The all-porcelain, resin-bonded bridge
Matthias Kern* / Helmut Knodel** / Jörg Rudolf Strub***

This case report describes the clinical and laboratory procedures for the fabrication and insertion of In-Ceram all-porcelain, resin-bonded bridges. All-porcelain crowns and fixed partial dentures have better biocompatibility and better esthetic results than do ceramometal restorations. In-Ceram has been shown to have better physical properties than other ceramic or glass materials. However, long-term clinical studies of the material are not yet available. (Quintessence Int 1991;22:257–262.)

Introduction

The primary and the secondary (after rebonding) long-term success rates of resin-bonded bridges with metal frameworks were between 66.5% and 88.0% and 93.0% and 93.5%, respectively. The esthetic disadvantage of conventional resin-bonded prostheses is the grayish shine-through of the metal framework. In addition, the biocompatibility of certain nonprecious metal alloys is in question.

To overcome these problems, all-porcelain, resin-bonded bridges were introduced. The greatest disadvantage of using traditional ceramic materials in crown and bridge prosthodontics is their lack of stability in the oral environment. The development of In-Ceram (Vita Zahnfabrik), a new ceramic material that has shown better stability than have traditional ceramics, makes the longevity of all-porcelain, resin-bonded prostheses appear more promising.

This paper describes a new technique for the fabrication of the In-Ceram resin-bonded bridge and the clinical procedures for its insertion.

Case report

The patient was missing tooth 11. Tooth 12 was caries free, and tooth 21 was restored mesially with composite resin material (Figs 1 and 2).

The resorbed marginal ridge in the area of tooth 11 was built up preprosthetically with a piece of preshaped lyophilized cartilage to create an ideal soft tissue profile for the planned ridge lap pontic. The surgical ridge augmentation procedure is important for getting optimal esthetic and functional results (Fig 3). A removable provisional denture was inserted in the maxillary arch (Figs 4 and 5) for 8 months to allow the augmented ridge to heal and remodel (Figs 6 and 7).

At that time, a minimal veneer preparation was created on the lingual side of the abutment teeth, 12 and 21. If there is no occlusal contact between the all-porcelain, resin-bonded fixed partial denture and the opposing teeth, only 30 to 50 µm of superficial enamel is removed. The removal of the outer layer of enamel, which has a high fluoride content, provides the best bonding strength between the resin and the tooth structure after etching. In the occlusal contact area, the depth of the tooth preparation should be 0.5 mm to provide space for a sufficient thickness of porcelain.

Hydrocolloid impressions were then taken and master casts were poured in Type IV die stone. One of the master casts and the study cast of the mandible were mounted in the articulator by use of the facebow. A wax up of the planned In-Ceram coping was made to check that no occlusal and functional discrepancies were present (Fig 8).
Prosthodontics

Fig 1  Frontal view of the preoperative situation. Tooth 11 is missing and the alveolar ridge in the area of tooth 11 is resorbed.

Fig 2  Occlusal view of the preoperative situation.

Fig 3  Ridge augmentation with lyophilized cartilage in the area of tooth 11 (Courtesy of Dr M. Hurzeler, Albert-Ludwigs University).

Fig 4  Frontal view of the removable provisional prosthesis.

Fig 5  Occlusal view of the removable provisional prosthesis.

Fig 6  Frontal view 8 months after the alveolar ridge augmentation in the area of tooth 11.
Fig 7 Occlusal view 8 months after alveolar ridge augmentation in the area of tooth 11.

Fig 8 Occlusal view of the waxup of the coping on the master cast, which is made out of Type IV die stone.

Fig 9 Palatal view of the transferred waxup onto the special plaster cast.

Fig 10 (right) Injection of the In-Ceram coping material through the injection sprue into the duplicated mold of the waxup with the special plaster cast.

Then, a duplicated cast of the abutment teeth, 12 and 21, and the pontic area was made out of a special plaster provided with the In-Ceram kit. The waxup of the coping was then transferred onto the special plaster cast (Fig 9). A duplication mold to the waxup and the special plaster cast was made. Then the waxup was removed from the special plaster cast. It was replaced by an aluminum oxide slip, which was pressed through the injection spine into the duplication mold (Fig 10). The moistness of the slip cast was absorbed by the special plaster cast. Afterward, the slip cast was taken out of the duplication mold together with the special plaster cast. The special plaster cast was glued on an aluminum oxide firing tray with cyanoacrylate resin. Then, it was cut with a saw mesial to teeth 12 and 21 (Fig 11). According to the manufacturer, the In-Ceram coping can also be produced directly on the special plaster cast with a brush build-up technique.

After the application of the In-Ceram stabilizer, the slip cast and the special plaster cast were sintered in the Vita Inceramat furnace (Vita Zahnfabrik) at 1120 °C for 2 hours. Contrary to the slip cast, the
Fig 11  In-Ceram coping after removal from the duplication mold and after the special plaster cast has been glued onto an aluminum oxide firing tray and cut with a saw.

Fig 12  In-Ceram coping after the sintering process. Note the shrinkage of the special plaster cast. The sintered coping has remained stable.

Fig 13  In-Ceram coping after glass infiltration firing. Excess glass is removed by air abrasion with aluminum oxide particles.

Fig 14  Frontal view of the veneered In-Ceram resin-bonded bridge.

Fig 15  Palatal view of the veneered In-Ceram resin-bonded bridge.

Fig 16  Occlusal view of the maxillary teeth covered with a rubber dam ready for cementation.
special plaster cast exhibits shrinkage during the sintering process (Fig 12). However, this effect did not damage the slip cast, because the special plaster cast had been cut before sintering. The sintered coping, which was removed easily from the special plaster cast, had an excellent marginal fit. It had a chalklike consistency and could be remodeled easily. Powder particles of colored glass from the Vita shade system were mixed with distilled water and brushed onto the surfaces of the coping. The inner surfaces of the coping wings, which are responsible for the bonding to the enamel, and the basis of the pontic excluded from the above-mentioned procedure. Then the coping, coated with glass powder, was placed on a platinum foil and fired in the Vita Inceramat at a temperature of 1100 °C for 4 hours. During this process, the melting glass infiltrates the sintered coping completely (Fig 13). After the infiltration firing, excess glass was removed with aluminum oxide powder air abrasion.

To finish the In-Ceram resin-bonded fixed partial denture, the coping was veneered with Vitadur-N ceramic material (Vita Zahnfabrik) (Figs 14 and 15). After the try-in of the all-porcelain, resin-bonded prosthesis, the inner surfaces of the coping wings were air abraded with aluminium oxide particle and coated with silane to increase the bonding strength with the luting cement.

The abutment teeth and the adjacent teeth were covered with a rubber dam (Fig 16). The abutment teeth were cleaned with a rotating rubber cup and nonfluoridated pumice. Then they were conditioned with an acid-etching gel (37% phosphoric acid) for 60 seconds, rinsed with water spray, and dried with air pressure. Then the fixed partial denture was inserted and cemented with Panavia Ex luting cement (Kuraray Co). After 15 minutes, excess resin cement was removed with fine rotating diamonds. Then the necessary occlusal corrections were performed. Two days after insertion, the margins of the In-Ceram resin-bonded bridge were polished (Figs 17 and 18).

**Discussion**

In-Ceram is a newly developed aluminum oxide ceramic with physical properties better than those of other ceramic or glass materials. Claus showed that the flexural strength of In-Ceram is three to four times higher than that of traditional ceramic materials. When In-Ceram is used, developing microcracks cannot spread out because of the intense contact between the aluminum oxide grains. Therefore, it can be expected that all-porcelain, resin-bonded prostheses made out of In-Ceram will have a good prognosis if treatment protocol is respected. The minimal thickness of the retainer wings should be 0.5 mm; to achieve this goal, sufficient space must be present, either because of overjet that is present or because of tooth preparations. Deep bite situation and bruxism are contraindications to use of this technique.

This material appears to provide esthetic and functional fixed partial dentures. However, long-term clinical experiences with In-Ceram and the described technique for resin-bonded prostheses are not available yet.
Acknowledgment

The authors thank Dr. H. F. Kappert, Chairman of Dental Materials, Albert-Ludwigs University, for his advice and technical assistance.

References

1. Thompson VP, Wood M, de Rijk W: Bonded bridge recalls and
Weibull distributions: results averaging seven years. J Dent Res

2. Williams VD, Thayer KE, Deneyh GE, et al: Cast metal resin
bonded prostheses: a 10-year retrospective study. J Prosthet Dent

3. Peters S, Kerschbaum Th: Bewährung dreigliedriger Adhäsiv-
brücken. Statistische Kontrolle von 922 Brücken durch ein mul-
tipelgreiches Adhäsivbrückenregister. Zahnärzl Mitteil

4. Williams HA, Caughman WF, Pollard BL: The esthetic hybrid

im Spaltkorrosionstest. Schweiz Monatschr Zahnmed
1987;97:571–590.

Fortschritte der Prothetik und Werkstoffkunde, Vol 4. Munich,

7. Helsen RL, Strasser HE: An innovative method for fixed anterior
tooth replacement utilizing porcelain veneers. Quintessence Int

8. Garbert DA, Goldstein RE, Feinman RA: Porcelain Laminate

9. Setz J, Simonis A, Diehl J: Klinische und zahnmedizinische Er-
fahrungen mit vollkeramischen Brücken. Dent Labor 1989,

10. Sadoun M: All ceramic bridges with the slip casting technique.
Presented at the 7th International Symposium on Ceramics,

11. Claus H: Vita In-Ceram, ein neues Verfahren zur Herstellung
oxidkeramischer Gerüste für Kronen und Brücken. Quintessenz

12. Kappert HE, Knade H, Manzotti L: Metallfreie Brücken für

13. Wirz J, Besimo C, Schmidli F: Verbundfestigkeit von Metall-
gerüst und Haftvermittler in der Adhäsivbrückentechnik. Part
1. Literaturübersicht und Schmelzätzung. Schweiz Monatschr


bonded all-porcelain bridges (In-Ceram). Presented at the 27th
Annual Meeting of the International Association for Dental
Research, Continental European Division, Berne, September
1990.