



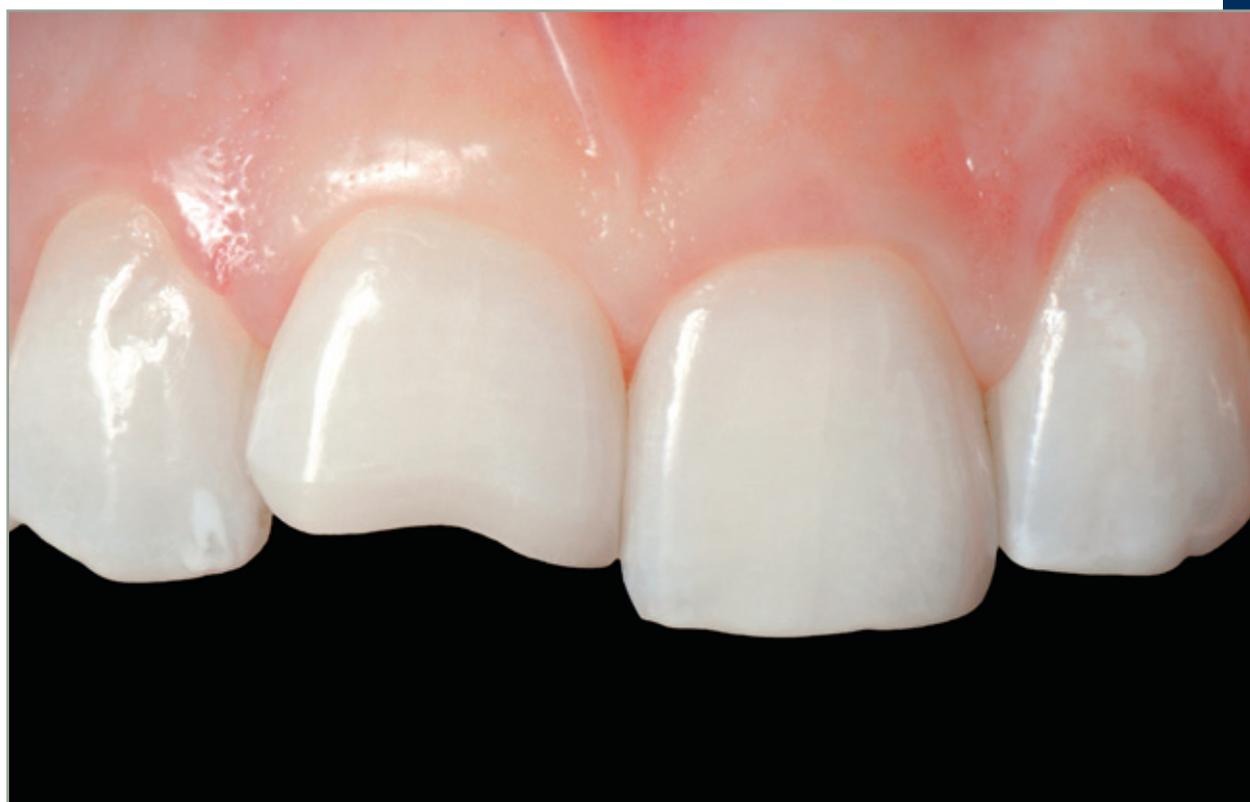
Minimally Invasive Restoration of a Maxillary Central Incisor with a Partial Veneer

Sebastian Horvath, Dr med dent

Assistant Professor, Department of Prosthodontics, School of Dentistry, Albert-Ludwigs University, Freiburg, Germany

Claus-Peter Schulz, MDT

Private Laboratory, Baden-Baden, Germany



Correspondence to: Dr Sebastian D. Horvath

Department of Prosthodontics, Albert-Ludwigs University School of Dentistry, Hugstetter Straße 55 D-79106 Freiburg, Germany;

Tel: +49-761-270-47320; Fax: +49-761-270-49600; E-mail: sebastian.horvath@uniklinik-freiburg.de / prothetik.uniklinik-freiburg.de



Abstract

Minimally invasive treatment modalities allow for the preservation of sound tooth substance. However, by limiting the preparation to the extent of a defect, the transition between restoration and natural tooth may be moved to more visible areas. The materials available for the restoration of a limited defect in the anterior area are either resin composite materials or porcelain. A patient was presented who asked for the replacement of a discolored filling on the maxillary right

central incisor. Tooth preparation was limited to the extent of the old filling, and a porcelain partial veneer restoration was fabricated. Despite the horizontal finish line in the middle of the clinical crown, a result could be achieved that was regarded as a success by the patient. This type of restoration proves to be a suitable alternative to direct composite restorations in the anterior area for the reconstruction of a limited defect, eg, due to a dental trauma.

(Eur J Esthet Dent 2012;7:6–16)





Introduction

Since the introduction of enamel surface treatment by Buonocore in 1955,¹ dentistry has seen a general shift towards more and more minimally invasive treatment modalities. Conventional restorations required preparation designs, which facilitate a mechanical retention of the reconstruction. Bonded restorations do not require extensive preparation, so that sound tooth structure may be preserved.² While this is advantageous, it also makes the achievement of an esthetically pleasing result more difficult. By limiting the preparation to the extent of the defect, eg, after a dental trauma, the transition between restoration and natural tooth is moved to more visible areas of the tooth. In the anterior area, the harmonic integration of the restoration into the surrounding dentition is a prime factor for the success of the treatment. Therefore, a restoration covering the entire labial surface of a tooth may be selected, even though the treatment is more invasive than a restoration limited to the defect itself.

For anterior teeth with a limited defect, the materials available for the reconstruction are either resin compos-

ite materials or porcelain. Composite restorations have the advantages of a direct placement, and that they may be easily modified and repaired. However, due to discoloration, surface staining, plaque accumulation and limited wear resistance, the esthetic appearance of composite restorations declines over time³⁻⁶ (Table 1). In an evaluation of patients with uncomplicated crown fractures after 16 years, every 2nd patient was dissatisfied with the composite restoration, with every 4th restoration being rated as unacceptable by the patient. Over time, most of the restorations had been replaced several times and most restorations had been in service for only 2 to 4 years. Therefore, the authors suggested that: "more permanent treatment ought to be used earlier".⁷

Porcelain laminate veneer restorations show good overall results with regard to esthetics, biocompatibility, fracture rates and patient satisfaction over a long period of time.⁸⁻¹³ Furthermore, it has been shown that in teeth with a worn enamel surface, the natural biomechanic properties may be restored after reconstruction with porcelain laminate veneers.¹⁴ Factors associated with higher fracture rates are functional

Table 1 Comparison of the advantages and disadvantages of direct resin composite and porcelain partial veneer restorations.

Material	Advantages	Disadvantages
Direct resin composite	Direct placement Simplified repair Modification possible	Long-term esthetics Polymerization shrinkage
Porcelain partial veneer	Esthetics Consistency Material properties	Treatment time Difficult repair



Not for Publication



Fig 1 Initial situation on the day the patient presented.



Fig 2 Labial and palatal view of the maxillary anterior area prior to treatment.

issues, extensive bonding to dentin, or bad internal fit.^{10,13,15} The difficult repair of a fractured porcelain laminate veneer is an issue. While small fractures may be corrected by a contouring of the restoration, large fractures necessitate the technically difficult repair with a direct composite restoration^{16,17} or the replacement of the restoration.

The following report presents and discusses the minimally invasive treatment of a single maxillary central incisor with a porcelain partial veneer restoration.

Case report

A 26-year-old female dentist was presented, requesting the esthetic replacement of a discolored resin composite filling on the maxillary right central incisor (Figs 1 and 2). Furthermore, the patient asked for brighter teeth. The dental history revealed that the tooth suffered an uncomplicated enamel-dentin fracture in an accident six years earlier. At that point, the missing tooth substance was restored with a multilayered resin composite restoration.



Fig 3 Labial and palatal view of the preparation.



Fig 4 Labial and palatal view of the provisional restoration.

The clinical examination of the patient revealed no probing depths greater than 3 mm. The vitality test of the maxillary right central incisor was positive. Apart from the maxillary right central incisor, the patient had a natural and healthy dentition. The treatment alternatives, with regard to material selection and expansion of the restoration, were discussed with the patient.

In office bleaching of the adjacent teeth was performed first (Power Whitening Gel Xtra, WHITEsmile, Birkenau,

Germany). Six weeks later, tooth preparation was performed with diamond burs (Gebr. Brasseler & Co, Lemgo, Germany) and polishing discs (Sof-Lex, 3M-ESPE, Seefeld, Germany). The preparation was limited to the extent of the old composite filling, maintaining a chamfered design of the margin (Fig 3). Afterwards, polyvinylsiloxane impressions were made (Affinis®Precious, Coltène/Whaledent, Altstätten, Switzerland). The provisional restoration consisted of a direct composite mock-up (Ceram X,



Fig 5 An outline that represented a compromise between the tooth axis of the maxillary right central incisor and the incisal edge of the maxillary left central incisor was selected (center).



Fig 6 The restoration was fabricated with the refractory die technique.

Dentsply DeTrey, Kontanz, Germany) that was performed using a silicone index of the old situation as a template. Retention of the provisional was achieved by etching of a spot approximately 2 x 2 mm in size prior to the mock-up. Furthermore, the provisional was retained with a glass-fiber ribbon (Dentapreg®, ADM, a.s., Brno, Czech Republic) that was bonded to the provisional and the two adjacent teeth (Fig 4).

Due to the irregularities in tooth axes and incisal edges in the maxillary anter-

ior teeth, three options for the outline of the restoration were simulated on the computer (Keynote, Apple, Cupertino, CA, USA) and discussed with the patient (Fig 5). It was agreed to select an outline that represented a compromise between the tooth axis of the maxillary right central incisor, and the incisal edge of the maxillary left central incisor.

Tooth shade was recorded with custom fabricated shade tabs of the used ceramic materials. The restoration was fabricated with feldspathic porcelain

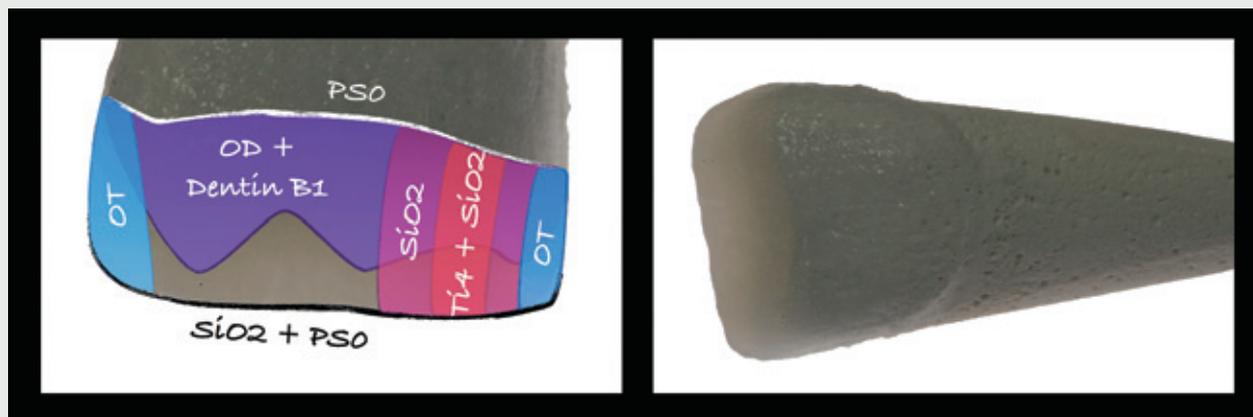


Fig 7 Illustration of the used ceramic materials.



Fig 8 Porcelain partial veneer restoration prior to cementation.

(Creation CC, Creation Willi Geler International, Meiningen, Austria) using the refractory die technique (Figs 6 to 8). The used ceramic materials are illustrated in Figure 7.

Prior to cementation, the area between the maxillary canines was isolated with rubber dam (OpraDam, Ivoclar Vivadent, Schaan, Principality of Liechtenstein). Cementation was performed with a dual-curing adhesive luting com-

posite (Variolink II Transparent High Viscosity, Ivoclar Vivadent) according to the manufacturer's recommendations. Any excess of cement was removed with a scalpel (Disposable scalpel 12d, Carl Martin, Solingen, Germany) and the margin polished (Fig 9) (Polishers for Ceramics, Brasseler & Co; Sof-Lex Polishing Discs, 3M-ESPE; Astrobrush, Ivoclar Vivadent). Figures 10 and 11 show the restoration after cementation.



Fig 9 The area between the maxillary canines was isolated with rubber dam (left). Excess cement was removed with a scalpel (center) and the margin polished (right).



Fig 10 Labial and palatal view of the maxillary anterior area after cementation of the restoration.



Fig 11 The restoration after cementation.



Discussion

The porcelain partial veneer on the maxillary right central incisor blends naturally into the surrounding unrestored teeth. Color, opacity and translucency of the adjacent natural teeth could be successfully mimicked by the restoration. Therefore the achieved result was regarded as a success by the patient.

The tooth form of the maxillary right central incisor matches the planned compromise between its angulation and the incisal edge of the maxillary left central incisor. Due to the differences in tooth angulation, the restored tooth seems slightly wider than the contralateral central incisor. However, a correction of the mismatch would have only been possible with an extensive treatment.

Because the restoration was limited to the incisal half of the tooth, a natural restoration of its surface texture could not be achieved. The surface texture of the maxillary right central incisor was probably lost in the polishing process of the old composite restoration six years earlier. This circumstance also helped in the concealment of the transition between tooth and restoration. The imitation of a smooth surface is less technically demanding than the imitation of complex micro- and macrottextures.

The reasons for the selection of a partial veneer restoration are multifold. A porcelain laminate veneer restoration covering the complete labial surface of the tooth has the advantage that the transfer between restoration and natural tooth is moved to a less visible area. However, such a restoration would have necessitated the removal of sound enamel. Therefore, this restoration type

was ruled out. Looking at the treatment result, it can be concluded that a distinct transfer between restoration and natural tooth could be avoided. Apart from the quality of the ceramic work, one of the reasons for this may be that the fracture line was not horizontal, but of a wave-like shape (Fig 4).

Direct composite restorations are often used in cases where there are limited tooth defects, in order to avoid the removal of sound tooth substance. However, as shown in this case, ceramic restorations can be as minimally invasive as composite restorations. The preparation design chosen in this case was identical to the design that would have been chosen for a direct composite restoration.¹⁸ With this proceeding, both the esthetic disadvantages of a transfer between restoration and natural tooth in the visible area, and the advantages of a minimally invasive preparation are equal for both restoration types. However, ceramic restorations have the advantage of superior material properties with regard to the esthetic result, consistency, wear resistance, and biocompatibility⁸⁻¹³ (Table 1). Furthermore, the patient was dissatisfied with the aging of the old composite restoration and wanted to avoid this issue with the new restoration. It has been shown that, over time, ceramic restorations have a higher patient satisfaction than composite restorations.¹²

Porcelain laminate veneer restorations have demonstrated high survival rates.^{8-11,13} However, the restorations investigated in these studies were extended to the complete labial surface of the teeth. In the present case, a partial veneer restoration was performed that was limited to the size of the defect, covering



approximately half of the clinical crown. Therefore, the results of the studies may not apply to this restoration without reservation. To the author's knowledge, only one clinical study investigated the survival of porcelain restorations with a limited extension.¹⁹ However, as the study investigated the survival of incisal veneers on canines to reestablish canine guidance, the results are not comparable to the situation in this patient case as well.

Conclusions

In this case presentation, the incisal half of a maxillary central incisor was restored with a porcelain partial veneer

restoration. Despite the horizontal finish line in the middle of the clinical crown, a result could be achieved that was regarded as a success by the patient. This type of restoration proves to be a suitable alternative to direct composite restorations in the anterior area for the restoration of a limited defect, eg, due to a dental trauma.

Acknowledgements

The authors express their sincere appreciation to Prof Dr Markus Blatz, Prof Dr Daniel Edelhoff, Dr Christian Cochman and Dr Stefan Schultheis for their professional advice in this patient case. Furthermore, the authors would like to thank Prof Dr Dr h.c. Jörg Strub for the proofreading of the manuscript. Dr Sebastian Horvath is a consultant to Dentsply DeTrey.

References

- Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. *J Dent Res* 1955;34:849–853.
- Edelhoff D, Sorensen JA. Tooth structure removal associated with various preparation designs for anterior teeth. *J Prosthet Dent* 2002;87:503–509.
- Jandt KD, Sigusch BW. Future perspectives of resin-based dental materials. *Dent Mater* 2009;25:1001–1006.
- Lacy AM, Wada C, Du W, Watanabe L. *In vitro* microleakage at the gingival margin of porcelain and resin veneers. *J Prosthet Dent* 1992;67:7–10.
- Kreulen CM, Creugers NH, Meijering AC. Meta-analysis of anterior veneer restorations in clinical studies. *J Dent* 1998;26:345–353.
- Meijering AC, Creugers NH, Roeters FJ, Mulder J. Survival of three types of veneer restorations in a clinical trial: a 2.5-year interim evaluation. *J Dent* 1998;26:563–568.
- Robertson A. A retrospective evaluation of patients with uncomplicated crown fractures and luxation injuries. *Endod Dent Traumatol* 1998;14:245–256.
- Fradeani M, Redemagni M, Corrado M. Porcelain laminate veneers: 6- to 12-year clinical evaluation – a retrospective study. *Int J Periodontics Restorative Dent* 2005;25:9–17.
- Guess PC, Stappert CF. Midterm results of a 5-year prospective clinical investigation of extended ceramic veneers. *Dent Mater* 2008;24:804–813.
- Peumans M, De Munck J, Fieuws S, Lambrechts P, Vanherle G, Van Meerbeek B. A prospective ten-year clinical trial of porcelain veneers. *J Adhes Dent* 2004;6:65–76.
- Magne P, Perroud R, Hodges JS, Belser UC. Clinical performance of novel-design porcelain veneers for the recovery of coronal volume and length. *Int J Periodontics Restorative Dent* 2000;20:440–457.
- Meijering AC, Roeters FJ, Mulder J, Creugers NH. Patients' satisfaction with dif-



- ferent types of veneer restorations. *J Dent* 1997;25:493–497.
13. Dumfahrt H, Schaffer H. Porcelain laminate veneers. A retrospective evaluation after 1 to 10 years of service: Part II – Clinical results. *Int J Prosthodont* 2000;13:9–18.
 14. Magne P, Douglas WH. Optimization of resilience and stress distribution in porcelain veneers for the treatment of crown-fractured incisors. *Int J Periodontics Restorative Dent* 1999;19:543–553.
 15. Magne P, Versluis A, Douglas WH. Effect of luting composite shrinkage and thermal loads on the stress distribution in porcelain laminate veneers. *J Prosthet Dent* 1999;81:335–344.
 16. Edelhoff D, Marx R, Spiekermann H, Yildirim M. Clinical use of an intraoral silicoating technique. *J Esthet Restor Dent* 2001;13:350–356.
 17. Blatz MB, Sadan A, Kern M. Resin-ceramic bonding: a review of the literature. *J Prosthet Dent* 2003;89:268–274.
 18. Eid H, White GE. Class IV preparations for fractured anterior teeth restored with composite resin restorations. *J Clin Pediatr Dent* 2003;27:201–211.
 19. Sieweke M, Salomon-Sieweke U, Zofel P, Stachniss V. Longevity of oroincisor ceramic veneers on canines – a retrospective study. *J Adhes Dent* 2000;2:229–234.