Effect of Immediate Dentin Sealing on Preventive Treatment for Postcementation Hypersensitivity

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Purpose: The aim of this study was to investigate the effect of Prime & Bond adhesive on preventing postcementation hypersensitivity of vital abutment teeth restored with a full-coverage restoration using the immediate dentin sealing (IDS) technique.
Materials and Methods: Twenty-five male patients received 25 three-unit fixed partial dentures. A split-mouth design was used and two vital abutment teeth in each patient were allocated randomly into Groups A or B. Teeth in Group A were treated with Prime & Bond using the IDS technique while teeth in Group B were used as a control and left untreated. The discomfort interval scale, ranging from 0 to 4, was adopted to evaluate hypersensitivity. The double-blind method was applied during the operation so that neither the patient nor the clinician knew which abutment had been treated. The sensitivity assessment was performed 1 week, and 1, 6, 12, and 24 months after cementation. Results were analyzed using the sign test. ***Results:*** Scores for teeth in Group A were statistically significantly lower than those in Group B at 1 week and 1 month postcementation ($P < .05$), whereas there was no significant difference between Groups A and B at the end of 6, 12, and 24 months ($P > .05$). ***Conclusion:*** Preventive treatment with Prime & Bond using the IDS technique can significantly reduce postcementation hypersensitivity. *Int J Prosthodont 2010;23:49–52.*

Postcementation hypersensitivity is a symptom characterized by a short, sharp pain when introducing thermal and chemical stimuli to the vital abutment teeth after a newly cemented crown or fixed partial denture is placed.[1] According to the survey of Rosenstiel and Rashid,[2] the incidence of postcementation hypersensitivity is about 10%. This type of hypersensitivity would be self-healing in most cases, but it may also last for a long time. In general, the perceived sensitivity will disappear 24 months after cementation.[3]

There are many factors considered to be associated with the occurrence of postcementation hypersensitivity. Overheating and desiccation during tooth preparation could cause pulp damage[4,5] and might explain the hypersensitivity associated with the use of glass ionomers.[6] Pupal damage beneath restorations might also be caused by the infiltration of bacteria that were either left behind or gained access to the dentin due to microleakage.[7] The amount of tooth reduction was considered to be a very important factor affecting postcementation sensitivity. Sixty percent of teeth prepared to within 0.5 mm of the pulp had a severe pulpal reaction, whereas only 5% of cavities with a remaining dentinal thickness greater than 1 mm had a severe reaction.[8]

The principal mechanism underlying dentinal hypersensitivity is explained by the hydrodynamic theory of Brännström.[9] According to this theory, a stimulus such as cold or friction on the dentinal surface, on which the dentinal tubules are open, will create a fluid flow in the dentinal tubule that can cause pain. The treatment strategy for dentinal hypersensitivity is based on either interfering with the sensitivity of the mechanoreceptors or occluding the dentinal tubules.

A large number of products and methods have been developed to cure dentinal hypersensitivity. Many studies found that the application of dentin desensitizers or dentin bonding agents could block the dentinal tubules and significantly reduce dentin permeability.[10–12] The application of the glutaraldehyde-based GLUMA Desensitizer (Heraeus Kulzer) could significantly relieve sensitive tooth cervical areas.[13] The combined application of an aqueous solution of 35% hydroxyethyl methacrylate and a commercially available dentin bonding agent was effective in reducing dentinal hypersensitivity and in maintaining a "sedative" effect.[14]

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Calcium hydroxide suspension or glutaraldehyde-based dentin primer could reduce tooth sensitivity after full-crown preparations.[15]

The use of an antimicrobial solution before cementation also has been applied and proved to be a logical method in reducing bacterial contamination and subsequent postcementation sensitivity.[16] The main cause of pulpal damage may be infection caused by the bacteria originating in the smear layer or deep in the dentinal tubules, so the dentin surface should be treated with an antibacterial solution and covered by a liner to decrease permeability before the provisional crown is placed.[17]

Immediate dentin sealing (IDS) is a new approach in which the dentin is sealed immediately after tooth preparation and prior to impression taking. When the dentin was sealed with a three-step etch-and-rinse dentin bonding agent (Optibond, Kerr) before impression taking, the continuity between the hybrid layer and dentin appeared with less gap formation under scanning electron microscopy. The results indicate that dentin treated with the IDS technique could potentially better tolerate long-term exposure to thermal and functional loads compared to delayed dentin sealing.[18] Patients treated with the IDS technique experienced improved comfort during the provisional restoration stage, limited need for anesthesia during insertion of the definitive restoration, and reduced postoperative sensitivity.[19]

Prime & Bond (Dentsply) is a fifth generation dentin bonding agent that combines the primer and bond component in a single bottle. It is much easier for the effective components to infiltrate into the dentinal tubules and peritubules to block the dentinal tubules after polymerization. Therefore, the outside stimulus would be isolated and the hypersensitivity relieved.

In this study, experimental teeth were treated with Prime & Bond using the IDS technique. The aim was to determine whether this type of treatment could reduce or eliminate the occurrence of postcementation hypersensitivity.

Materials and Methods

The investigation was carried out at the Department of Prosthodontics, Hospital of Stomatology, Zhejiang University, from January 2004 to January 2007. A total of 25 patients were enrolled in this study. Inclusion criteria were as follows: *(1)* male patients between the ages of 20 and 30 years who needed three-unit fixed partial denture restorations without the consideration of implants, *(2)* a competent mandibular premolar and molar to be used as abutment teeth, *(3)* abutment teeth vital and intact, *(4)* no alveolar resorption or other periodontal symptoms, and *(5)* no complaints regarding dentinal hypersensitivity of the abutment teeth.

The two abutment teeth of each patient were randomly allocated into either Group A or B and each group included 25 teeth. Teeth in Group A were treated with Prime & Bond immediately after tooth preparation, whereas teeth in Group B were used as a control and left untreated.

Treatments were carried out with the patients' informed consent. All patients received detailed particulars (verbal and written) on the course of treatment and the purpose of the study. The double-blind method was adopted where both the patients and clinicians carrying out the sensitivity assessment had no idea which teeth were treated with Prime & Bond and which were not. The clinical procedures were performed by one clinician, whereas the sensitivity assessment was done by another clinician.

Every tooth in Group A was prepared by a diamond rotary cutting instrument with 6 degrees of axial inclination. The occlusal reduction was 2 mm and axial reduction was 1.2 mm, determined by use of a depth gauge bur (S4 bur, Intensiv). A rounded shoulder finish line on the labial aspect and a metal-only chamfer on the palatal aspect were required.

After tooth preparation, the abutment teeth were isolated with rubber dam. The prepared surface was then etched with a 32% phosphoric acid semigel (Uni-Etch, Bisco) for 10 seconds and rinsed with air-water spray for 30 seconds. Afterwards, the tooth was dried via blown air but desiccation of the dentin was avoided. Sufficient Prime & Bond was dispensed onto the prepared tooth surface for 60 seconds with a disposable brush and blown gently for 5 seconds to make sure the surface had a uniform, glossy appearance. It was then light-cured for 20 seconds. With the completion of the application of Prime & Bond to the prepared abutment teeth, the definitive impression was made and sent to a dental technician. The provisional fixed partial denture was also fabricated to protect the prepared teeth.

After the fixed partial denture was finished, it was tried in and bonded with resin-modified glass ionomer (3M ESPE) according to the manufacturer's instructions.

The teeth in Group B were prepared with the same standards as Group A but no Prime & Bond was applied after tooth preparation.

The level of sensitivity of the tooth was determined as follows: The adjacent teeth were covered with cotton pellets. Compressed air was then blown over the cervical area of the abutment teeth at a distance of 3 cm for 2 seconds. Patients were then asked to rate the level of sensitivity they had experienced on a discomfort interval scale from 0 to 4 (0 = no pain, 1 = mild pain, 2 = moderate pain, 3 = severe pain, 4 = intolerable pain).

The sensitivity testing of each patient was performed by the same clinician 1 week and 1, 6, 12, and 24 months after cementation. The evaluation data were

Table 1 Discomfort Interval Scale Scores for Teeth in Group A After Treatment

Patient	1 wk	1 mo	6 mo	12 mo	24 mo
1	0	0	0	0	0
2	2	2	1	0	1
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	2	1	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	3	2	1	0	0
12	0	0	0	0	0
13	2	1	0	1	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	2	2	0	1	1
18	2	1	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	2	0	1	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	3	2	1	0	0

0 = no pain; 1 = mild pain; 2 = moderate pain; 3 = severe pain; 4 = intolerable pain.

Table 2 Discomfort Interval Scale Scores for Teeth in Group B After Treatment

Patient	1 wk	1 mo	6 mo	12 mo	24 mo
1	0	0	0	0	0
2	2	1	0	0	1
3	3	3	0	0	0
4	2	2	1	1	0
5	0	0	0	0	0
6	3	2	0	0	0
7	3	2	1	1	0
8	3	2	0	0	0
9	0	0	1	0	0
10	3	2	1	0	0
11	2	2	0	0	0
12	3	2	1	0	1
13	2	1	0	0	0
14	2	0	0	0	0
15	0	0	0	0	0
16	2	1	0	0	0
17	2	1	0	0	0
18	2	2	0	0	0
19	2	2	1	1	0
20	0	0	0	0	0
21	0	0	0	0	0
22	3	1	1	0	0
23	3	2	0	0	0
24	0	0	0	0	0
25	2	1	1	0	1

0 = no pain; 1 = mild pain; 2 = moderate pain; 3 = severe pain; 4 = intolerable pain.

registered on tables and analyzed using the sign test (Tables 1 and 2). The difference between Groups A and B was analyzed by time of evaluation. Statistical significance was set at $\alpha = .05$.

Results

This study population consisted of 25 men between the ages of 20 and 30 years. A total of 25 mandibular premolars and 25 mandibular molars were enrolled.

The sensitivity scores for teeth in Group A were statistically significantly lower than those in the Group B 1 week and 1 month after cementation ($P < .05$), whereas there was no significant difference between Groups A and B at 6, 12, and 24 months after cementation ($P > .05$).

There was no hypersensitivity detected in 17 teeth in Group A and 7 teeth in Group B 1 week posttreatment. Most of the symptomatic teeth in Group A were ranked as a 2 and those in Group B as a 2 or 3; there were no teeth ranked as a 4 in both groups. Twenty-one teeth in Group A and 17 in Group B were free of sensitivity at the end of 6 months. Only 2 teeth in Group A and 3 in Group B were ranked as a 1 at the end of 24 months. All other teeth were free of sensitivity.

Teeth in Group A experienced better comfort with the temporary restoration in situ and limited discomfort during definitive insertion of the restorations.

Discussion

This study was carried out to investigate the effects of Prime & Bond on preventing postcementation hypersensitivity of vital abutment teeth restored with full-coverage crowns using the IDS technique. There are many products available to treat dentinal hypersensitivity, but the treatment effects vary among studies.[20–22] Furthermore, most vital abutment teeth have been cemented without clinical use of desensitizers so the placebo was adopted as a control in this study.[23]

The pain threshold of teeth may vary with respect to sex, age, and position. In this study, all patients were men between the ages of 20 and 30 and the teeth used were mandibular premolars or molars. With those inclusion criteria, the selection bias of this study was minimized. Air-blow sensitivity, adopted as the evaluation method in this study, was considered to be more reliable than telephone interview.[24]

IDS sealed the freshly cut dentin directly after the completion of tooth preparation, thus the sealed dentin had much more resistance to bacterial leakage and sensitivity during impression taking and the provisional restoration phase.[18] An in vivo study confirmed that the application of different primers immediately after tooth preparation could reduce bacterial penetration and sensitivity during porcelain veneer preparation.[25]

Freshly cut dentin was thought to be the ideal substrate for dentin bonding, which presented only at the time of tooth preparation.[26] A dentin bonding agent polymerized directly after tooth preparation resulted in improved bond strength when compared with those in which the bonding agent and the overlying composite were polymerized together.[27] This may be due to the fact that the prepolymerization of dentin bonding agents could prevent the collapse of the dentinal collagen, which might be compromised by pressure during placement of the restoration or contaminated during the provisional phase of treatment.[28] Resin-modified glass ionomer, together with the primer and bonding agent, could obtain a similar bond strength to the composite resin system.[29] Therefore, the application of Prime & Bond was considered to have no interference with the bonding itself.

The results of this study demonstrated that teeth in Group A showed less sensitivity within 1 month after cementation, while after 6 months, most of the sensitive teeth of Group B had naturally reduced sensitivity and showed no statistical difference from those of Group A. These results agree with another study that indicated that perceived sensitivity would be self-healed within 24 months posttreatment.[3]

Although the sensitivity of untreated teeth may be self-healing in the long term, tooth hypersensitivity during the early stage after cementation brings pain and discomfort to patients. Therefore, it was necessary to reduce the incidence of tooth hypersensitivity through the application of Prime & Bond using the IDS technique.

Conclusion

Preventive treatment with Prime & Bond and the IDS technique can significantly reduce the occurrence of postcementation hypersensitivity.

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