removal of tooth tissue. So, preference is given for minimally invasive restorations such as onlays, inlays, and laminate veneers. However, in tooth preparation there is significant amount of tooth structure removed so exposure of dentin tubules is inevitable. Provisional cementation materials provide an inadequate sealing which caused exposure of dentin and is confronted with bacterial microleakage, as well as chemical and mechanical stimuli transmitted during impression-taking, rinsing, drying, function, and removal of provisional materials.

Magne et al. suggests that the Immediate Dentin technique would provide improved the bond strength of the final restoration. Both total-etch and self-etch dentin bonding agents demonstrated an increased bond strength to final restoration.^[15]

Minimally invasive dentistry and remaining dental tissue conservation through adhesion is the cornerstone of the biomimetic approach in restorative dentistry. Duarte et al proposed 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).^[10]

Conclusion:-

The IDS technique is advantageous with regard to bond strength, gap formation, bacterial microleakage, and dentin hypersensitivity. Major concern arises from interaction with impression materials, the provisional phase, and conditioning methods before cementation which require further investigation.

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