One-year clinical evaluation of anterior composite veneered restorations made of the Solidex composite and silver-palladium-copper-gold alloy

Naomi Tanoue, DDS, PhD,[a] Shuichi Mori, RDT,[a] Hidenori Sugawara, DDS, PhD,[b] Hideo Matsumura, DDS, PhD,[c,d] and Hiroyasu Koizumi, DDS, PhD[c,d]

[a]Nagasaki University Hospital of Medicine and Dentistry, Nagasaki, [b]Private Practice, Nagasaki, [c]Department of Fixed Prosthodontics, Nihon University School of Dentistry, and [d]Division of Advanced Dental Treatment, Dental Research Center, Nihon University School of Dentistry, Tokyo, Japan

Purpose: The purpose of the current study was to evaluate the clinical performance of composite veneered restorations made of a light-activated composite material and silver-palladium-copper-gold alloy.
Materials and Methods: A total of 52 restorations veneered with the Solidex composite were clinically evaluated using modified USPHS criteria. Color match, veneer-metal interfacial staining, veneer surface texture, wear, and recurrent dental caries were examined. The average observation period was 12 months.
Results: All restorations were judged as Alfa for all categories at baseline. After an observation period of 12 months, the following cases were judged as Bravo; one for color match, two for veneer surface texture, and one for wear. Veneer-metal interfacial staining and recurrent dental caries were not detected.
Conclusion: Within the limitation of the current study, it can be concluded that the Solidex indirect composite is clinically reliable material for use as an anterior veneering agent. **(Int Chin J Dent 2006; 6: 105-109.)**
Key Words: clinical evaluation, composite, restoration, veneer.

Introduction

The use of composite materials for veneered restorations has increased substantially, mainly due to improvement in material properties. The Solidex material (Shofu Inc., Kyoto, Japan) is one of the highly loaded composites applicable for indirect restorations with or without metal substructure. In vitro evaluation demonstrated that the Solidex composite demonstrated improved or equivalent properties as compared with other indirect composite materials.[1-18] Indication of the Solidex composite was therefore extended from single restorations to cast veneered fixed partial dentures (FPDs).

Although in-vitro property-test results have been extensively reported, limited information is available about dental laboratory procedure and clinical results of restorations associated with the Solidex veneer.[19] This study reports on the clinical performance of composite veneered restorations made of the Solidex composite and silver-palladium-copper-gold (Ag-Pd) alloy, after an average observation period of 12 months.

Materials and Methods

The Solidex composite was selected for clinical evaluation. The material consists of splintered glass (average 3 μm), colloidal silica, prepolymerized silica composite, and urethane dimethacrylate (UDMA). The total filler loading is 78%, and total inorganic filler loading is 53%.[4,6]

A total of 36 adult patients (20 females and 16 males), in whom full coverage facing restorations were planned, were successively included. Fifty-two teeth (30 maxillary incisors, 10 maxillary canines, seven mandibular incisors, and five mandibular canines) were restored in the current study. The abutment was prepared according to the conventional design for a composite veneered restoration with approximately 1.0-1.2 mm labial rounded shoulder preparation, lingual chamfer preparation, and 2.5-3.0 mm incisal edge reduction.

An impression was made with a silicone elastomeric material, poured with die stone and lab stone, and a working cast was prepared. A composite veneered restoration or FPD was fabricated with the Solidex composite

and Ag-Pd alloy according to the manufacturer's specifications (Figs. 1-15). On the patient's next visit, the restoration was tried-in, occlusion and articulation were adjusted, and the restoration was seated with a luting agent. The patients entered a check-up program and oral examination was continued once or twice a year.


Fig. 1. Pre-operative view.


Fig. 2. Three anterior abutments.


Fig. 3. Try-in of a cast framework.


Fig. 4. Air-abrasion with alumina.

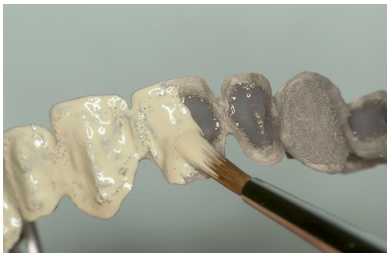
Fig. 5. Application of opaque resin.

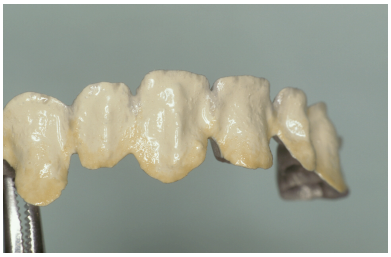
Fig. 6. Staining of cervical areas.


Fig. 7. Dentin-colored material.


Fig. 8. Enamel-colored material.

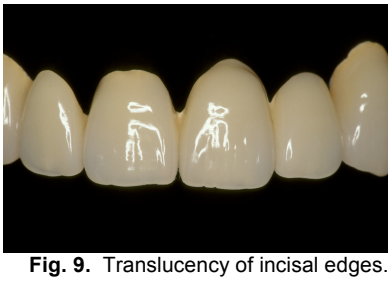
Fig. 9. Translucency of incisal edges.


Fig. 10. Completed FPD.


Fig. 11. Lingual view.


Fig. 12. Seated FPD.


Fig. 13. Occlusal view.


Fig. 14. Labial view after 12 months.


Fig. 15. Occlusal view after 12 months.

The restorations were evaluated immediately after seating (baseline) and after one year. On the basis of the modified United States Public Health Service (USPHS) criteria, the following characteristics of the restorations were evaluated; color match, veneer-metal interfacial staining, veneer surface texture, wear, and recurrent dental caries. The modified USPHS guidelines used in the current study are shown in Table 1.[20-24] The clinical

protocol was approved by the Ethical Committee for Clinical Practice of the Nagasaki University Hospital of Medicine and Dentistry (Approval No. 23) and the Medical Ethics Committee, Nihon University School of Dentistry (2003-22).

Table 1. Modified USPHS criteria for direct clinical evaluations.

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.
Veneer-metal interfacial staining	
A	No discoloration or incidence of microleakage.
B	Slight or superficial staining that can be polished away.
C	Deep penetration of staining that cannot be polished away.
Veneer 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.
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.

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

Results

Table 2 shows the clinical evaluation of the veneered restorations at baseline and after an average observation period of 12 months. All restorations were judged as Alfa for all categories at the baseline evaluation. The numbers of restorations judged as Bravo rating at the recall visit were; one for color match, two for veneer surface texture, and one for wear. The remaining restorations were judged as Alfa for all categories. In the current study, no restorations were judged as Charlie for any of the categories.

Table 2. Clinical evaluation of composite-veneered restorations.

Category	Baseline			After ave. 12 months		
Rating	A	B	C	A	B	C
Color match	52	0	0	51	1	0
Veneer-metal interfacial staining	52	0	0	52	0	0
Veneer surface texture	52	0	0	50	2	0
Wear	52	0	0	51	1	0
Recurrent dental caries	52	--	0	52	--	0

A, Alfa; B, Bravo; C, Charlie. N=52.

Discussion

The one-year clinical evaluation of restorations made of the Solidex composite and Ag-Pd alloy demonstrated

favorable results. Of the 52 restorations, only one exhibited change of color during the observation period. Examination revealed that the staining composite material applied to the surface of the veneer has been disappeared. This is probably caused by excessive tooth brushing for this restoration. This phenomenon is also related to Bravo rating of veneer surface texture as well as wear of the veneering agent. The other case that received Bravo rating in the category of veneer surface texture was micro-fracture of maxillary canine with direct traumatic injury. Neither the laboratory procedure nor the material property was responsible for the Bravo rating in this case. The incisal edge was modified with diamond cutting instrument and polished with a rotary silicone instrument containing file diamond particles (Compo Master, Shofu Inc.).

As shown in the clinical results, restorations made of the Solidex composite demonstrated clinical success for all cases after one year without Charlie rating. On the basis of the current evaluation, it can be concluded that the Solidex composite is a clinically reliable material for use as an indirect veneering agent of anterior cast restorations.

Acknowledgments

This study was supported in part by Grants-in-Aid for Scientific Research B 18390525 (2006-2007) and C 17592030 (2005-2007) from the Japan Society for the Promotion of Science (JSPS), a Grant from Dental Research Center, Nihon University School of Dentistry, and by Sato Fund from Nihon University School of Dentistry.

References

1. Tanoue N, Matsumura H, Atsuta M. Curing depth of four composite veneering materials polymerized with different laboratory photo-curing units. J Oral Rehabil 1998; 25: 348-52.
2. Tanoue N, Matsumura H, Atsuta M. Properties of four composite veneering materials polymerized with different laboratory photo-curing units. J Oral Rehabil 1998; 25: 358-64.
3. Ellakwa A, Shortall A, Shehata M, Marquis P. Influence of veneering composite composition on the efficacy of fiber-reinforced restorations (FRR). Oper Dent 2001; 26: 467-75.
4. Soeno K, Matsumura H, Atsuta M, Kawasaki K. Effect of acidulated phosphate fluoride solution on veneering particulate filler composite. Int J Prosthodont 2001; 14: 127-32.
5. 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.
6. Suzuki S, Nagai E, Taira Y, Minesaki Y. In vitro wear of indirect composite restoratives. J Prosthet Dent 2002; 88: 431-6.
7. Almilhatti HJ, Giampaolo ET, Vergani CE, Machado AL, Pavarina AC. Shear bond strength of aesthetic materials bonded to Ni-Cr alloy. J Dent 2003; 31: 205-11.
8. Andrade Tarozzo LS, Chiarello De Mattos Mda G, Faria Ribeiro R, Semprini M. Comparison of retentive systems for composites used as alternatives to porcelain in fixed partial dentures. J Prosthet Dent 2003; 89: 572-8.
9. Ban S. Effect of alkaline treatment of pure titanium and its alloys on the bonding strength of dental veneering resins. J Biomed Mater Res A 2003; 66: 138-45.
10. Lakatos S, Rominu M, Negrutiu M, Florita Z. The microleakage between alloy and polymeric materials in veneer crowns. Quintessence Int 2003; 34: 295-300.
11. Arikawa H, Kanie T, Fujii K, Ban S, Homma T, Takahashi H. Optical and color stabilities of paint-on resins for shade modification of restorative resins. Dent Mater J 2004; 23: 155-60.
12. Da Fonte Porto Carreiro A, Dos Santos Cruz CA, Vergani CE. Hardness and compressive strength of indirect composite resins: effects of immersion in distilled water. J Oral Rehabil 2004; 31: 1085-9.
13. Kanie T, Arikawa H, Fujii K, Ban S. Adhesive strength of paint-on resins to crown and bridge composites. Dent Mater J 2004; 23: 441-6.
14. Behr M, Rosentritt M, Faltermeier A, Handel G. Electron beam irradiation of dental composites. Dent Mater 2005; 21: 804-10.
15. Ikeda M, Nikaido T, Foxton RM, Tagami J. Shear bond strengths of indirect resin composites to hybrid ceramic. Dent Mater J 2005; 24: 238-43.
16. Pontes AP, Oshima HM, Pacheco JF, Martins JL, Shinkai RS. Shear bond strength of direct composite repairs in indirect composite systems. Gen Dent 2005; 53: 343-7.
17. Soares CJ, Pizi EC, Fonseca RB, Martins LR. Mechanical properties of light-cured composites polymerized with several additional post-curing methods. Oper Dent 2005; 30: 389-94.
18. Seimenis I, Sarafianou A, Papadopoulou H, Papadopoulos T. Shear bond strength of three veneering resins to a Ni-Cr alloy using two bonding procedures. J Oral Rehabil 2006; 33: 600-8.
19. Kaytan B, Onal B, Pamir T, Tezel H. Clinical evaluation of indirect resin composite and ceramic onlays over a 24-month period. Gen Dent 2005; 53: 329-34.
20. 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.
21. Ryge G. Clinical criteria. Int Dent J 1980; 30: 347-58.
22. O'Neal SJ, Leinfelder KF, Barrett CE. Clinical evaluation of Dentacolor as a posterior veneering agent. J Esthet Dent 1989; 1: 29-33.
23. Matsumura H, Nakamura M, Tanoue N, Atsuta M. Clinical evaluation of an urethane tetramethacrylate-based composite material as a prosthetic veneering agent. J Oral Rehabil 27: 846-52, 2000.
24. Shiono H, Koizumi H, Nemoto M, Ishikawa Y, Matsumura H, Tanoue N. Clinical evaluation of jacket crowns made of the Estenia indirect composite. Int Chin J Dent 2005; 5: 17-21.

Reprint request to:
Dr. Naomi Tanoue
Department of Specialized Dentistry
Nagasaki University Hospital of Medicine and Dentistry
1-7-1, Sakamoto, Nagasaki 852-8501, Japan
Fax: +81-95-849-7689 E-mail: t-naomi@net.nagasaki-u.ac.jp

Received June 8, 2006. Accepted August 28, 2006.