Clinical evaluation of jacket crowns made of the Estenia indirect composite

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Purpose: The purpose of the present study was to evaluate the clinical performance of jacket crowns made of a highly loaded indirect composite material.
Materials and Methods: A total of 25 jacket crowns made of the Estenia composite were seated with resin-based luting agent, and thereafter clinically evaluated using modified USPHS criteria. Color match, marginal integrity, surface texture, wear of both restoration and antagonist, recurrent dental caries, fracture or detachment, and gingivitis around the abutments were examined. The observation period varied from 16 to 83 months with an average of 38.9 months.
Results: All crowns were judged as Alfa for all categories at baseline. After an average observation period of 38.9 months, the following number of cases were judged as Bravo; one for color match, nine for surface texture, one for wear, five for wear of the silver-palladium alloy antagonists, and two for gingival inflammation. Wear of enamel antagonists, however, was not remarkable. Deterioration of marginal integrity, recurrent dental caries, and fracture of crown were not observed in any patients.
Conclusion: It can be concluded that the Estenia composite is clinically applicable for use as jacket crowns. **(Int Chin J Dent 2005; 5: 17-21.)**

Clinical Significance: Clinical evaluation demonstrated that jacket crowns made of the Estenia composite can function satisfactorily for more than three years.
Key Words: clinical evaluation, composite, jacket crown.

Introduction

The use of composite materials for restoration and fixed partial dentures (FPDs) has increased substantially, probably due to improvement in material properties. The Estenia material (Kuraray Medical Inc., Tokyo, Japan) is one of the most highly loaded composites applicable for indirect tooth-colored restorations. In vitro evaluation demonstrated that the Estenia composite is superior in color stability,[1] wear resistance,[2,3] and flexural strength,[4] to other composites. Indication of the Estenia composite was therefore extended from single indirect restorations[5,6] to cast veneered FPDs,[7] super-structure of implant-supported prostheses,[8] and fiber-reinforced FPDs.[9]

Although the property test results and clinical procedure of Estenia restorations have been extensively reported, limited information is available about clinical results of restorations made from the Estenia composite. This study reports on the clinical performance of jacket crowns made from the Estenia composite, after an average observation period of 38.9 months.

Materials and Methods

The Estenia composite was selected for clinical evaluation. The material consists of 8% hydrophobic multifunctional methacrylates including urethane tetramethacrylate (UTMA), 16% submicron filler (0.02 μm), and 76% glass filler (1.5-2.0 μm). The total filler loading is 92%.

A total of 21 adult patients (20 females and one male), in whom full coverage tooth-colored restorations were planned, were successively included. Twenty-five teeth (one maxillary incisor, two maxillary canines, 14 maxillary premolars, and eight mandibular premolars) were restored in the current study. The abutment was prepared according to the conventional design for a jacket crown with approximately 1.2 mm rounded shoulder preparation and 1.5-2.0 mm occlusal plane reduction.

Table 1. Modified USPHS criteria for direct clinical evaluations.[10-12]

Category/Rating	Characteristics
Color match	
A	The restoration appears to match the shade and translucency of adjacent tooth tissues.
B	The restoration does not match the shade and translucency of adjacent tooth tissues, but the mismatch is within the normal range of tooth shades.
C	The restoration does not match the shade and translucency of adjacent tooth, and the mismatch is outside the normal range of tooth shades and translucency.
Marginal integrity	
A	The explorer does not catch when drawn across the surface of the restoration toward the tooth, or, if the explorer does catch, there is no visible crevice along the periphery of the restoration.
B	The explorer catches and there is visible evidence of a crevice, into which the explorer penetrates, indicating that the edge of the restoration does not adapt closely to the tooth structure.
C	The explorer penetrates a crevice defect.
Surface texture	
A	Surface texture similar to polished enamel as determined by means of a sharp explorer.
B	Surface texture gritty similar to a surface subject to a white stone or similar to a composite containing supramicron sizes particles.
C	Surface pitting is sufficiently coarse to inhibit the continuous movement of an explorer across the surface.
Wear	
A	The restoration is a continuation of existing anatomic form or is slightly flattened.
B	A surface concavity is evident.
C	There is a loss of restorative substance such that a surface concavity is evident. Replacement is required.
Wear of antagonist	
A	The antagonist is a continuation of existing anatomic form or is slightly flattened.
B	A surface concavity is evident.
C	There is a loss of antagonist substance such that a surface concavity is evident. Replacement or restorative treatment is required.
Recurrent dental caries	
A	The restoration is a continuation of existing anatomic form adjacent to the restoration.
C	There is visual evidence of dark deep discoloration adjacent to the restoration.
Fracture/Detachment	
A	No bulk fracture/detachment is present.
C	Bulk fracture/detachment is evident.
Gingiva	
A	No clinical inflammation is present.
B	Clinical inflammation is present.

A, Alfa; B, Bravo; C, Charlie.

An impression was made with a silicone elastomeric material, poured with lab stone and die stone, and a working cast was prepared. A composite jacket crown was fabricated with the Estenia composite according to the manufacturer's specifications. An opaque composite was used for specific cases to hide the metallic color of the abutment dowel core. On the patient's next visit, the jacket crown was tried-in, occlusion and articulation were adjusted, and the crown was seated with one of the resin-based luting agents. Clearfil DC Cement, Panavia

F dual activated composites (Kuraray Medical Inc.) as well as other resin-based luting materials were employed for luting. The patients entered a check-up program and oral examination was continued once or twice a year.

The jacket crowns were evaluated immediately after seating (baseline), after one year, and again after two or three years. On the basis of the modified United States Public Health Service (USPHS) criteria, the following characteristics of the crowns were evaluated: color match, marginal integrity, surface texture, wear of both restoration and antagonist, recurrent dental caries, fracture or detachment, and gingivitis around the abutments. The modified USPHS guidelines used in the current study are shown in Table 1.[10-12]

The worn surface of an antagonist restoration was observed with a scanning electron microscope (SEM) operated at 15 kV. The current study was performed in compliance with permission for use of human subjects from the Medical Ethics Committee, Nihon University School of Dentistry.

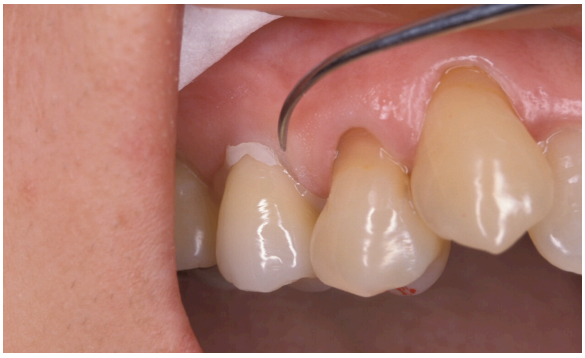
Results

Table 2 shows the clinical evaluation of the jacket crowns at baseline and after an average observation period of three years and 2.9 months. All crowns were judged as Alfa for all categories at the baseline evaluation. The numbers of crowns judged as Bravo rating at the recall visit were nine for surface texture, five for wear of antagonist, two for gingivitis, one for color match, and one for wear of jacket crown. The remaining crowns were judged as Alfa for all categories. In the current study, no crowns were judged as Charlie for any of the categories.

Table 2. Clinical evaluation of jacket crowns made of the Estenia composite.

Category	Baseline			After ave. 38.9 months			Note
Rating	A	B	C	A	B	C	
Color match	25	0	0	24	1	0	
Marginal integrity	25	0	0	24	0	0	
Surface texture	25	0	0	16	9	0	
Wear of jacket crown	25	0	0	24	1	0	Ag-Pd alloy antagonist
Wear of antagonist	25	0	0	20	5	0	Ag-Pd alloy antagonists
Recurrent caries	25		0	25		0	
Fracture/Detachment	25		0	25*		0	
Gingiva	25	0		23	2		

A, Alfa; B, Bravo; C, Charlie. N=25. *Two dowel cores detached, but were re-seated.



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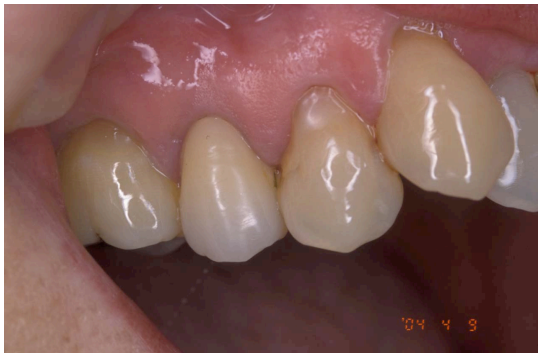

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Figs. 1, 2. Buccal view of a jacket crown made of the Estenia composite during cementation (1) and three years after insertion (2). The patient was satisfied with the clinical course of the treatment.

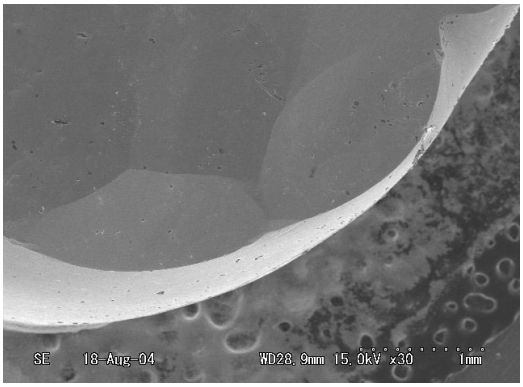

Fig. 3. Slightly worn antagonist opposed to the Estenia jacket crown.

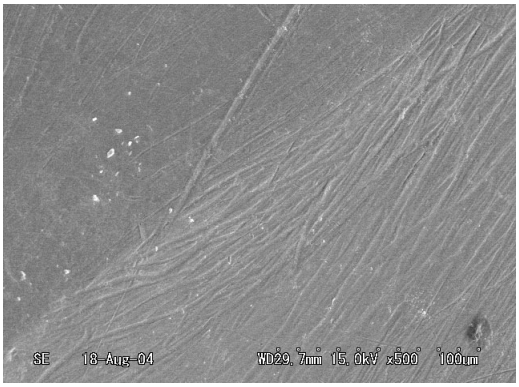

Fig. 4. An interface between the worn surface (lower right) and the intact surface.

Figs. 1 and 2 show a typical buccal view of a jacket crown during cementation and three years after insertion. Degradation was not detected for majority of the crowns when they were in contact with saliva. Figs. 3 and 4 show scanning electron micrographs of a worn antagonist lingual cusp detected after two years and two months from the baseline evaluation. The antagonist crown was made of a silver-palladium-copper-gold (Ag-Pd) alloy. It was notable that a total of five antagonists showed moderate wear judged as Bravo, all of which were cast restorations made of silver-palladium-copper-gold alloy.

Discussion

The clinical evaluation of jacket crowns made of the Estenia composite demonstrated favorable results. Of the 25 jacket crowns, nine exhibited slight frosty appearance when the crown surface was air-dried. Surface roughness of the crowns, however, was not distinct when the surface was in contact with saliva. This phenomenon is clinically acceptable because it is desirable for individual dentition that the wear rate of natural teeth and restorative materials is equivalent. The slightly roughened surface detected in the current cases could be polished with a rotary silicone instrument containing file diamond particles (Compomaster, Shofu Inc., Kyoto, Japan).

Clinical evaluation also revealed that wear of antagonists was evident when they were restored with cast restorations made of Ag-Pd alloy. This is probably due to insufficient wear resistance and hardness of Ag-Pd alloy when opposed to the Estenia composite, especially in the area of centric holding cusp.

As shown in the clinical results, jacket crowns made of the Estenia composite demonstrated clinical success for all cases even after three years or more. On the basis of the current evaluation, it can be concluded that the Estenia composite is a clinically reliable material for use in anterior and premolar jacket crowns.

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References

1. Nakamura T, Saito O, Mizuno M, Tanaka H. Changes in translucency and color of particulate filler composite resins. Int J Prosthodont 2002; 15: 494-9.
2. Tanoue N, Matsumura H, Atsuta M. Wear and surface roughness of current prosthetic composites after toothbrush/dentifrice abrasion. J Prosthet Dent 2000; 84: 93-7.
3. Suzuki S, Nagai E, Taira Y, Minesaki Y. In vitro wear of indirect composite restoratives. J Prosthet Dent 2002; 88: 431-6.
4. Kawano F, Ohguri T, Ichikawa T, Matsumoto N. Influence of thermal cycles in water on flexural strength of laboratory-processed composite resin. J Oral Rehabil 2001; 28: 703-7.

5. Jayasooriya PR, Pereira PN, Nikaido T, Burrow MF, Tagami J. The effect of a "resin coating" on the interfacial adaptation of composite inlays. Oper Dent 2003; 28: 28-35.
6. Shiono H, Koizumi H. Clinical performance of a premolar jacket crown made of a highly loaded indirect composite and seated with an adhesive luting agent: A clinical report. Int Chin J Dent 2003; 3: 100-4.
7. Matsumura H, Yoneyama T, Shimoe S. Veneering technique for a Ti-6Al-7Nb framework used in a resin-bonded fixed partial denture with a highly filled indirect composite. J Prosthet Dent 2002; 88: 636-9.
8. Takahashi Y, Hisama K, Sato H, et al. Probability of failure of highly filled indirect resin-veneered implant-supported restorations: an in vitro study. Int J Prosthodont 2002; 15: 179-82.
9. Nakamura T, Waki T, Kinuta S, Tanaka H. Strength and elastic modulus of fiber-reinforced composites used for fabricating FPDs. Int J Prosthodont 2003; 16: 549-53.
10. Ryge G, Cvar JF. Criteria for the clinical evaluation of dental restorative materials. US Public Health Service Publication 790-244. San Francisco: Government printing Office; 1971.
11. Ryge G. Clinical criteria. Int Dent J 1980; 30: 347-58.
12. Krejci I, Krejci D, Lutz F. Clinical evaluation of a new pressed glass ceramic inlay material over 1.5 years. Quintessence Int 1992; 23: 181-6.

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