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Clinical Technique/Case Report

A Case Report of a 20-year Clinical Follow-up of Porcelain Laminate Veneer Restorations

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Clinical Relevance

Porcelain laminate veneer restorations of tetracycline-stained teeth had sufficient longevity *in vivo*. But, in long-term clinical cases, re-exposure of the discolored cervical tooth surface is inevitable due to the gingival recession of aging.

INTRODUCTION

Even though cutting of the tooth substance is slight, porcelain laminate veneer restorations (PLVR) have many advantages related to recovering esthetics of the following dysfunctions: morphological, shading and functional disharmonies, and widely-spreading tooth caries.[1-5]

The authors of the current study investigated the long-term clinical follow-up of PLVR *in vivo*. The clinical change of the restorations was mainly evaluated using 10 indices: color matching, marginal adaptation, surface roughness, wear, pulpal reaction, marginal discoloration, incisal fracture, falling, cervical width of the re-exposed tooth surface due to gingival recession and secondary caries. Detailed observations of PLVR were also investigated by use of a scanning electron microscope (SEM) on fine replica models.

This report deals with one case of a 20-year clinical follow-up of PLVR.

CASE STUDY

The patient was a 16-year-old female. She complained of discolored teeth and was not satisfied with her esthetic appearance, especially related to her maxillary incisors (Figure 1). When she visited the Clinic of Conservative Dentistry, the Dental Hospital affiliated

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Figure 1. *Unesthetic discolored teeth (F3) were observed at the upper and lower front incisors.*

with the Nippon Dental University School of Dentistry at Niigata, the following teeth: #16 13-23 26 and #46 43-33 36 were diagnosed as being tetracycline-stained teeth (F3).[6] After obtaining informed consent, the upper front discolored teeth were restored using PLVR (Cosmotech System, GC Corp, Tokyo, Japan).[7-9] Recall evaluations of the restorations were conducted every six months between the baseline and at two-years; subsequently, the evaluations were made every year up to 20 years (Figures 2-5).

The 20-year recall evaluation was clinically conducted. After direct examination *in vivo*, intraoral color pictures were taken, then fine replica models of the restored upper front teeth were made using hydrophilic vinyl polysiloxane impression materials (Examixfine Injection Type, GC Corp) and Bisphenol A-type epoxy resin (Stycast 1264/A·B, Japan Ablestic Co, Kanagawa, Japan) die material.

The maximum width of the re-exposed tooth surface was measured vertically using replica models by employing a Nikon measuring microscope MM-40 (Nikon, Tokyo, Japan). In addition, replica models were mounted on aluminum slabs and sputter coated with platinum/palladium (Hitachi E101, Hitachi Co, Tokyo, Japan). Marginal adaptation, surface roughness and wear of each PLVR were evaluated with a scanning electron microscope (Hitachi S-800, Hitachi Co) at an accelerating voltage of 15KV.

Figure 2. *Clinical findings of PLVR from the baseline to five-years: IA: Immediately after (baseline), 1Y: One year, 2Y: Two years, 3Y: Three years, 4Y: Four years, 5Y: Five years.*

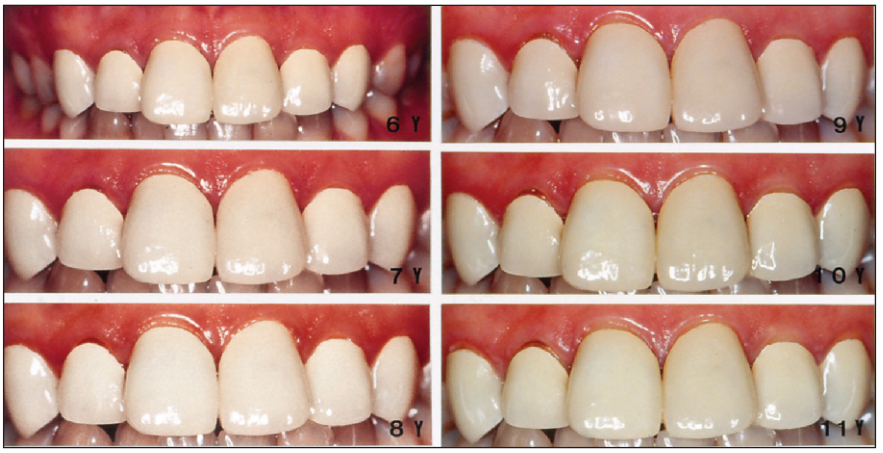


Figure 3. *Clinical findings of PLVR from six years to 11 years: 6Y: Six years, 7Y: Seven years, 8Y: Eight years, 9Y: Nine years, 10Y: 10 years, 11Y: 11 years.*

Facial and lingual findings of the 20-year clinical follow-up revealed almost no changes in the eight indices, except for gingival recession (Figure 4). Both cervical detail of the re-exposed tooth surface and slight marginal gap formation at the incisal edge could be seen on representative SEM images of the #21 tooth replica model (Figure 5). All the restored teeth were vital and there was no secondary caries (Figure 6).

Figure 7 shows schematic drawings of gingival recession and cervical width of the re-exposed tooth surfaces at 10 years, 15 years and 20 years.

At 10 years, the minimum/maximum (0.3 mm-0.7 mm) and width average (0.5 mm) formations were measured. It was found through each year from baseline to 10 years that the width average (0.05 mm) increased. At 15-years, the minimum/maximum (0.5 mm-1.1 mm) and average (0.8 mm) width formations were measured. Through each year, from 10 years to 15 years, the width average (0.06 mm) increased. At 20 years, the minimum/maximum (0.7 mm-1.1 mm) and average (0.9 mm) width formations were measured. Through each year from 15 years to 20 years, the width average (0.02 mm) increased. Therefore, the average re-exposed width during the 15th year to the 20th year was relatively slight. It was approximately one-third of the

Figure 4. *Clinical findings of PLVR at 20 years: Figure 4a is the facial view and Figure 4b is the lingual view.*

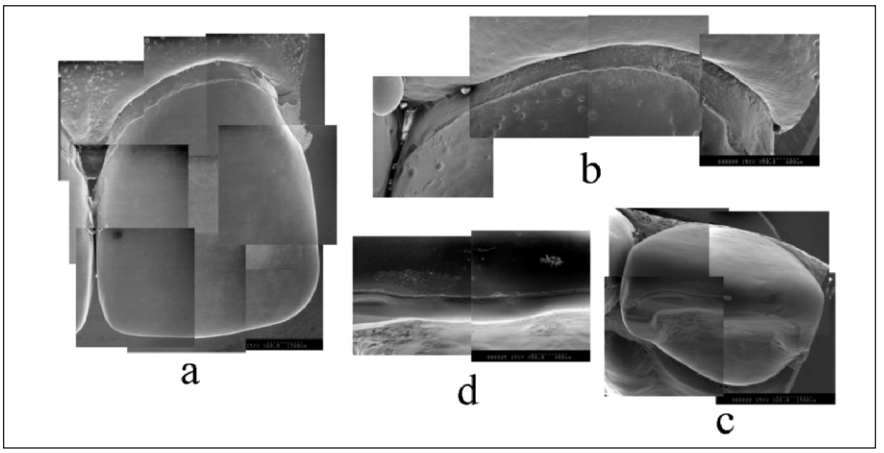


Figure 5. *Representative SEM images of tooth #21: Figure 5a is a facial view and the re-exposed tooth surface can be seen; Figure 5b is a magnified view and detailed findings of the re-exposed tooth surface are visible; Figures 5c and 5d are lingo-incisal findings. Slight marginal gap formation is visible at the incisal margin.*

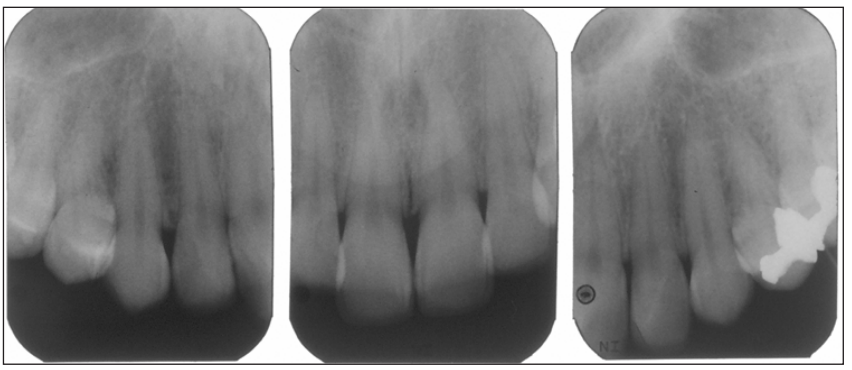


Figure 6. *X-ray finding 20 years after PLVR. All restored teeth were intact and vital.*

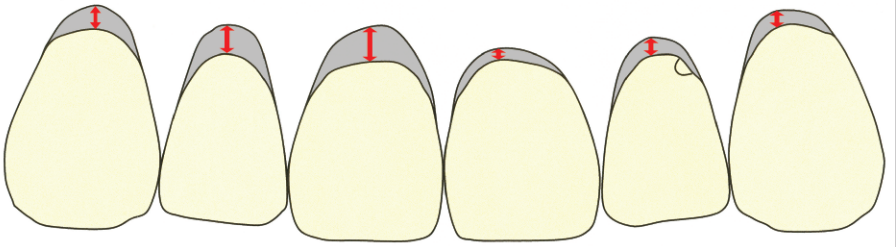
width compared to other observation periods. The authors of the current study can say that the 15th year to the 20th year of the patient was a relatively stable stage of the gingival tissue condition.

DISCUSSION

The long-term clinical follow-up results of this case were generally satisfactory, and it was confirmed that PLVR was a clinically durable restorative method that could last for 20 years. It was reconfirmed that the PLVR method is an excellent restorative method. The restorations can be made with minimal removal of the tooth substance, which improves the following dysfunctions: morphological unsightliness; color mismatching and/or translucency; functional disorders and widespreading caries.[10-22] And, it also follows the contemporary MI restorative philosophy as well as eliminating the patient's psychological inferiority complex. In addition, the color of the pictures of PLVR of each investigated period was observed as being slightly different. These results were due to the effects of the following photographic conditions: differences of the manufacturers, characteristics of the film products used and the lot number of film emulsion.

On one hand, after restoration, the authors needed to be careful in terms of re-exposure of the discolored cervical tooth surface due to gingival recession, which will lead to a recurrence of the original esthetic problem. The annual re-exposure width, on average, was in following post-operative order: baseline to 10 years, 10 years to 15 years and 15 years to 20 years, and were approximately 0.02 mm-0.06 mm.

This method seems to reasonably follow the guidelines of PLVR: when the patient's age is from the latter half of the teens to the middle of the twenties, although gingival recession at these ages progresses over time, resin composite laminate veneer restoration is highly recommended as a first choice, because this material is of reasonable cost performance and covers a wide range of restorative uses, such as adhesive repair restorations. After the mid-twenties, PLVR is a good choice, even if it is high in price, because the patient's oral condition becomes stable and it is also relatively economical in cost.[23-25] What needs to be taken into consideration is that the clinical follow-up results of this type of restoration are subjected to occlusal conditions and the patient's habits, as well as plaque quality control of the patient. Excellent prognosis is usually obtained in patients who keep good maintenance control.



	13	12	11	21	22	23	$\overline{m}$
Twenty-years	0.991	0.970	1.149	0.763	1.042	0.739	0.9
Fifteen-years	0.990	0.969	1.148	0.697	0.650	0.487	0.8
Ten-years	0.513	0.533	0.650	0.334	0.509	0.390	0.5
Baseline	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(mm)

Figure 7. *Schematic drawings of gingival recessions and cervical widths of the re-exposed tooth surface at baseline, 10 years, 15 years and 20 years.*

CONCLUSIONS

It was confirmed that, when the patient's condition is satisfactory, PLVR has sufficient longevity to be used for 20 years *in vivo*. However, in long-term clinical cases, due to natural gingival recession with aging, re-exposure of the discolored cervical tooth surface is inevitable. Therefore, when the patient is young, the clinician must give sufficient consideration to the materials to be used for laminate veneer restorations.

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References

1. Katoh Y, Ohkawa A, Yamaguchi R, Uesugi A & Takagi Y (1985) Cosmetic restoration by veneering technique using photocured adhesive composite resin and preformed mastique veneer—Part 1 & Part 2 *Dental Outlook* **6(1)** 357-367, **6(2)** 583-588.
2. Garber DA, Goldstein RE & Feinman RA (1988) *Porcelain Laminate Veneers* Quintessence Chicago 10-133.
3. Katoh Y (1990) Laminate veneer restorations on discolored teeth, Porcelain Laminate Veneer Technique In: Haga M, Ishikawa T (eds) *Dental Forum* Tokyo 115-124.
4. Katoh Y (1997) *Biological Concepts in Adhesive Dentistry 1. Fundamental Restorative Techniques* Quintessence Tokyo 45-48, 142-148.
5. Aschheim KW & Dale BG (2001) Porcelain laminate veneers and other partial coverage restorations In: Aschheim KW & Dale BG (eds) *Esthetic Dentistry* Mosby St Louis 151-183.
6. Feinman RA, Goldstein RF & Garber DA (1987) *Bleaching Teeth* Quintessence Chicago 1-100.
7. Kimura T, Inaba T, Yamaguchi R & Katoh Y (1993) Study on the porcelain laminate veneer restoration Part 1. Fitness observation of laminate veneers manufactured in 3 different cavity forms and commercial products *Journal of Esthetic Dentistry** **5(1)** 22-32.
8. Kimura T & Katoh Y (1995) Study on porcelain bonded laminate veneer restoration—On the properties of cyclic loading endurance and marginal closure in relation to cavity forms, setting positions of gingival margins and incisal loading points *Japanese Journal of Conservative Dentistry* **38(5)** 1149-1167.
9. Kimura T, Inaba T, Yamaguchi R & Katoh Y (1995) Study on the porcelain bonded laminate veneer restoration Part 2. On the properties of cyclic loading endurance and marginal closure in relation to cavity forms and setting positions of gingival margins *Journal of Esthetic Dentistry** **7(1)** 115-121.
10. Paterson JR & Anson RA (1980) Laminates—A practical approach to restoring tetracycline-stained teeth *Pediatric Dentistry* **2(4)** 300-303.
11. Charkley Y (1980) Clinical use of anterior laminates-construction and placement *Journal of the American Dental Association* **101(3)** 485-487.
12. Black JB (1982) Esthetic restoration of tetracycline-stained teeth *Journal of the American Dental Association* **104(6)** 846-852.
13. Calamia JR (1985) Etched porcelain veneers: The current state of the art *Quintessence International* **16(1)** 5-12.
14. Katoh Y, Takagi Y, Hasegawa K & Sekiguchi H (1993) Esthetic improvement of teeth discolored by the side-effects of antibiotic tetracycline using porcelain laminate veneer and castable glass ceramics crown *Journal of Esthetic Dentistry* **6(1)** 33-39.
15. Nixon RL (1996) Masking severely tetracycline-stained teeth with ceramic laminate veneers *Practical Procedures & Aesthetic Dentistry* **8** 227-235.
16. Peumans M, Van Meerbeek B, Lambrechts P, Vuylsteke-Wauters M & Venherle G (1998) Five-year clinical performance of veneers *Quintessence International* **29(4)** 211-221.
17. Feradiani M (1998) Six-year follow-up with Empress veneers *The International Journal of Periodontics & Restorative Dentistry* **18** 217-225.
18. Friedman MJ (1998) A 15-year review of porcelain veneer failure: A clinicians observations *Compendium of Continuing Education in Dentistry* **19** 625-636.
19. Dumfahrt H & Schäffer H (2000) Porcelain laminate veneers. A retrospective evaluation after 1 to 10 years of service: Part II—Clinical results *International Journal of Prothodontics* **13** 9-18.
20. Katoh Y, Shinkai K, Yoshikawa T, Sunico M & Medina V III (2001) Porcelain laminate veneer restoration: Long-term clinical prognosis and countermeasure for postoperative changes *Journal of Esthetic Dentistry* **13(2)** 17-23.

21. Filho AM, Vieira CC, Baratieri N & Lopes GC (2005) Porcelain veneers as an alternative for the esthetic treatment of stained anterior teeth: Clinical report *Quintessence International* **36(3)** 191-196.

22. El-Mowafy OM (2008) Use of porcelain veneers, crowns and an implant to resolve an esthetic problem *Journal of the Canadian Dental Association* **74(8)** 709-713.

23. Hobo S, Katoh Y & Iwata T (1988) *Clinical Practice of Laminate Veneer Restoration* Quintessence Tokyo 5-104.

24. Katoh Y (2003) Composite resin laminate veneer restoration of enamel hypoplasia *Clinical Guide, Operative Dentistry* In: Senda A, Terashita M, Tagami J & Katayama T (eds) Ishiyaku Publishers, Inc Tokyo 226-233.

25. Katoh Y (2005) *Modern Composite Resin Restoration* Oral Health Association of Japan, Tokyo 29-69.

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