XP BOND IN SELF-CURE MODE USED FOR LUTING PORCELAIN RESTORATIONS: 1-YEAR RECALL

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Abstract

Purpose: The aim of this clinical study was to evaluate the post-operative sensitivity and other clinical parameters of Empress II restorations luted under clinical conditions with the XP BOND adhesive system in combination with Calibra cured in self-cure mode after 1 year of clinical service.

Materials and methods: Fifty-three restorations were placed in 38 patients from March 2006 until April 2006. Luting procedures were performed following manufacturers' instructions. The restorations were evaluated for post-operative sensitivity, marginal discoloration, marginal integrity, secondary caries, maintenance of interproximal contact and fracture at baseline, after 2 weeks, 6 months and 1 year of clinical service.

Results: At 1-year recall, post-operative sensitivity was reported in only 3 patients. Only 2 restorations of 53 showed bravo score for marginal integrity/stain. All other parameters showed alpha scores.

Conclusions: All the evaluated restorations were in place and acceptable. The post-operative sensitivity recorded after using XP BOND and Calibra in self-cure mode was clinically acceptable.

Keywords: Ceramic crowns, Self-curing, Clinical Trial, Bonding

Introduction

The baseline report of post-operative sensitivity of the XP Bond adhesive system, (DENTSPLY De Trey, Konstanz, Germany) used in combination with Calibra dual cure resin cement, for luting indirect posterior porcelain restorations was recently published [1]. It is a fact that post-operative sensitivity is a common complication when porcelain crowns are luted on vital teeth [2].

When porcelain restorations are luted on vital abutments, a perfect bonding, which has to integrate all parts into one coherent structure, is a necessity [3]. Luting material and technique as well as the substrate characteristics therefore represent success-determining factors [4].

Different combinations of adhesive-luting materials were tested and the selection of a dual-curing bonding system is often the first choice [5-14], which permits polymerization of the adhesive materials and the resin cement below thick ceramic. XP BOND was recently introduced and tested experimentally, showing interesting data when the adhesive was used in self-cure mode[15].

The aim of the present prospective clinical trial was to evaluate the 1-year clinical behavior of Empress II restorations (Ivoclar-Vivadent, Schaan, Liechtenstein), luted with the adhesive system XP BOND (DENTSPLY DeTrey, Konstanz, Germany) and Calibra resin cement (DENTSPLY Caulk, USA), both used in self-cure mode.

Materials and Methods

A consecutive sample of 53 restorations in 38 patients in need of one or two single-units were placed. Partial or full restoration was performed from the pool of patients accessing the department of Restorative Dentistry of the University of Siena. Patients written consent to the trial was obtained after having provided a complete explanation of the aim of the study.

Inclusion criteria

Males and females aged 18-60 years in good general and periodontal health were included.

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Exclusion criteria

Patients with the following factors were excluded from the clinical trial:

1. Nonage (< 18 years); 2. Pregnancy; 3. Disabilities; 4. Potential prosthodontic restoration of the tooth; 5. Pulpitic, non-vital or endodontically treated teeth; 6. (Profound, chronic) periodontitis; 7. Deep defects (close to pulp, < 1mm distance) or pulp capping; 8. Heavy occlusal contacts or history of bruxism; 9. Systemic disease or severe medical complications; 10. Allergic history concerning methacrylates; 11. Rampant caries; 12. Xerostomia; 13. Lack of compliance; 14. Language barriers.

Test stimuli and assessment

Before applying the adhesive material, a pain measurement was performed utilizing a simple pain scale based on the response method. Response was determined by a one-second application of air from a dental unit syringe (at 40-65 p.s.i. at approximately 20°C), directed perpendicularly to the root surface at a distance of 2 cm and by tactile stimuli with a sharp #5 explorer. The patient was asked to rate the perception of the sensitivity experienced during this thermal/evaporative stimulation by placing a mark on a visual analog scale or line beginning at 0 and ending at 10 (where 0 = no pain and 10 = excruciating pain). In order to translate these scores into easily understood pain levels, a score of 0 was defined as no pain, 1-4 as mild sensitivity (which was provoked by the dentist's air blast), and 5-10 as strong sensitivity (which was spontaneously reported by the patient during drinking and eating). Only patients scoring low on the analog scale were included in the study, whereas high score cases were excluded by the assumption that irreversible pulp inflammation may be sustaining the high sensitivity. The status of the gingival tissues adjacent to the test sites was observed at baseline and at each recall. Patients were recalled at our department for testing post-operative sensitivity after 2 weeks, 6 months and 1 year.

Clinical Procedure

For standardization purposes the same operator performed all the clinical procedures. Following anaesthesia, rubber dam was placed, all carious structures were excavated, and any restorative material was removed. Preparation was performed using conventional diamond burs in a high-speed hand piece, with no bevel on margins. The preparation design was dictated by the extent of decay and pre-existing restorations. The Residual Dentin Thickness (RDT) was evaluated on a periapical radiograph, and teeth with RDT thinner than 0.5 mm were excluded. After preparation, an impression of the prepared tooth was taken and sent to the laboratory. A temporary restoration was performed. One week later, the ceramic restorations were luted following manufacturer's instructions. The restorations were placed in the time period between March and April 2006 and examined for post-operative sensitivity at baseline, after 2 weeks and after 6 months by the same operator. At each recall, data regarding post-operative sensitivity, stability and longevity were collected with reference to the USPHS criteria. The following parameters were therefore assessed: Post-operative Sensitivity: patient comfort with the restoration under function, cold and warm stimuli, and a gentle air stream was assessed. Sensitivity was defined on a scale from 0-10.

The other evaluated clinical parameters were: marginal discoloration and integrity, secondary caries, fracture, vitality test, retention and interproximal contacts. The null hypothesis that the self-cure mode cannot control post-operative sensitivity after 1 year of clinical service was tested.

Results

The results are summarized in Tables 1-2. All 53 teeth were evaluated at baseline, after 2 weeks, after 6 months and 1 year. At baseline 3 patients showed pre-operative sensitivity in 5 teeth. 10 cases of postoperative sensitivity were observed at the two weeks recall and only 3 after 6 months. In one case, post-operative sensitivity was raised from 0 to 6 immediately after luting the restoration (after the anesthetic effect wore off) but dropped to grade 3 after 6 months. In 7 cases showing an increase in post-operative sensitivity after 2 weeks, the hypersensitivity disappeared completely after 6 months. In two cases a residual post-operative sensitivity of grade 2 remained after 6 months. No adverse events/effects occurred. All other parameters showed alpha scores (Table 2).

After 1 year of clinical service only 3 restorations showed residual post operative sensitivity of a low degree (media score 2).

Discussion

Accordingly, with the results of this clinical study, the null hypothesis that the self-cure mode cannot control post-operative sensitivity after 1 year of clinical service was rejected.

With the intention of controlling any additional source of variation beside patient-related variability, the same operator placed all the restorations in this clinical trial. After 2 weeks from the placement of all restorations, the occurrence of post-operative sensitivity was found in around 19% of the restorations with a medium score of 1.9. Only in one case of ten the post-operative sensitivity was fairly high (score 6), whilst in other cases the sensitivity was not spontaneous. The case in which post-operative sensitivity was initially high (score 6) showed residual sensitivity after 1 year, a clinically acceptable score 2 . This observation is in agreement with a study that reported hypersensitivity to be the most common post-operative complication [16]. However, at the 6 month recall, the score dropped from grade 6 (strong) to grade 3 (mild) and after 1 year to grade 2.

Table 1
Changes in pre- and post-operative sensitivity of 11 sample abutments of the 53 tested (1 = lowest sensitivity, 10 = highest sensitivity).

	XP Bond / SCA / Calibra				
Case	Type of restoration	Pre-operative sensitivity	Post-op. sensitivity (2 weeks after placement)	Post-op. sensitivity (6 months after placement)	Post-op. sensitivity (after 1 year)
1	Inlay (OD)	0	6	3	2
2	Inlay (MOD)	0	1	0	0
3	Inlay (MO)	0	1	0	0
4	2 Onlays	2	0	0	0
5	Onlay	0	1	0	0
6	Inlay (OMD) and Onlay	3	1	0	0
7	Inlay (OM)	0	1	0	0
8	Onlay	4	1	0	0
9	Onlay	0	3	2	3
10	Inlay (OMD)	0	1	0	0
11	Inlay (OMD)	0	3	2	1

The accurate fitting of the crown is another aspect that is worth mentioning, even though this feature was not explicitly assessed in this paper. A good fitting of the ceramic restoration can avoid post-operative sensitivity and pulp complications. After 1 year of clinical service, two restorations scored bravo for marginal stain/integrity, a score still clinically acceptable. This observation can be also related to the fact that the marginal wear of a composite luting cement could undermine the mechanical support [8,13]. To prevent excessive marginal wear, it is therefore mandatory to have the narrowest gap between cavity preparation and ceramic restoration. Optimal fit (ranging from 50 to 100 µm) is preferred [7], particularly if the margins extend below the cementum-enamel junction [2,4]. Further clinical recalls will clarify whether the margins are affected during longer clinical service.

A proper set of adhesive-cement material combination is essential for avoiding post-operative sensitivity. Other self-activated bonding system are available in the market and were tested clinically [6,10]. All of them are usually self-activated as well as light-cured in order to guarantee a complete set of the bonding layer in the area of the surface where bonding can be reached by light and in those areas where light can not reach the adhesive layer.

Dual-cure resin cements are used in combination with the proprietary bonding systems. In this clinical trial the Self-Cure Activator of XP BOND was also able to activate Calibra resin cement. Accordingly with the data of this study, the self-cured XP BOND in combination with self-activated Calibra showed clinical acceptable control of post-operative sensitivity at the 1 year recall. These findings will be re-evaluated during next recalls at 2 and 3 years.

The utilization of a correct bonding technique is mandatory to achieve good clinical results in the luting of ceramic inlays [2]. In direct resin restorations, the bonding agent is routinely light-cured prior to the insertion of the composite. In ceramic luting procedures pre-curing of the adhesive resin may make restoration seating more difficult. The use of a self-cure bonding agent is also advantageous in this regard. In the present study a self-curing cement was chosen for luting the restorations. Self-cure cements are also able to achieve an adequate degree of conversion at sites where light-curing may be hindered by the thickness of the ceramic. The setting time of the resin cement can be also directly correlated to room temperature, glass plate and mouth temperature.

Conclusions

In only three cases of the 53 luted porcelain restorations, XP BOND used in self-cure mode showed a residual post-operative sensitivity of low intensity after 1 year of clinical service.

Table 2a and 2b
Performance criteria according to Ryge at baseline, 6 months and 1 year recall.

Table 2a

Criteria and number of restorations evaluated at baseline and 6 months		XP Bond / SC / Calibra			
		alpha	bravo	charlie	delta
Marginal discoloration and integrity	53	53	0	0	0
Secondary caries	53	53	0	0	0
Vitality test	53	53	0	0	0
Interproximal contacts	53	53	0	0	0
Retention	53	53	0	0	0
Fracture	53	53	0	0	0

Table 2b

Criteria and number of restorations evaluated at 1 year recall		XP Bond / SC / Calibra			
		alpha	bravo	charlie	delta
Marginal discoloration and integrity	53	51	2	0	0
Secondary caries	53	53	0	0	0
Vitality test	53	53	0	0	0
Interproximal contacts	53	53	0	0	0
Retention	53	53	0	0	0
Fracture	53	53	0	0	0

Table : Performance criteria according to Ryge. For post-operative sensitivities, mean value and standard deviation is provided (1 = lowest sensitivity, 10 = highest sensitivity)

Clinical relevance:
The results of this 1 year study reveal good clinical performance by XP BOND in self-cure mode.

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